

Changes in composition and spatial distribution of knowledge-based economy in rural areas of Latvia

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Abstract. One of the features in the 21st century is growth of knowledge-based economic sector, which is referred as new growth theory. New growth theory reflects the attempt to understand the role of knowledge and technology in driving productivity and economic growth. In this view, key factors are investments in research and development, education and training and new managerial work structures. The aim of research is to estimate the composition and geographic location of knowledge economy and its perspectives in rural areas of Latvia in post-crisis stage. A special focus was placed on the mentioned processes in territorial units of the regions – municipalities, as the life of residents is influenced not only by national policies, but also by on-going processes in the administrative territories of local governments. The Eurostat classification of industries was used for the analysis of changes in composition and spatial distribution of knowledge-based economy. Data were processed by quantitative and qualitative statistical analysis, as well as grouping methods. The analysis of the information allows concluding that: municipalities with high and medium-high business is increasing and the business directions with bioeconomic features are the fastest growing ones in terms of composition. It must be stated that the economic growth in the rural territories was greatly affected by the quality of local governance and the fact that local community residents' readiness for active, innovative and inclusive action is strengthened.

Keywords: knowledge-based economy, Eurostat classification of industries, composition and spatial distribution, local governance, local community.

JEL codes: O30, P31, R12.

INTRODUCTION

Expansion of knowledge-based economy sector is treated as a development model or stage in 21th century. 'The knowledge based economy' is an expression coined to describe trends in advanced economies towards greater dependence on knowledge, information and high skill levels, and the increasing need for ready access to all of these by the business and public sectors (OECD, 2005). The classification of economic sectors developed by EUROSTAT clearly indicates, which processing industries and services are a part of the knowledge economy segment (EUROSTAT, NACE Rev.2, 2008), thus

opening up the possibilities for current in-depth analysis of the national economy segment.

Firstly, the theoretical basis of the research is a spatial approach to the analysis of the phenomenon, which includes both its territorial disposition and its socio-economic and environmental objective-subjective characteristics and ongoing changes. In general, these processes are characterized by significant sociologists (Sztompka, 1993; Castells, 2000; Macionis, 2004), as well as leading researchers in rural development in Europe (Ploeg J.D. van der, etc., 2000; Woods M., 2012). The abovementioned researchers indicate that developments in the field of rural development at the beginning of the 21st century include multi-level changes in agricultural and public relations, changes in the agricultural sector itself, as well as the combination of various activities within the agricultural sector.

In the 21st century, the question of rural viability and, hence, the optimization of opportunities provided by rural areas has been raised. Researchers focus on the impact of rural space on economic growth, including the knowledge economy, the use of riches provided by the rural environment for the production of organic food and other needs (Chotovinsky & Altmann, 2017; COTER, Territorial impact, 2017; Ronkkoi & Aarrevaara, 2017; etc.).

Secondly, research is based on theoretical understanding of structural changes in economics and a set of practical evidence. The economy functioning in the territory of the state, region, municipality (local territory) is a system consisting of economic activity sectors and industries. The change in the share of sectors and industries in the system reflects the potential directions for the economic development of the territorial unit and points to the tasks to be solved in the first place (Hartwig, 2010; Campligio, 2014; Lankauskiene, 2015; Sipilova, 2015, etc.). The increase in the productivity of economic activity is set as the main desired benefit of structural change is. (Padilla-Perez & Villareal, 2017; Vu, 2017). Research concludes that quantitative and qualitative growth does not occur at the same time – at the beginning there is a quantitative growth and qualitative changes begin and develop only after a certain period of time (Chen et al., 2011). During analysis of the situation, certain steps must be taken: Economic structure → Economic sectors → Economic sector performance → Economic growth (Lankauskiene & Tvaronavičienė, 2013), a successive implementation of which can provide an assessment for the ongoing processes and conclude, whether the structural upgrading has yielded expected results.

A knowledge-based economy together with its formation and functioning processes and its problems has become a significant research field in the whole world. Therefore, rural communities must participate in the knowledge economy to fully utilize the advances in research and development. All types and sizes of rural business must have access to appropriate technology, state-of-the-art connectivity, as well as new management tools to deliver economic, social and environmental benefits (CORK 2.0. Declaration 2016).

