

Bojan Krstić¹
Tanja Stanišić²
Vladimir Radivojević³

JEL: O38, O31, C35
DOI:10.5937/industrija44-10674
UDC: 005.591.6
339.137(4-672EY)
Original Scientific Paper

The Impact of Innovativeness Factors on the EU Countries' Competitiveness

Article history:

Received: 7 April 2016
Sent for revision: 16 May 2016
Received in revised form: 6 June 2016
Accepted: 12 June 2016
Available online: 11 July 2016

Abstract: *The purpose of this paper is to explore the impact of innovativeness factors in the European Union (EU) member states on the level of their national economy competitiveness (global competitiveness of each country in the EU). The aim of the research is to identify the vital factors of innovativeness, innovative activity and innovation capital in the EU member states. The research is realized by the method of correlation, regression and cluster analysis. The research results point to the existence of differences in the level of innovativeness of the EU countries, a high correlation level between competitiveness and innovativeness, as well as segments of innovation activities (innovativeness factors) which require necessary actions for increasing the competitiveness level of the EU countries. The study gives recommendations to the innovation policy makers in the European Union countries for formulating national innovation strategy.*

Keywords: *innovation, innovativeness, competitiveness, European Union.*

Uticaj faktora inovativnosti na konkurentnost zemalja EU

Apstrakt: *Cilj ovog rada je da istraži uticaj faktora inovativnosti u zemljama članicama Evropske unije (EU) na nivo konkurentnosti njihove nacionalne ekonomije (globalne konkurentnosti svake zemlje pojedinačno u EU). Cilj istraživanja je da se identifikuju vitalni faktori inovativnosti, inovativne aktivnosti i inovacionog kapitala u zemljama članicama EU. Istraživanje je realizovano primenom metoda korelacione, regresione i klaster analize. Rezultati istraživanja ukazuju na postojanje razlika u stepenu inovativnosti*

¹ University of Niš, Faculty of Economics, bojkr@eunet.rs

² University of Kragujevac, Faculty of Hotel Management and Tourism in Vrnjačka Banja

³ Ministry of Defense of the Republic of Serbia, Serbian Armed Forces, Niš

zemalja EU, na visok nivo korelacije između konkurentnosti i inovativnosti, kao i na segmente inovacionih aktivnosti (tzv. faktori inovativnosti) koji zahtevaju neophodne akcije za povećanje nivoa konkurentnosti zemalja članica EU. Istraživanje pruža preporuke kreatorima inovacione politike u zemljama Evropske unije za formulisanje nacionalne strategije inovacija.

Ključne reči: inovacije, inovativnost, konkurentnost, Evropska unija.

1. Introduction

The knowledge economy is information and intangible age in which innovations and intellectual resources are necessary for contemporary business activities. "The knowledge economy is the one in which knowledge in the form of intellectual capital is the primary factor of production" (Bedford, 2013, 278). Development of the knowledge economy is "one of the most important priorities of the modern society" (Melnikas, 2011). The challenges which modern knowledge economies face in a constant quest to survive in a competitive game in the global market require continuous improvement of all activities of knowledge creation and application in various fields (Krisciunas & Daugeliene, 2006). Such activities primarily involve innovation, research and development, education and training of the workforce. The aim to keep up with the developed world economies by continually strengthening competitiveness is a difficult, but unavoidable task.

The knowledge society and innovation economy are based on the following postulates:

- 1) Stimulating the development of the environment and institutional regime, as well as a legal institution that provides the efficient creation, dissemination and application of existing and newly created knowledge (Anderlini, Felli, Immordino, & Riboni, 2013; Tebaldi & Elmslie, 2013);
- 2) Educated and skilled people that continuously improve their personal competencies to effectively create and use new, productive knowledge;
- 3) An effective innovation system which includes companies, research centers, universities and other public organizations that promote innovations and growth of innovation capital (Verspagen, 2006);
- 4) An adequate information infrastructure that will ensure effective communication, dissemination and analysis of knowledge in the aim of better innovation realization process.

