RGSA – Revista de Gestão Social e Ambiental
ISSN: 1981-982X
Submission date: 12/2/2024
Acceptance date: 2/3/2025
DOI: https://doi.org/10.24857/rgsa.v19n4-010
Organization: Interinstitutional Scientific Committee
Chief Editor: Ana Carolina Messias de Souza Ferreira da Costa
Assessment: Double Blind Review pelo SEER/OJS

THE DEVELOPMEMT OF INNOVATIONS IN UKRAINIAN REGIONS: CHALLENGES AND SOLUTIONS

Olga Nosova [1]
Oksana Makovoz[2]

ABSTRACT

Objective: This study focuses on the role of innovation policy in regional development and examines how innovations contribute to effective regional development in Ukraine.

Theoretical Framework: The research is grounded in Schumpeter's theory of technological accumulation and creative destruction, emphasizing that innovation development provides a solid foundation for understanding the context of the investigation.

Method: The methodology employed in this research includes hierarchical cluster analysis to compare 27 Ukrainian regions based on their innovative development. Economic and statistical methods were utilized to assess the level of creative development across these regions, using data from regional statistics on R&D and innovation in Ukraine.

Results and Discussion: Hierarchical cluster analysis provides valuable insights into how the classification of regional clusters depends on the input factors of production in Ukrainian regions. The study's findings confirm the effectiveness of hierarchical cluster analysis in evaluating regional innovation potential.

Research Implications: The introduction and implementation of innovation policy aim to reduce inequality and enhance competitiveness among Ukrainian regions. Substantiated the development and implementation of policies considering the innovative components for smoothing regional disparities. It is recommended that regional authorities develop and implement inter-cluster innovative projects and facilitate the exchange of experiences and new ideas.

Originality/Value: This study reviews various scientific approaches regarding the role of innovations in regional development. By utilizing hierarchical cluster analysis, the research reveals the asymmetric distribution of input factors of production, suggesting policies that can attract investment to Ukrainian regions. The findings provide valuable insights for researchers, policymakers, and practitioners looking to stimulate innovation for regional development.

Keywords: Innovations, Development, Input Factors of Production, Innovation Policy.

O DESENVOLVIMENTO DE INOVAÇÕES NAS REGIÕES DA UCRÂNIA: DESAFIOS E SOLUÇÕES

RESUMO

Objetivo: Este estudo centrou-se no papel que a política de inovação desempenha no desenvolvimento regional e examinou como as inovações afetam o desenvolvimento regional eficiente na Ucrânia.

Referencial Teórico: A pesquisa está fundamentada na teoria de acumulação tecnológica e destruição criativa de Schumpeter, enfatizando que o desenvolvimento da inovação fornece uma base sólida para a compreensão do contexto da investigação.

[1] Mykolas Romeris University, Vilnius, Lithuania. E-mail: olgano59@gmail.com
Orcid: https://orcid.org/0000-0002-8523-7802
[2] National Technical University "Kharkiv Polytechnic Institute," Kharkiv, Ukraine.
E-mail: oksana.makovoz@khpi.edu.ua Orcid: https://orcid.org/0000-0001-8728-1500

Método: A metodologia utilizada nesta investigação inclui uma análise hierárquica de clusters para comparar 27 regiões ucranianas com base no seu desenvolvimento inovador. Foram utilizados métodos económicos e estatísticos para avaliar o nível de desenvolvimento criativo nestas regiões, utilizando dados de estatísticas regionais sobre I&D e inovação na Ucrânia.

Resultados e Discussão: A análise hierárquica de clusters fornece informações valiosas sobre como a classificação dos clusters regionais depende dos factores de produção nas regiões ucranianas. As conclusões do estudo confirmam a eficácia da análise hierárquica de clusters na avaliação do potencial de inovação regional.

Implicações da Pesquisa: A introdução e implementação de uma política de inovação visam reduzir a desigualdade e aumentar a competitividade entre as regiões ucranianas. Fundamentou o desenvolvimento e implementação de políticas considerando os componentes inovadores para suavizar as disparidades regionais. Recomenda-se que as autoridades regionais desenvolvam e implementem projetos inovadores entre clusters e facilitem a troca de experiências e novas ideias.

Originalidade/Valor:.Este estudo analisa várias abordagens científicas relativas ao papel das inovações no desenvolvimento regional. Ao utilizar a análise hierárquica de agrupamentos, a investigação revela a distribuição assimétrica dos factores de produção, sugerindo políticas que podem atrair investimento para as regiões ucranianas. As conclusões fornecem informações valiosas para investigadores, decisores políticos e profissionais que procuram estimular a inovação para o desenvolvimento regional.

Palavras-chave: Inovações, Desenvolvimento, Factores de Produção, Política de Inovação.