A group of researchers working on the development of rural viability analysis and smart development has carried out quantitative growth of the economy in 2009–2016 (Rivza et al., 2016; Rivza et al., 2017; Rivza & Kruzmetra 2017). An extensive evaluation of the knowledge economy segment was performed, the results of which are summarized in this article.

The aim of research is to estimate the composition and geographic location of knowledge economy and its perspectives in rural areas of Latvia in post-crisis stage. A special focus was placed on the mentioned processes in territorial units of the regions – municipalities, as the life of residents is influenced not only by national policies, but also by on-going processes in the administrative territories of local governments.

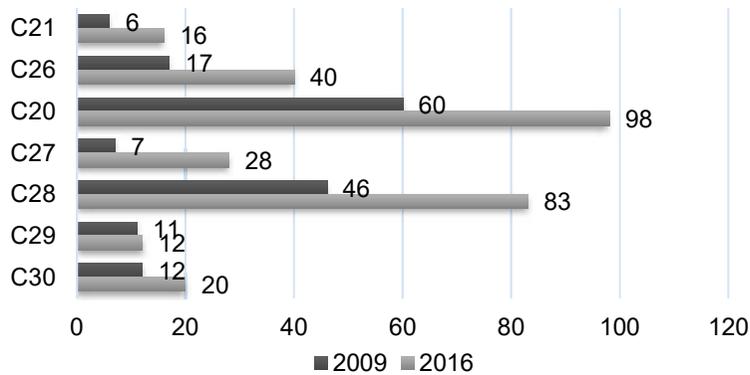
Methodology and methods: For the analysis of the knowledge economy, the Eurostat methodology for classifying NACE Rev.2 industries and the Latvian Bioeconomy Strategy 2030 for the classification of bioeconomy have been used. The Latvian Business Register (LURSOFT) data for the period 2009–2016 and Central Statistical Bureau data for the period 2009–2016 were used as information sources. The data were processed by quantitative (growth) and qualitative (structural changes) statistical analysis methods, as well as cluster analysis – the grouping of Latvian municipalities in terms of the composition and spatial structural changes in the segment of high and medium-high technology processing industry. The development of knowledge economy is assessed based on the changes in the number of businesses involved in high-tech (HT) and medium-high tech (MHT) activities and the changes in the share of specific activities.

RESULTS AND DISCUSSIONS

1. Composition changes in the knowledge economy of HT and MHT manufacturing industry segments

Changes in the economy can take place and be evaluated: among sectors, within the sectors, i.e. among industries of the sector, including changes in sector and industry specialization (Palan, 2010). The research part of the present article provides extensive analysis of the knowledge economy, consisting of HT and MHT manufacturing enterprises. This share of 0.9% of the economy in total has increased slightly to 0.98% over the period under review. The study reveals the content of this process.

As shown in the Fig. 1, the growth is observed in all sector groups, but rapid increase can be seen in five of the seven industry groups – in both high-tech groups (C21, C26) and in three medium-high technology groups (C20, C27 and C28). In absolute numbers, the number of hi-tech enterprises in 110 municipalities has increased 2.43 times, while the medium-high technology – 1.77 times. Since C20 and C21 are considered as traditional bioeconomic sectors (Bioeconomic Strategy..., 2017), the authors carried out an internal analysis of the C20 and C21 enterprises for determining the composition. The obtained data indicate that C21 industry had the largest increase in number of pharmaceutical enterprises, but in the case of C20 – among enterprises, specializing in fertilizer and nitrogen compound production, as well as soap and detergent manufacturing enterprises. These trends justify the nomination of a bioeconomy as a significant direction of rural business in Latvia also in the segment of high and medium technology business segment (Pilvere et al., 2016). The data also confirms that Latvia is involved in implementing the EU policy of bio-economic strategy (European Commission, 2017).



where C21 – manufacture of basic pharmaceutical products and preparations; C26 – manufacture of computer, electronic and optical products; C20 – manufacture of chemicals and chemical products; C27 – manufacture of electrical equipment; C28 – Manufacture of machinery and equipment; C29 – manufacture of motor vehicles, trailers and semi-trailers; C30 – manufacture of other transport equipment.

Figure 1. Increase of knowledge economy enterprises in the rural space of Latvia in 2009–2016 (number of enterprises).