Innovations are becoming central to creating and sustaining competitive advantage (Houghton & Sheehan, 2000). "Innovations constitute a distinctive attribute of modern economies" (Clancy & Moschini, 2013). Innovations are

the basis on which the growth strategies of enterprises and national economies are formulated (Carlaw & Lipsey, 2006; Grossman & Helpman, 1994; Rutkauskas, 2008; Lucas, 2009; Zachariadis, 2003, Chen & Iyigun, 2011). The confirmation of this claim can be found in the document "Europe 2020", which puts forward three mutually reinforcing priorities:

- 1) Smart growth: developing an economy based on knowledge and innovation,
- 2) Sustainable growth: promoting a more resource efficient, greener and more competitive economy,
- 3) Inclusive growth: fostering a high-employment economy delivering social and territorial cohesion (European Commission, 2010).

As we can see, innovations and knowledge occupy the first place on the list of defined priorities with the aim of improving national competitiveness (Vigier, 2007). In fact, the European Union (EU) strives towards creating Innovation Union, where fast-growing, innovative firms strive and create new, high value added jobs and where innovation offers products and solutions responding to the society's needs and expectations.

Competitive pressures accelerate innovations (Vives, 2008). The aim is to discuss both a competitive challenge (closing Europe's gap in innovation) and a cultural challenge (integrating research and innovation to focus on societal challenges), which should lead to structural change towards more knowledge intensive economic activities (European Commission, 2011). The main elements in the EU knowledge-based economy and society are the following: innovation, competitiveness, sustainable development, and social cohesion. The Lisbon strategy focuses on the increased dynamism of European industry and future competitiveness.

This paper, in the first part, examines the achieved level of competitiveness, and innovativeness of the EU countries. The analysis of indicators within the Innovation pillar in the EU countries is done in the second part of the paper. The relationship between the level of competitiveness and innovativeness level of the EU countries is examined in the third part of the paper. The fourth part is devoted to the analysis of the impact of innovation to the level of competitiveness of the EU countries.

2. Research context – Innovativeness as Determinant of the Level of National Economy Competitiveness

Innovations stand for an important factor of growth and development in the contemporary business environment. Innovations are considered as a "crucial

vehicle for improving competitive performance" (Radas, Dabić, & Andrejević – Matovac, 2009, 293). Many studies researched and confirmed the impact of innovations in building competitive advantage (Barney, 1991; Cainelli, Evangelista, & Savona, 2004; Chen, Lin, & Huang, 2007; Hult, Snow, & Kandemir, 2003; Karo & Kattel, 2011). Innovations are the most important source of distinctive competitive advantage.

Competitiveness of national economy "could be driven by environmentally friendly innovation and enhanced social provision, in addition to intensified investment in research and development and liberalization of markets" (Nowarth, 2007, 89). The implementation of university–industry–government model relations is also relevant for improvement of competitiveness of the national economy (Etzkowitz & Leydesdorff, 2000).

There are still many possibilities for enterprises and national economies "to improve competitiveness in situations of confining score ranges of technological innovation capability" (Guan, Yam, Mok, & Ma, 2006). Also, efficient knowledge management has an important role in that process (Krstić & Stanišić, 2013; Cvjetković, 2015). „Not too long ago, it was recognized that there are direct cause and effect relations between knowledge resource and invention" (Edvinsson, Dvir, Roth, & Pasher, 2004, 40). Companies that wish to be successful must constantly generate and disseminate new knowledge while ensuring that it is quickly translated into innovative products and services (Krstić, Jovanović, Štarc, & Stanišić, 2015, 69). Knowledge management supports innovation and, consequently, innovations generate a higher level of competitiveness. In other words, there is a knowledge management influence on innovations and competitiveness of enterprises and business communities (Carneiro, 2000, 95; Sedziuviene & Veinhardt, 2010). If innovation and innovational capital are relevant for enterprises, they are also important for the productivity and competitiveness of national economies.