EL DESARROLLO DE INNOVACIONES EN LAS REGIONES DE UCRANIA: DESAFÍOS Y SOLUCIONES

RESUMEN

Objetivo: Este estudio se centra en el papel de la política de innovación en el desarrollo regional y examina cómo las innovaciones contribuyen al desarrollo regional efectivo en Ucrania.

Marco Teórico: La investigación se basa en la teoría de acumulación tecnológica y destrucción creativa de Schumpeter, enfatizando que el desarrollo de la innovación proporciona una base sólida para comprender el contexto de la investigación.

Método: La metodología empleada en esta investigación incluye un análisis de conglomerados jerárquico para comparar 27 regiones de Ucrania en función de su desarrollo innovador. Se utilizaron métodos económicos y estadísticos para evaluar el nivel de desarrollo creativo en estas regiones, utilizando datos de estadísticas regionales sobre I+D e innovación en Ucrania.

Resultados y Discusión: El análisis de conglomerados jerárquicos proporciona información valiosa sobre cómo la clasificación de los conglomerados regionales depende de los factores de entrada de la producción en las regiones de Ucrania. Los hallazgos del estudio confirman la eficacia del análisis de conglomerados jerárquicos para evaluar el potencial de innovación regional.

Implicaciones de la Investigación: La introducción e implementación de políticas de innovación tienen como objetivo reducir la desigualdad y mejorar la competitividad entre las regiones de Ucrania. Fundamentó el desarrollo e implementación de políticas considerando los componentes innovadores para suavizar las disparidades regionales. Se recomienda que las autoridades regionales desarrollen e implementen proyectos innovadores entre clústeres y faciliten el intercambio de experiencias y nuevas ideas.

Originalidad/Valor: Este estudio revisa varios enfoques científicos sobre el papel de las innovaciones en el desarrollo regional. Al utilizar un análisis de conglomerados jerárquicos, la investigación revela la distribución asimétrica de los factores de producción, lo que sugiere políticas que pueden atraer inversiones a las regiones de Ucrania. Los hallazgos brindan información valiosa para investigadores, formuladores de políticas y profesionales que buscan estimular la innovación para el desarrollo regional.

Palabras clave: Innovaciones, Desarrollo, Factores de Producción, Política de Innovación.

RGSA adota a Licença de Atribuição CC BY do Creative Commons (https://creativecommons.org/licenses/by/4.0/).

1 INTRODUCTION

The aim of this paper is to analyze the impact of innovation policy on effective regional development in Ukraine. The main goal is to define the basic causes of regional disparities', and the estimation of the role of innovation policy for regional inequalities smoothing. Innovation policy in regions vary by country. Some countries include the crucial role of innovation in regional strategy. Other countries emphasize the role of innovation for economic growth based on regional territorial advantages.

Schumpeter's approach to the technological accumulation and creative destruction is the basic theory of dynamic economic growth explaining the nature of innovation. The concepts of technological accumulation and creative destruction are fundamental in the theory of J. Schumpeter. The author "distinguishes investments in R&D from two other common kinds of capital investment, including physical and human capital."

Metcalfe & Ramlogan (2006) consider "innovation to be the process of knowledge generation, connecting investment, demand, and structural transformation." Technical progress and the competitive process carried out inseparably, a moreover adaptive evolutionary process coordinated by diverse market structures, changing patterns of economic behavior. Kingston (2017) examines "capitalism using the concept of property rights. He explains the historical development of economic cycles of capitalism through the changes of property's forms, especially intellectual property rights." The author emphasizes the creative innovations have been captured by a group of people who wanted mostly to benefit from them. The reduction of wealth generalization and inequality growth contradicts the modern capitalist system's progress.

Antonelli (2017) applies "the Schumpeterian creative response by implementing the tools of complexity economics". Aghion et al. (2001) address "the product market competition, and imitation good and prove a positive effect on growth. The authors point to complementary roles for competition (antitrust) policy and patent policy."

The application Schumpeterian model for human capital accumulation determines a country's capacity to absorb knowledge and provide its diffusion. After increasing a country's

absorption capacity, it starts to be not an imitator, but an innovator who create new knowledge itself.

We apply scientific and special methods of cognition: structural-logical method – to build the general structure of the research. Content analysis and bibliographic search applied to study of innovation policy in regions based on a theoretical study of national innovation systems and regional policies supporting innovations, the role of policymakers who are making the tough decisions about the future of competitiveness and innovations, and empirical works considering the linkages between R&D, patents, innovations, entrepreneurship, and growth. The comparative analysis used to study and compare forms and methods of innovation development in Ukraine.

We use hierarchical cluster analysis for comparing the regions of Ukraine in terms of innovative development. Economic and statistical methods used to assess the level of innovative development in Ukraine's regions. The comparison of regional competitiveness estimation of 12 Ukraine's regions based on the methodology of the Global Competitiveness Index (GCI) for 2012 and 2018 demonstrates an increase in territorial unevenness and aggravation of socio-economic and political problems in the country.