Source: classification of HT and MHT manufacturing industry groups by division of NACE Rev. 2.

Different growth pace in the composition of high and medium-high technology enterprises has also been initiated by changes in the share of enterprises in a particular group. Three directions – C27 Manufacture of electrical equipment, C26 Manufacture of computer, electronic and optical products and C21 Manufacture of basic pharmaceutical products and pharmaceutical preparations have increased their impact (Table 1).

Table 1. Changes in the share of high-tech and medium tech enterprises by their economic activity between 2009 and 2016

	C21	C26	C20	C27	C28	C29	C30	Total
2009	3.8	10.7	37.7	4.4	28.9	6.9	7.5	100.0%
2016	5.4	13.5	33.0	9.4	27.9	4.0	6.7	100.0%
Changes	+1.6	+ 2.8	- 4.7	+ 5.0	- 1.0	- 2.9	- 0.8	

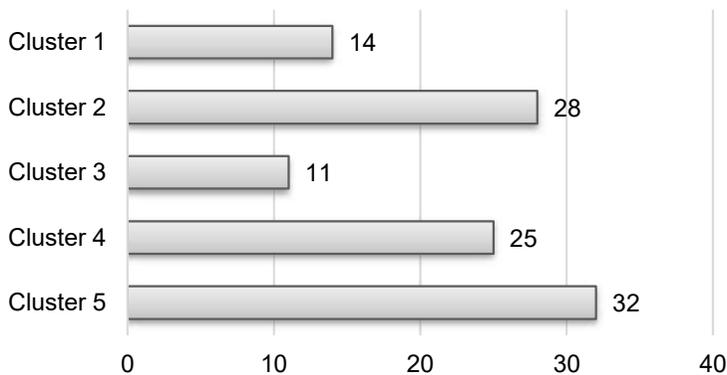
However, this has not changed the situation the dominant sector in high and medium technology group is C20 Manufacture of chemicals and chemical products and C28 Manufacture of machinery etc. As a result, it can be concluded that the group of high and medium-high technology enterprises in the country's rural economy has grown overall and its internal restructuring has taken place in the desired direction.

2. Changes in the spatial location of the knowledge economy in HT and MHT manufacturing industry segment

The analysis of LURSOFT data shows not only the increase in the number of HT and MHT enterprises and the changes in composition within these groups of enterprises, but also the changes in spatial layout. As a result, it is possible to distinguish five municipality groups or clusters, the common feature of which is the existence and

absence of a HT and MHT enterprises groups, but different feature – the growth, stagnation or decline of the particular group of enterprises.

In all 110 municipalities of Latvia, the growth of the HT and MHT manufacturing industry group is characterized in 53 municipalities (48.2% of the total number of municipalities – Clusters 2 and 4). In addition, the HT and MHT manufacturing industry group has emerged and continues to function in the post-crisis period in 25 districts (22.7% – Cluster 4). Stagnation has occurred in 14 municipalities (12.7% – Cluster 1), where the HT and MHT manufacturing industry group has been maintained, but expansion has not been achieved. The decline in the significant segment of the national economy has taken place in 11 municipalities (10.0% – Cluster 3). Finally, it should be noted that there are 32 municipalities in Latvia (29.1% – Cluster 5), where the group of such enterprises did not exist at all and has not appeared during post-crisis period. Such processes took place in common rural area of Latvia outside cities of national significance (Fig. 2).



where Cluster 1 – municipalities, where corresponding enterprise group existed in 2009 and continue to work also in 2016, but the number of enterprises over the present period has not changed; Cluster 2 – municipalities, where corresponding enterprise group existed in 2009, but the number of enterprises increased rapidly by 2016; Cluster 3 – municipalities, where corresponding enterprise group existed in 2009, but the number of enterprises decreased or stopped its activity by 2016; Cluster 4 – Municipalities, where corresponding enterprise group did not exist in 2009, but emerged by 2016; Cluster 5 – municipalities, where corresponding enterprise group did not exist in 2009, and has not emerged by 2016.