In the modern business environment, there is a growing demand for qualified workers capable of innovative and critical thinking. Product innovations and performance improvement have implications on business efficiency. Innovation is the result of creativity, research, drafting, design, commercialization and diffusion (Smith, 2010, 9). Innovation is the result of intangible assets or intangible capital of enterprises. This capital determines the national intangible capital that contributes to GDP growth (Stahle, Stahle, & Lin, 2015) in knowledge-based economies. Innovation is the knowledge-based outcome, and the output of innovation process and innovation behavior in an enterprise and innovation economies (Tang, 2006). In addition, innovation is the knowledge resource that is utilized at a particular moment for generating current income and for acquiring future profit by the evolution of innovation. Theoretical concept, technological invention, and commercial exploitation are of essential importance for innovation concept (Trott, 2005;

Tellis, 2008). The process of innovation diffusion “describes the spread of new technologies throughout the economy... Each improvement, itself an innovation, erodes the value of the previous generation of a technology” (Thomson, 2011, 480). Effective innovations in enterprises within a national economy increase competitive intellectual capital of a nation which is the vital determinant of national competitiveness level.

Radical and incremental innovations are relevant for improving competitive advantage. Radical innovations incorporate new markets, technology improvement, science, and research and development. “Incremental innovations can range from changes to processes for making existing products to adopting wholesale products and practices from elsewhere” (Mole & Worrall, 2001, 354).

The American Department of Commerce defines innovation as the evolution and implementation of new or altered products, services, procedures, organizational structures and business models with the intention of producing value (DOC, 2008). This definition identifies innovation in research and development activities, that is, with innovation management and new product development.

It becomes clear that innovation activity and innovativeness result from using the intangible (intellectual) resources that integrate knowledge, skills, and technology in the exploitation and commercialization of products in an enterprise. Innovation is the basis of success in all businesses. The introduction of new products, technological management, and intellectual property management are the key factors through which enterprises create value.

Innovation is the central driver of economic growth, development and better jobs (Tee, Low, Kew, & Ghazali, 2014, 162; Kraft & Kraftova, 2012). “It is the key that enables firms to compete successfully in the global marketplace, and the process by which solutions are found to social and economic challenges” (INSEAD, 2011). “Successful investment in research and innovation can boost both, productivity and competitiveness” (European Commission, 2012, 6). That is the fundament for the starting position of significant interdependence between competitiveness and innovations.

Porter (1990) delineates the concept of national competitiveness as the state's ability to create innovations with the role of achieving or sustaining advantage over other countries. The World Economic Forum (WEF) defines competitiveness as the chain of institutions, policies and actors that determine the level of a country's productivity (WEF, 2013). With the aim of national competitiveness improvement, “innovation research must as far as possible provide policy-makers with an unambiguous, consistent and well-founded set

of guidelines for the formulation of technology and innovation policies” (Castellacci, 2008, 35).

The Global Competitiveness Index (GCI) is a widely accepted methodological framework for assessing the competitiveness at the national level. The GCI is an aggregate measure of competitiveness as complex performance of each national economy. The GCI as an indicator of national (country) competitiveness is organized into three subindices: 1. Basic requirements; 2. Efficiency enhancers; 3. Innovation and sophistication factors.

The focus of this paper is on the Innovation pillar within the Innovation and sophistication factors subindex. The Innovation pillar consists of seven indicators or factors of innovativeness and, so called factors of innovation capital of each country (Capacity for innovation, Quality of scientific research institutions, Company spending on R&D, University-industry collaboration in R&D, Government procurement of advanced tech products, Availability of scientists and engineers, PCT patent applications). The value of all seven indicators, that reflect the factors which affect the innovation activity of a country and its innovativeness as the ability to implement innovations, affect the value of Innovation pillar. The WEF explains these indicators in its Report (2013-2014).

3. Research Assumptions and Methodology

The aim of this analysis is to study the interdependence between the GCI and the Innovation pillar within the GCI. The purpose of the paper is to find out the impact of seven vital indicators within the Innovation pillar on the value of the GCI, as well as on the value of Innovation pillar in the EU countries.