The graphic method used to visualize estimation calculation results. The application of graph analysis of data of Gross Domestic Product (GDP) and index of economic freedom for Ukraine 1991-2017 illustrates economic activity decrease in unpredictable world conjuncture, and regional economic and social disparities increase. Scientific generalization justifies the results of an investigation, make conclusions, and propose policy recommendations.

In the first part of the paper, we consider the basic approaches to innovation system and innovation policy, and their forms and methods. Entrepreneurs' innovations considered a factor in the long-term company's growth.

In the second part of the paper, we turn our attention to Ukraine's regional economic performance assessment. We estimate the factors influencing the existence of disproportions between the sectors. We define the basic problems of regional development where we show that the lack of capital investments, old capital assets, and the high share of unprofitable enterprises, enterprise's indebtedness, low innovations' level, and insufficient infrastructure level hamper economic upswing. In the third part of the paper, we estimate the results of hierarchical cluster analysis for 27 Ukrainian regions and emphasize such of them, which have high or low innovative potential. The assessment of Ukrainian competitiveness shows the market concentration at the national level and inadequate finance and human capital distribution in regions. The competition is still weaker at the regional level. The financial shortage causes

the reduction of the number of enterprises applied the innovations. Applying Schumpeter's approach to dynamic economic growth, we suggest proposals for regional equalizations based on asymmetric innovative development in regions.

2 THEORETICAL FRAMEWORKS

2.1 REVIEW OF RELATED STUDIES

Most scientists identify the company's innovative activities as the main component of economic growth. Using innovation allows you to adapt to the constant changes in the external environment. Chaminade et al. (2018, p.79) examine "the innovation system related to economic, social, and environmentally sustainable development." Authors consider innovative policy in regions based on the theoretical study of national innovation systems in globalization, the legal environment, and regional policies supporting innovations. Edler &Fagerberg, J. (2017) focus "their research on the definition of innovation policy, theoretical rationales. They consider the innovation policy mechanism and introduce the model designed to identify, analyze, and deepen our understanding of innovation policy, and its application mechanism."

Edler et al (2016) attempt "to understand the logic and effects of innovations. The scientists present meta-evaluations for 16 key forms of innovation policy instruments and their complex analysis." They underline the role of policymakers who are making tough decisions about the future of competitiveness and innovations. Granstrand (2018)"reviews the connections between R&D, various patents, different kinds of innovations, entrepreneurship, and effects on growth rate."

Schomberg and Hankins (2018) "develop the concept of reasonable innovation and explore the prospects for its further implementation in emerging markets." The authors consider the impacts of investigation through reconnecting science and innovations using the same standards opposite other existed public policies. They argue that "responsible innovation needs to be sensitive to local, regional, and specific cultural contexts." The discussion on shared values may well lead to a variety of different requirements for good innovations (Schomberg & Hankins, 2018, p. 6). Fagerberg (2018, p. 16) ascertains those various national factors influenced firms' abilities to benefit from their own technological capabilities. National and firm - level capabilities interact in the process of development. Edler &Fagerberg, J. (2017) focus "their research on the definition of innovative policy and theoretical rationales.". Eriksson et al (2010) apply the Strategic Niche Management (SNM) approach that designed to facilitate

the introduction and diffusion of new technologies through setting up protected experimental settings (niches) in which actors learn about the design, user needs, cultural and political acceptability, and offers suggestions for regional policy.

Polverari (2018, p.10) points out the current paradigm, open innovation, that considers innovation as an open process that takes place in 'innovation ecosystems', 'in which companies, public research institutions, financial institutions, and government bodies interact through the exchange of skills, information, and ideas. First, by pulling financial resources from both kinds of policies to fund the same programs, schemes, or projects, and second, strategic alignment. *Pyka et al. (2019) introduces an agent-based model that provides a virtual simulation environment for ex-ante evaluation of policy intervention in regional innovation systems. The findings demonstrate that regional learning and knowledge exchange processes tend to be accompanied by pronounced non-linearity. Different policy interventions may affect each other in complex and often-unexpected ways that have far-reaching implications for policymakers.* Bogliacino et al. (2016) prove that "without complementary investments, it will not be possible to fully benefit from the advantages of ICT capital for productivity growth." Authors have posited the importance of identifying the driving forces and channels, as well as the speed of response to regulatory influences, which can establish more effective conditions for the implementation of innovative potential. Sineviciene et al. (2018) affirm that determining the driving factors, channels, and response periods for regulatory effects is crucial in establishing more effective conditions for the implementation of innovation's potential.