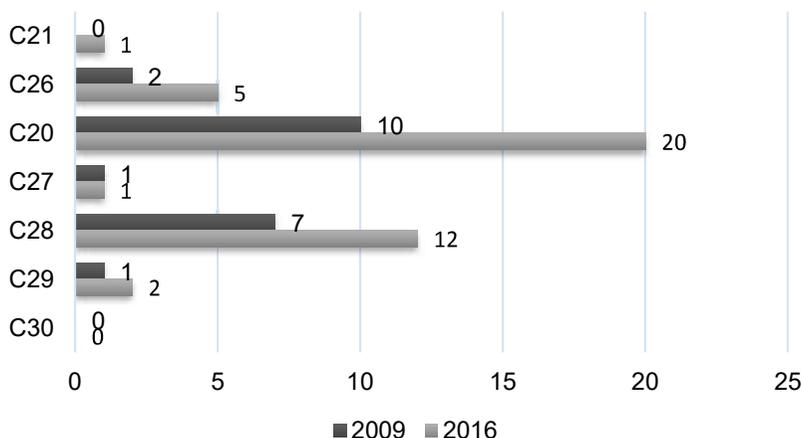
Figure 2. Spatial view of development processes in enterprises of knowledge economy (year 2016 in comparison to 2009) (number of municipalities).

Territorial differences in the entry of the HT and MHT manufacturing industry into the rural area raise new challenges for further research. It is necessary to answer the questions – what facilitates and what hinders the process? – to what extent they are objective factors (natural environment, geographic location, etc.) and to what extent they are subjective factors (quality of management, citizens' readiness for the new economic model, etc.)? – how to promote knowledge transfer processes from research findings to practical work both in management system and business better?

3. Common and different in the group of HT and MHT enterprises in Zemgale and Kurzeme regions

The analysis of individual regions in previously performed divisions, of course, shows some differences. For comparison, the authors selected HT and MHT group companies of two regions for the analysis of the composition and spatial changes – Kurzeme and Zemgale. Kurzeme and Zemgale regions are spatially encountered, since they are neighboring regions, as well as they both belong to medium-sized regions of Latvia in terms of size and population. Both regions consist of two national cities each and municipalities – eighteen municipalities in Kurzeme, and twenty municipalities in Zemgale. The changes in HT and MHT manufacturing industry composition occurring in these municipalities over the revised period reveal differences.

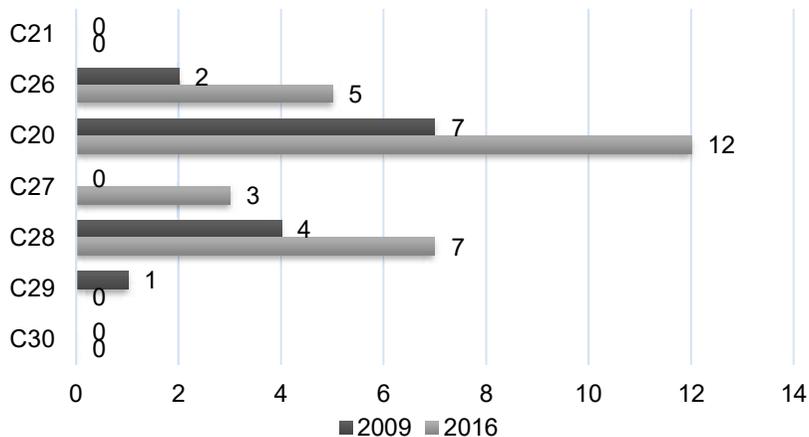
In the rural area of the Zemgale region, as in all 110 municipalities, the number of HT companies has increased more rapidly than the number of MHT companies (HT – 3.0 times, but MHT – 1.8 times). In the high technology group, two directions stand out – C21 and C26, and two in the medium high technology group – C20 and C28 (Fig. 3).



where C21 – manufacture of basic pharmaceutical products and preparations; C26 – manufacture of computer, electronic and optical products; C20 – manufacture of chemicals and chemical products; C27 – manufacture of electrical equipment; C28 – Manufacture of machinery and equipment; C29 – manufacture of motor vehicles, trailers and semi-trailers; C30 – manufacture of other transport equipment.

Figure 3. Growth of knowledge economy enterprises in the rural area of Zemgale Region in 2009–2016 (number of enterprises).