The following research assumptions will be discussed according to the aim and purpose of this research:

- a) There is a positive correlation between national economy competitiveness and innovativeness in the EU member states;
- b) There is the significant impact of country innovativeness on the achieved level of the national economy competitiveness in EU member states.

The following methods are applied in the paper: correlation analysis, regression analysis and cluster analysis. The correlation analysis is used in order to examine the interdependence of indicators within the Innovation pillar, on the one hand, and the GCI, on the other hand. The regression analysis is applied for the purpose of estimating the impact of the Innovation pillar indicators on the GCI in the EU countries. The cluster analysis is used in order to classify the EU countries and explore the impact of the indicators

within the Innovation pillar on the GCI observed by the defined group of countries. The Global Competitiveness Reports 2013-2014 make the information base for this research.

4. Research Results and Discussions

The results of the conducted research and their interpretation are organized into three segments:

- Examination of the interdependence between the GCI and the score of Innovation pillar in the EU;
- Examination of the impact of the Innovation pillar and indicators within the Innovation pillar on the GCI score in the EU; and
- Exploring the impact of the indicators within the Innovation pillar on the GCI observed by the group of the EU countries.

a) Examination of the interdependence between the GCI and the score of Innovation pillar in the EU

The correlation analysis is applied with the purpose of examining the interdependence between the GCI and the Innovation pillar (Table 1). The value of correlation coefficient (0.969) shows that there is an extremely strong direct correlation between the GCI and the Innovation scores in the EU. The obtained correlation coefficient shows that the first assumption of research is confirmed. The EU countries are characterized by high and significant interdependence between competitiveness and innovations. Competitiveness of the EU countries is based on innovations.

Table 1. The Results of Correlation Analysis (Pearson's Correlation Coefficient)

	GCI (score)
Innovation pillar	0.969*
Capacity for innovation	0.966*
Quality of scientific research institutions	0.831*
Company spending on R&D	0.964*
University-industry collaboration in R&D	0.899*
Government procurement of advanced tech products	0.802*
Availability of scientists and engineers	0.504*
PCT patent applications	0.891*
* Correlation is significant at the 0.01 level.	

Source: Authors' calculation

The analysis of interdependence between the GCI and certain elements within the Innovation pillar at the EU level (Table 1) shows an extremely strong direct correlation (Capacity for innovation – 0.966, Company spending on R&D – 0.964) and a very strong direct correlation (PCT patent applications – 0.891, University-industry collaboration in R&D – 0.899, Quality of scientific research institutions – 0.831, Government procurements of advanced tech products – 0.802). A somewhat moderate (weaker) correlation is recorded between the GCI and the Availability of scientists and engineers indicator (0.504).

b) Examination of the impact of the Innovation pillar and indicators within the Innovation pillar on the GCI score in the EU

The regression analysis is applied with the purpose of examining the impact of the Innovation pillar and indicators within the Innovation pillar on the GCI score (Table 2). First, a simple linear regression analysis was applied in order to examine the impact of the Innovation pillar on the GCI. The estimated value of the slope coefficient is 0.556 (p-value < 0.001), which indicates that there is a statistically significant positive influence of the Innovation pillar on the GCI. The obtained result is in favour of confirming the second assumption of the research.

Table 2. The impact of the indicators of the Innovation pillar on the GCI in the EU countries (2014)

Indicators within the Innovation pillar	Unstandardized Coefficients		t	Sig.
	B	Std. Error		
(Constant)	2.522	0.310	8.130	0.000
Capacity for innovation	0.184	0.141	1.308	0.206
Quality of scientific research institutions	0.099	0.086	1.146	0.265
Company spending on R&D	0.138	0.128	1.078	0.294
University-industry collaboration in R&D	-0.026	0.112	-0.232	0.819
Government procurement of advanced tech products	0.164	0.066	2.475	0.022*
Availability of scientists and engineers	-0.031	0.047	-0.650	0.523
PCT patent applications	0.001	0.001	2.023	0.057
Dependent Variable: GCI, R Square = 0.963				
*Significant on the 0.05 level				