Understanding the national innovation system, we define regional policy. Implementation mechanism supports the idea of interdependence and direct effects of innovations into economic sectors, improved synergies in regions, and internationalization of firms increasing cooperation at the international markets (Nosova, 2017, p. 117). The utilization of the existing approaches` results suggests new complex approaches for supporting innovations as a component of regional policy.

2.2 PECULIARITIES OF INNOVATION DEVELOPMENT IN UKRAINE

The late and incomplete reforms impede economic development in Ukraine. It creates numerous market distortions and arbitrage opportunities that generated highly concentrated rents for powerful special interest groups. The modern spatial development of Ukraine characterizes by such main transformational tendencies as:

- strengthening interregional socio-economic differentiation;

- combination processes of interstate interregional integration and disintegration;
- transition from downturn to economic growth with significant regional peculiarities.

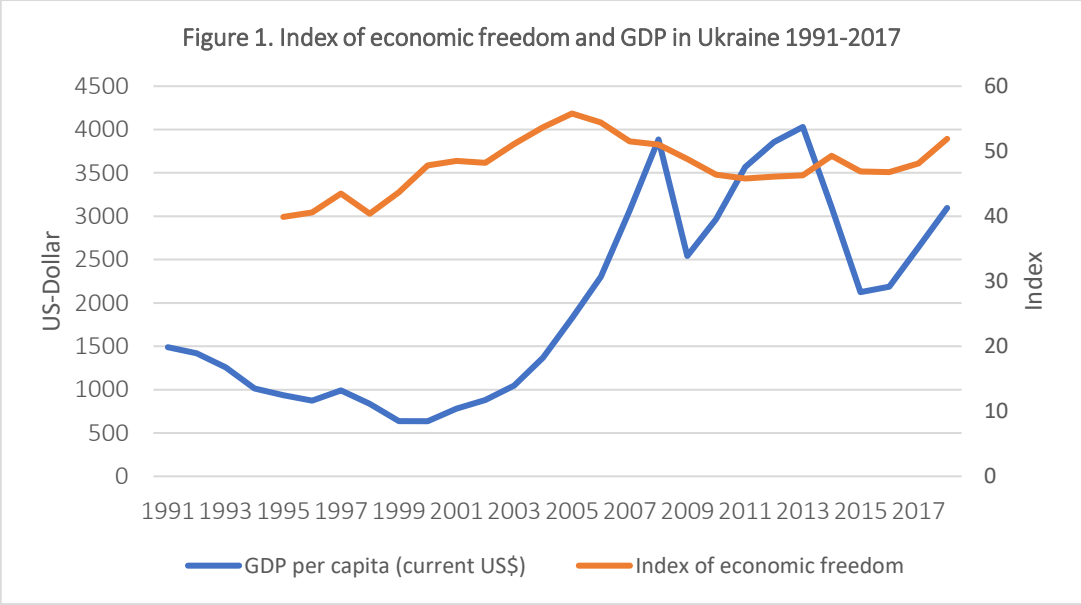
Disproportionate regional development negatively affects a country's growth. It should be noted an increase in disproportions between regions in many indicators, both economic and social in Ukraine's regions in transition (Nosova, 2017, p. 90)).

The period from 2009-2015 characterizes by financial and economic instability that discourage capital formation and could be seen in the falling apart of the curves GDP and index of economic freedom (See Figure 1).

GDP shrank by 16% in the two-year period from early 2014 to late 2015, while inflation surged, reaching a peak of 61% in April 2015, the exchange rate weakened, and the terms of trade deteriorated. The crisis of 2014-15 emphasized several institutions inherent in the Ukrainian economy (OECD, 2018). The dramatic depreciation of the hryvnia had a devastating effect on the balance sheet of enterprises. Following the latest updates of the overall situation in Ukraine, that country has overcome the heavy crisis caused by armed conflict in the eastern part of the country. At the same time, a 200 per cent devaluation of Ukrainian national currency (hryvnia) in 2014-2015 made Ukrainian goods and services cheaper and more competitive.

Figure 1

Index of economic freedom and GDP in Ukraine in 1997-2017



Source: Constructed on the data of Worldwide Governance Indicators. World bank Database.

In 2016, for the first time since 2010, the economy grew more than 2 %. Ukraine's GDP amounted to approximately 93.26 billion U.S. dollars in 2016. The analysis of Ukrainian

macroeconomic data GDP per capita in 2017 depicts on the tendency of industrial production shortage in heavy industry, including metallurgy and coal-mining industry. It explains through the high production costs, inefficient labor organization, and undeveloped infrastructure. The share of R&D expenditures in GDP always dropped the low level of 0.48 % in 2016 from 1 % a decade ago. The share of innovative enterprises in industry rose from a minimum level of 10 % to approximately 15-17%. At the same time, expenditure on innovation activities dropped substantially in 2014-2015 in comparison with previous years (Electronic Yearbook on Statistics, 2017). The level of innovation activities remains at low levels in comparison to the neighboring countries in Central and Eastern Europe. Global Competitiveness Report published by the World Economic Forum in 2019 and covered 141 economies. The Global Competitiveness Index measures national competitiveness – defined as the set of institutions, policies, and factors that determine the level of productivity. Competitiveness Index in Ukraine averaged 16.02 points from 2007 and a record low of 3.90 points in 2011. Ukraine scored 57 points out of 100 in 2019. (The Global Competitiveness Report 2019, 2019). The report shows various spheres in which Ukraine's competitiveness has dropped. Economic stability has fallen in two places.