The analysis of Kurzeme region data shows three differences in comparison with Zemgale region. Firstly, the highest growth was not observed in the HT group (2.5 times), but in the MHT group (3.3 times). This growth rate is almost twice as the average in Latvia. Secondly, the high-technology group consists only of C26 – Manufacture of computer, electronic and optical products, but the group of medium-high technology companies distinguishes three directions – C20, C27 and C28 (Fig. 4). Thirdly, bioeconomic direction is growing more rapidly in Zemgale region, in comparison with Kurzeme region, while in Kurzeme region, compared to Zemgale region, a faster breakthrough is in the production of electrical and mechanical equipment.



where C21 – manufacture of basic pharmaceutical products and preparations; C26 – manufacture of computer, electronic and optical products; C20 – manufacture of chemicals and chemical products; C27 – manufacture of electrical equipment; C28 – Manufacture of machinery and equipment; C29 – manufacture of motor vehicles, trailers and semi-trailers; C30 – manufacture of other transport equipment.

Figure 4. Growth of knowledge economy enterprises in the rural area of Kurzeme Region in 2009–2016 (number of enterprises).

The different growth rates of the composition growth, of course, lead to a change in their share. There are also differences and common features in the process for both regions.

As data show, the largest increase in the share of Zemgale region is for HT companies (C21 and C26), although the majority of HT and MHT companies retain the largest share (even slightly increasing) C20 – Manufacture of chemicals and chemical products, with the decrease of the C28 share (Table 2). In Kurzeme region, HT and MHT companies generally have an increase in the share of only two directions: C26 and C27. C20 dominance remains, but declines by 5.6%. So again, from another aspect of view (the proportion of HT and MHT companies in general), the conclusion can be confirmed that the production of electrical and mechanical equipment is becoming more important in Kurzeme region. At the same time with the growth and restructuring of the HT and MHT processing industry in Zemgale and Kurzeme region, the results of the research showed changes in the spatial arrangement of this processing industry group (Table 3).

Table 2. Changes in the share of high- tech and medium high-tech companies in Zemgale and Kurzeme regions

	C21	C26	C20	C27	C28	C29	C30	Total
Zemgale region								
2009	0.0	9.5	47.6	4.8	33.3	4.8	0.0	100.0%
2016	2.4	12.2	48.8	2.4	29.3	4.9	0.0	100.0%
Changes	+ 2.4	+ 2.7	+1.2	-2.4	-4.0	+ 0.1	0.0	
Kurzeme region								
2009	0.0	14.3	50.0	0.0	28.6	7.1	0.0	100.0%
2016	0.0	18.5	44.4	11.1	25.9	0.0	0.0	100.0%
Changes	0.0	+4.2	-5.6	+ 11.1	-2.7	0.0	0.0	

Table 3. The changes in the spatial distribution of HT and MHT enterprises in Zemgale and Kurzeme regions during 2009–2016

Indicators	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Total
<u>Changes in the location of enterprises in municipalities of Zemgale region</u>						
2009	7	9	5	0	0	21
2016	7	20	2	12	0	41
The number of municipalities	2 municipalities	4 municipalities	2 municipalities	6 municipalities	6 municipalities	20
<u>Changes in the location of enterprises in municipalities of Kurzeme region</u>						
2009	7	2	5	0	0	14
2016	7	9	3	8	0	27
The number of municipalities	3 municipalities	2 municipalities	2 municipalities	7 municipalities	4 municipalities	18

Source: Calculation by the authors after LURSOFT data,

where Cluster 1 – municipalities, where corresponding enterprise group existed in 2009 and continue to work also in 2016, but the number of enterprises over the present period has not changed; Cluster 2 – municipalities, where corresponding enterprise group existed in 2009, but the number of enterprises increased rapidly by 2016; Cluster 3 – municipalities, where corresponding enterprise group existed in 2009, but the number of enterprises decreased or stopped its activity by 2016; Cluster 4 – Municipalities, where corresponding enterprise group did not exist in 2009, but emerged by 2016; Cluster 5 – municipalities, where corresponding enterprise group did not exist in 2009, and has not emerged by 2016.