The estimation results of index Component Innovation Capability of Global Competitiveness Index for Ukraine in 2019 demonstrate the tendency of decreasing the portion R&D expenditures to GDP from 1,1 % in 1998 to 0,4 % in 2019 (See Table 1).

Table 1

Index component innovation capability of global competitiveness index for Ukraine in 2019

№	Index Component	Value	Score	Rank	Best performer
	Research and Development 0-100	-	31.1	59	Japan
12.05	Scientific publications score	229.3	80.6	50	United Kingdom
12.06	Patent applications per million population	1.56	17.3	62	Sweden
12.07	R&D expenditures % GDP	0.4	15.0	67	Germany
12.08	Research institutions prominence 0-100 (best)	0.04	11.8	44	Germany

Source.constructed on the data of "The Global Competitiveness Report 2019", p. 573.

The analysis of the other index components for innovation capability displays low values comparing to world indicators, which demonstrates the need to increase the volume of R&D spending in Ukraine and stimulate generation of economic growth. The deteriorated domestic and external demand affects the output decrease in the major sectors of the Ukrainian economy. It reflected in decreasing the tendency of the volume of industrial production, fixed capital investment, exports and imports of goods and services. Because of uncertainty and high-

country risks, the consumer price index is increased. The current account and financial account deficits covered by the interventions of the National Bank of Ukraine.

Following the tendency, it should be mentioned that the present stage of economic development characterized by the growing role of regions as economic agents and participants at the international division of labor. Regional development significantly infuses and determines the pace of the country‘s growth.

The regional development illustrates an increase in territorial unevenness and aggravation of socio-economic and political problems in the country. Gross regional product (GRP) per capita is the most significant index characterizing the regional potential for producing goods and services. Innovation activities in countries behind the technology frontier, such as Ukraine, focus mainly on the adaptation of machinery, equipment, and software (Majcen et al., 2009). The estimation results point out the lower-level divergence in terms of GRP per capita. Hanouz, et al. (2008) make a conclusion that the degree of economic divergence between Ukrainian regions is moderate compared to other countries.

The innovation cost includes current and capital costs incurred by enterprises to innovate. The asymmetrical distribution of innovation expenditures by innovation activity direction in 2019 is evident in Kyiv, Kharkiv, Dnepropetrovsk, Odesa, Zaporizhzhia, and the remaining regions with low innovation expenses. Internal R&D, external R&D, acquisition of machinery, equipment and software security, other outside knowledge, and other expenses (including design, training, marketing, advertising, and other relevant activities) demonstrate the same tendency. The biggest number of innovative efficient industrial enterprises 119 situates in the Kharkiv region.

The analysis of the economic assessment of Ukrainian competitiveness shows the market concentration at the national level and the high degree between regional markets. The competition is still weaker at the regional level. Concentration has a negative and highly significant effect on labor productivity growth (2019 Index of Economic Freedom, 2019). Ukraine ranked 71 among 190 economies in the ease of doing business, according to the latest World Bank annual ratings. The rank of Ukraine improved to 71 in 2018 from 76 in 2017. Ease of Doing Business in Ukraine made 112.36 from 2008 until 2018, reaching an all-time high of 152 in 2011 and a record low of 71 in 2018 (Ease of Doing Business in Ukraine, 2019). The proportion of scientific and technical (experimental) advancements in Ukraine's overall spending on scientific R&D in 2023 was 49.6%, up from 59% in 2015. Research and development spending as a percentage of GDP fell from 0.75% in 2010 to 0.33% in 2023 (Economic statistics. (2020).

Estimation of the data for science, technology, and innovation in Ukraine shows that in terms of innovation activity, the state of high-tech products' production, the volume of science investigations, the infrastructure entrepreneurship development of Ukraine is far behind the leading countries in the world. Following the research, the approach focuses our attention on the complex character and comprehension of diverse factors influencing regional economic development. To activate the innovation process in the country, it should be considered the driving force of scientific, technological, and economic activity as a breakthrough to higher efficiency, productivity, competitiveness, and better quality of products.

3 METHODOLOGY

We analyze the results of hierarchical cluster analysis for Ukrainian regions from 2009 to 2013. The data of the State Statistics Service of Ukraine used for assessment Gross Regional Product from variables defining regional development for 27 Ukrainian regions (Statistical Publication. Regions of Ukraine, 2019).

Hierarchical cluster analysis identifies and organizes data object structures into clusters. It identifies homogenous groups of cases of unknown groups of estimation. We apply hierarchical clustering analysis of Gross Regional Product (GRP) from the employment, industrial production index, fixed capital investment index, the number of organizations, conducting scientific research, the total value of innovating costs per one thousand employed workers, and foreign direct investment (FDI). The hierarchical clustering analysis uses the SPSS Statistics program. The application Ward's method calculates the simple Euclidean distances from each case in a cluster to the mean of all variables. We assume that GRP determines total industrial production in Ukraine's regions. Employment defines labor in the region. The industrial production index, fixed capital, investment index determines regional capital. The number of organizations, conducting scientific research, total value of innovate costs per one thousand employed workers and FDI in region denote total factor productivity. The research limited with data analysis for 27 regions due to the temporal occupation parts of the territory of Ukraine in 2022.

4 RESULTS AND DISCUSSIONS

4.1 RESEARCH HYPOTHESIS

We test the following hypothesis: the dependence of regional cluster classification on the input factors of production combination in regions in Ukraine. We assess calculated distances between the most developed regions and the least undeveloped regions in hierarchical clustering. We estimate the single linkage criteria, that show the distance between the closest neighboring points. The results outline that the Kyiv distinguished from other regions. Capital Kyiv considered an outlier from other Ukrainian regions for all estimated periods with the biggest share of GRP.

Regions produce specific kinds of heavy industry products that caused division between highly industrialized developed regions with high urbanization and ‘less developed’ rural regions with agrarian orientation in Ukraine. The centralized industrial organization and the inefficient regional structure formation resulted in the disproportionate regional division in the former Soviet Union.

“Growth in incomes during the decade before the crisis was driven by favorable prices for commodity exports (particularly steel and chemicals) rather than much-needed improvements in productivity and competitiveness” (OECD, 2013). Consistent delays in implementing structural reforms and recurrent political instability left the economy stuck in transition and overly exposed to external shocks. The external position also strengthened, with the current account deficit falling from 9.2% of GDP in 2013 to 3.6% in 2016. Gross reserves remain low but have doubled to USD 15 billion.

Low demand and liquidity problems remained the major impediments for business development for Ukrainian industrial enterprises in 2013. Other important barriers to development were excessive taxation (which includes tax rates and tax administration) and unfavorable regulatory climate. Enterprise managers assessed the investment climate in 2013 as unfavorable. The share of the enterprises that considered the year 2013 to be “unfavorable for the purchase of equipment”, the indicator that measures investment environment, increased by 13.9 % to 71% in 2013. According to the results of the survey conducted in the 1st quarter of 2014, among major obstacles that hampered investment activity of companies in 2013 were insufficient income value (45.5%), unstable political situation (34%), and high cost of capital (28.7%) (Innovation support measures currently in place in Ukraine, 2017).

4.2 MODEL SPECIFICATION

The Gross Regional Product estimation interdependence from variables of the employment (thousand people), industrial production index (%), fixed capital investment index (%), the number of organizations, conducting scientific research (number), the total value of innovating costs per one thousand employees (%) and FDI (UAH) strengthens the dependence of regional cluster classification on the input factors of production combination in Ukrainian regions.

The present structure does not consider the geographical location, the economic endowment, and regional specificity. The graphical analysis of the line of the significant coefficients Ward's method proves the basic three clusters determination. The three clusters differ regard to the levels of industrial development and scientific potential. It should be noted the increase of heterogeneity with every step of econometric analysis. A hierarchical clustering model of 27 regions graphically represented at the dendrogram of regional cluster c classification on the input factors of production combination in regions for 2013. Classification on the input factors of production combination in regions demonstrates that each region has various distributions. The estimation results demonstrate the predominance of the Kyiv region in the analysis comparing to other regions and indicate their insignificant role in regional development. To define the role of the rest regions we exclude the Kyiv region from the sample and analyze 26 regions.

Hierarchical cluster analysis usage for 26 Ukrainian regions in 2013 demonstrates the presence of significant differences in the level of economic, scientific potentials, and confirms the low convergence between three clusters. The sufficient industrial and scientific endowment inheritance creates opportunities to exploit potentials and to improve position in cluster 2 in the rest regions.

The first cluster shows relatively higher than average level of economic estimation in comparison with two others. The real GDP index decreases, inflation (consumer price index), public debt, unemployment rate increases in 2013.