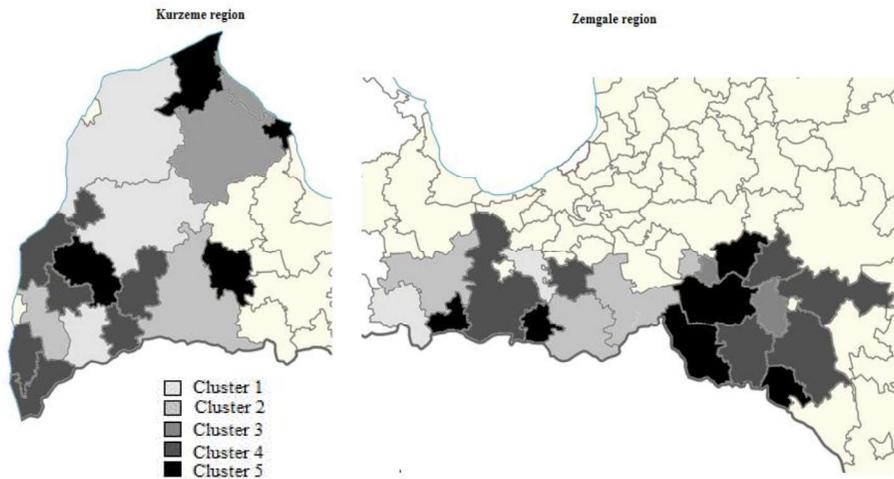


Figure 5. Spatial distribution of HT and MHT manufacturing industry groups in Kurzeme and Zemgale regions.

In terms of spatial analysis, both regions are characterized by two common qualitative features:

- there are municipalities in both regions where the HT and MHT enterprises until 2016 has not entered (Cluster 5);
- both regions have municipalities where in 2009 there were no HT and MHT manufacturing industries, but it has formed by 2016 (Cluster 4).

The difference is in the pace of spatial changes. In Kurzeme region spatial expansion, including new municipalities has occurred more rapidly than in Zemgale region. In Kurzeme region, the number of municipalities where HT and MHT processing

enterprises operate over eight-year period has increased from 38.9% to 77.8% of the total number of municipalities, but in Zemgale region – from 40.0% to 70.0%. Within the framework of the research, the spatial expansion of HT and MHT is significant because it confirms that the knowledge-intensive industry does not have the tendency to focus only on selected sites, but it has the opportunity to expand sufficiently widely in rural areas outside large national cities (Fig. 5).

CONCLUSIONS

Changes in the knowledge economy, including high and medium-high technology business, are happening. At the same time, there are also substantial changes in this part of the business. The direction of the bio-economy and the production of innovative equipment in the economy has a tendency to increase. The high and medium-high technology business is expanding not only in the municipalities where it operated already in 2009, but also expanding spatially, starting its activity in completely new areas. So, the business of high and medium technology is expanding substantially and spatially.

Comparison of data in Zemgale and Kurzeme regions shows that the composition and spatial changes in the processing industry of the knowledge economy result in differences between regions over time. Data analysis for municipalities of Zemgale and Kurzeme region indicates that the process of composition and spatial change in the knowledge economy processing industry takes place within the region as well. There are municipalities where innovation expands in all territory of municipality, there are municipalities where innovations are expanding, but at the same time, there are municipalities where the high and medium-high technology processing industry has never been and does not form a part in the national economy. Therefore, from the scientific as well as the economic point of view, the questions remain: – whether the pace of changes in the processes corresponds to the current requirements; – how justified are the composition and spatial changes in high and medium technology processing businesses; – how this business option in the rural environment is influenced by the readiness of local people for innovative action.

Finding answers to these questions is possible only by developing cooperation between research institutions and scientists in creating synergies for the development of a sustainable and intelligent rural area.

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REFERENCES

- Bioeconomic Strategy of Latvia. Informative report. (03.05.2017), 10 pp. Access: https://www.zm.gov.lv/public/files/CMS_Discuss_Doc/00/00/00/12/74/ZMZino_31072017_LIBRA.pdf (in Latvian).
- Campligio, E. 2014. The structural shift to green services: A two-sector growth model with public capital and open-access resources. *Structural Change and Economic Dynamics* Vol. 30, pp. 148–161.
- Castells, M. 2000. *The Rise of the network Society*. 2nd ed. Blackwell Publishing, Oxford, UK, 594 pp.