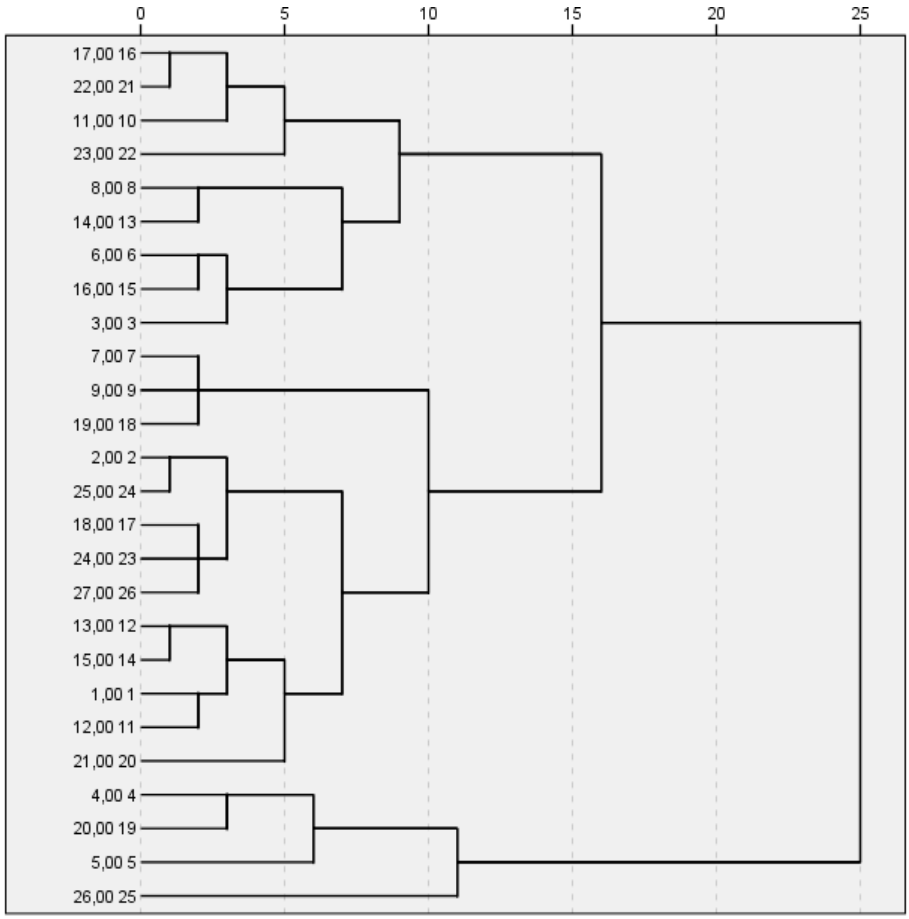
The current account balance was negative. The business activity decreases, macroeconomic instability and insufficient quality of institutions constitute a major impediment to Ukraine's regional economic performance as reflected in the regional indicators for 2013 (Institute for Economic Research and Policy Consulting Report, 2013).

The presented dendrogram uses an average Linkage ((between groups}. Combination of scaled distance clusters.

It is evident that the first cluster includes Kharkiv, Dnepropetrovsk and Donetsk regions (See Figure 2). The first cluster indicates the biggest industrial production indices in Ukraine. These regions concentrate the highest innovation capacities, more than average per capita income, and attracts the significant financial flows of capital. Kharkiv, Dnepropetrovsk and Donetsk regions show the best performing capital, labor, R&D capacities in the country. The cluster 2 includes the main regions Autonomous Republic Crimea, Zaporizhzhia, Kyiv, Lviv, Odessa, Luhansk, and Mykolaiv. The last cluster 3 involves the rest regions, some of which are specialized on agrarian production. Cluster mobility shows the low spread in economic development between regions.

Figure 2

Dendrogram of regional cluster classification on the input factors of production combination in regions



Strategic tasks of the regional policy in Ukraine: increasing the competitiveness of the regions and strengthening their resource potential; ensuring the development of human

resources; determination of spheres innovative breakthrough, development of inter-regional cooperation; creation of institutional conditions for regional development.

Further estimations tree of unification Ukrainian regions in the clusters by the method of single communication using features of the logarithmic scale demonstrates domination the predominance of industrial regions. The variables number of enterprises that introduced innovations, costs of technological innovations, new technological products, low waste; resource-saving, waste -free processes applied for assessment 26 regions in 2014 in Ukraine. The research proves that the bulk of R&D resources is concentrated in Kyiv, Kharkiv, Dnepropetrovsk, and Donetsk regions. It causes the necessity of redistribution of scientific resources among regions for equalization of its regional gross regional product per capita.

The choice and construction of the model of hierarchical cluster analysis suggest the assessment of the economic variables, estimation of the significant coefficients, and determination of some of the basic factors of innovation policy. The limitation of research indicates the problem of availability statistical information, methods of estimation results. The increased period of investigation and inclusion of additional variables for estimation will provide a detailed analysis of regional development in Ukraine.

The results of the study confirm the feasibility of applying this approach to assess regional innovation potential. Providing access to the results of hierarchical cluster analysis offers an insightful assessment of innovation policy practice and its evaluation for Ukraine's regions. We consider that regional policy should consider the innovation component for each individual region.

The regional authority's function is to elaborate and realize inter - cluster projects, and support of new ideas and experience. The organization attractive innovation policy for innovative cluster development based on coordination activities, financing, and attracting investment will stimulate innovations' increase in regions.

5 CONCLUSION

The regional economic policy implementation provides a necessity for paying attention to the innovative component. Cluster analysis confirms the asymmetric distribution of input factors of production in Ukrainian regions. The balanced regional policy stimulates equalization gross regional product per capita. Clusters' creation in the form of technopark is the strategy for innovative development in the regions. The mechanisms for technoparks implementation consider based on zones with attractive innovation climate. The favorable law legislation, tax

exemptions, access to financial resources, availability of office production infrastructure, telecommunications, conditions for comfortable living standards are vivid components of analyzed mechanism.

In the process of hierarchical cluster application, it should be noted the crucial role of forms of private - public partnership. The state is responsible for legal initiatives in providing policy for innovative environment formation. Entrepreneurship development plays a crucial role in disseminating innovative ideas and implementing innovative projects.

REFERENCES

Aghion, P., Harris, C., Howitt, P. (2001). Competition, Imitation and Growth with Step -by-Step Innovation, *Review of Economic Studies, vol. 68, issue 3,* 467-492.

Antonelli, C. (2017). *Endogenous Innovation. The Economics of an Emergent System Property,* Edward Elgar Publishing.

Bogliacino, F., Lucchesse, M., Nascia, L., Pianta, M. (2016). Modeling the virtuous circle of innovation. A test on Italian firms, *Industrial and Corporate Change,* 26 (3).

Electronic Yearbook on Statistics of R&D and Innovation (2017), https:// www.ukrstat.gov.ua

Chaminade, C., Lundvall, B-A., Shagufta, H. (2018). *Advanced Introduction to National Innovation Systems*, Edward Elgar Publishing.

Edler, J., Cunningham, P., Gok, A. (2016). *Handbook of Innovation Policy*, Edward Elgar Publishing.

Edler, J., Fagerberg, J. (2017). Innovation Policy: What, Why and How, *Oxford Review of Economic Policy*, volume 33, issue 1, 2-23.

Granstrand, O. (2018). Patents and Innovation for Growth and Welfare. IP Policy issues for Europe, Edward Elgar Publishing. June.

Kingston, W. (2017). *How Capitalism Destroyed Itself: Technology Displaced by Financial Innovation*, 21 March, Edward Elgar Publishing.

Metcalfe, S. J. & Ramlogan, R. (2006). Adaptive Economic Growth, *Cambridge journal of Economics, 30(1), February* 7 -32.

Nosova, O.V. (2017). The Effects of Industrial Policy on Regional Development in Ukraine, *Zarządzanie Publiczne,* (Nr 4(42), 90 – 101.

Nosova, O.V. (2017). The Impact of Globalization on Financial Institutions' Development, *Europa Regionum, Tom XXX. Household Finance. Uniwersytet Szezecinski*, № 1, 99 - 119.

Policy Research Paper, No. 102, University of Strathclyde Publishing, April.

Pyka, A., Kudic, M., Muller, M. (2019). Systemic Interventions in Regional Innovation Systems: Entrepreneurship, Knowledge and accumulation and Regional Innovation, *Regional Studies. Volume 53, Issue 9,Vol. 53, https://doi.org/10.1080/00343404.2019.1566702*

Sineviciene, L., Shkarupa, O., Sysoyeva, L. (2018) Socio-economic and Political Channels for Promoting Innovation as a Basis for Increasing the Economic Security of the State: Comparison of Ukraine and the Countries of the European Union. SocioEconomic Challenges, Volume 2, Issue 2, RRMG Publishing: 81-93

Economic statistics. (2020). Science, Technology and Innovation https://ukrstat.gov.ua/operativ/menu/menu_u/ni.htm

The Global Competitiveness Report 2019. (2019). Professor Klaus Schwab World Economic Forum Editor.

Ukraine Competitiveness Index. https://tradingeconomics.com/ukraine/competitiveness-index

Ukraine Competitiveness Rank, 2019. available online at: https://tradingeconomics. com> Ukraine>competitiveness-rank

Von Schomberg, R., Hankins J. (2019), *International Handbook on Responsible Innovation. A Global Resource*, Edward Elgar Publishing.

Worldwide Governance Indicators. Worldbank Database. https://info.worldbank.org/governance/wgi/Home/Documents#wgiOverTime