- Chen, S., Jeffersen, G.H., Zhang, J. 2011. Structural change, productivity growth and industrial transformation in China. *China Economic Review* **22**, 133–150.
- Chotovinský, O. & Altmann, V. 2017. Performance analysis of biodegradable municipal solid waste collection in the Czech Republic. *Agronomy Research* **15**(4), 1559–1570.
- CORK 2.0. Declaration 2016. A Better Life in Rural Areas.
Access: https://ec.europa.eu/agriculture/events/rural-development-2016_en
- COTER. 2017. Territorial Impact Assessment. Smart specialisation. Brussels, 3.03.2017.
Access: <http://cor.europa.eu/en/events/Documents/COTER/TIA/smart-specialisation.pdf>
- European Commission. 2017. Review of the 2012 European Bioeconomy Strategy Luxembourg: Publications Office of the European Union.
- EUROSTAT. 2008. NACE Rev. 2. Statistical classification of economic activities in the European Community. Luxembourg: Office for Official Publications of the European Communities <http://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF>
- Hartwig, J. 2010. Testing the growth effects of structural change, KOF Working Papers No. **264**, Zurich.
- Lankauskiene, T. & Tvaronaviciene, M. 2013. Economic Sector Performance and Growth: Contemporary Approaches in the Context of Sustainable Development. *Intellectual Economics*, Vol. **7**, **3**(17), 355–374 doi:10.13165/IE-13-7-3-07
- Lankauskiene, T. 2015. *Economic Structure and Economic Growth Evaluation. Doctoral Dissertation*. Vilnius Gediminas Technological University, Vilnius 'Technica', pp.37–44.
- Macionis, J. 2004. *Society: the Basics*. Pearson, 544 pp.
- OECD 2005. *The Measurement of Scientific and Technological Activities Guidelines for Collecting and Interpreting Innovation Data: Oslo Manual, Third Edition*, 71 pp.
Access: <https://stats.oecd.org/glossary/detail.asp?ID=6871>
- Padilla-Perez, R. & Villareal, F.G. 2017. Structural change and productivity growth in Mexico, 1990–2014. *Structural Change and Economic Dynamics* **41**, 53–63.
- Palan, N. 2010. Measurement of specialization. The choice of indices. *FIW Working Paper* Nr. 62.
- Pilvere, I., Nipers, A. & Silamikele, I. 2016. *Output of Bioeconomy Strategy in Latvia*. 16–22 pp.
Access: http://www.norden.lv/Uploads/2016/08/26/1472194599_.pdf
- Ploeg, J.D. van der etc. 2000. Rural Development: From Practices and Policies towards Theory. *Sociologia Ruralis* **40**, 391–408.
- Rivza, B., Kruzmetra, M. & Zaluksne, V. 2016. Performance Trends for Smart Growth in the Rural Territories of Latvia. *Agronomy Research* **14**(5), 1684–1693.
- Rivza, B., Kruzmetra, M. & Zaluksne, V. 2017. Through Economic Growth to the Viability of Rural Space. *Agronomy Research* **15**(5), 2079–2089.
- Rivza, B., Kruzmetra, M. 2017. Through economic growth to the viability of rural space. *Entrepreneurship and Sustainability Issues* **5**(2), 283–296
Access: [https://doi.org/http://doi.org/10.9770/jesi.2017.5.2\(9\)](https://doi.org/http://doi.org/10.9770/jesi.2017.5.2(9))
- Ronkoi, E. & Aarrevaara, E. 2017. Towards Strengths-based Planning Strategies for Rural Localities in Finland. *European Countryside* **9**(3), 397–415. DOI: 10.1515/euco-2017-0024
- Sipilova, V. 2015. *Structural Changes in Manufacturing and their Impact on Economic Growth*. Doctoral Thesis. Daugavpils University, 117 pp. (in Latvian).
- Sztompka, P. 1993. *The Sociology of Social Changes*. Oxford UK, Cambridge US: Wiley-Blackwell. 368 pp.
- Vu, K.M. 2017. Structural change and economic growth: Empirical evidence and policy insights from Asian economies. *Structural Change and Economic Dynamics* **41**, 64–77.
- Woods, M. 2012. New directions in rural studies? *Journal of Rural Studies* **28**, 1–4.