Source: Authors' calculation

The individual impact of the indicators within the Innovation pillar on the GCI was tested by applying a multiple regression analysis. According to the results presented in the Table 2, among the seven analyzed indicators, Capacity for innovation, Government procurement of advanced tech products and

Company spending on R&D have the highest impact on the GCI, whereas the remaining indicators record a minor or negative impact. Although the regression model is representative (R Square = 0.963), the estimated values of all the regression coefficients (except coefficient which indicates the influence of Government procurement of advanced tech products) are not statistically significant. Therefore, these values cannot be generalized and the coefficients are relevant only for a sample of the EU countries. Within the framework of innovation policies, the priority of the EU countries is to improve the performances of the university-industry collaboration in R&D and develop and increase the base of scientists and engineers. Namely, indicators University-industry collaboration in R&D and Availability of scientists and engineers has the negative value of the regression coefficient. Their improvement is the priority for policy maker in the area of innovativeness in the EU countries with the aim to increase the national economy competitiveness.

c) Exploring the impact of the indicators within the Innovation pillar on the GCI observed by the group of the EU countries

In order to more detailed analysis of the impact of certain indicators of innovation activities, as well as the allocation of critical factors of innovation activities which improvement can significantly contribute to improving the competitiveness of the EU countries, the authors classify EU countries into three groups in a segment of this analysis. Classification is done by hierarchical cluster analysis, which belongs to the multivariate statistical methods. The cluster analysis serves for observation unit classification according to their characteristics (similarity or dissimilarity). If the classification of individual countries according to measured characteristics is good, a "subject within clusters will be close together when plotted geometrically, but different clusters will be far apart" (Chandra & Menezes, 2001, 89). The cluster analysis of the EU countries according to the indicators within the Innovation pillar determined the following structure of clusters:

Cluster 1: Denmark, Finland, Germany, Sweden;

Cluster 2: Austria, Belgium, France, Ireland, Luxembourg, Netherlands, United Kingdom;

Cluster 3: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovak Republic, Spain, Slovenia.

Final cluster centers (mean values of the indicators), given in Table 3, show that cluster 1 includes the EU countries that achieve the best results in terms of all indicators of innovative activities, while Cluster 2 includes countries with somewhat lower performance in terms of analyzed indicators of innovative activities. The Cluster 3 consists of the greatest number of countries and

includes countries with the lowest score when it comes to all seven indicators of innovative activities.

Table 3. Final Cluster Centers

Indicators within the Innovation pillar	Cluster		
	1	2	3
Capacity for innovation (score)	5.44	4.98	3.60
Quality of scientific research institutions (score)	5.58	5.58	4.32
Company spending on R&D (score)	5.30	4.65	3.14
University-industry collaboration in R&D (score)	5.34	5.10	3.79
Government procurement of advanced tech products (score)	4.00	3.82	3.13
Availability of scientists and engineers (score)	5.26	4.61	4.27
PCT patent applications	251.10	118.96	18.34

Source: Authors' calculation

Table 4 shows the intensity of the impact of the Innovation pillar on the GCI value observed by created clusters. The impact is estimated by simple regression analysis. The values of the parameters of the simple regression model, i.e. regression coefficients are estimated by ordinary least squares method.

Table 4. The influence of the Innovation pillar on the value of the GCI observed by groups (clusters) of the EU countries

Cluster	Regression coefficient			
	Unstandardized Coefficients		t	Sig.
	B	Std. Error		
Cluster 1	0.473	0.124	3.816	0.062
Cluster 2	0.857	0.163	5.270	0.003*
Cluster 3	0.387	0.100	3.871	0.002*
Dependent Variable: GCI				
*Significant at the 0.05 level				

Source: Authors' calculation

According to the values shown in Table 4, it can be concluded that, in the EU countries which are grouped in cluster 2, there is the strong, statistically significant, influence of the Innovation pillar on the GCI. Substantial lowest influence showed countries grouped in cluster 1, while the weakest (but statistically significant) impact of the Innovation pillar on the GCI is recorded in countries grouped into clusters 3.

Table 5 gives the values of the coefficients, estimated by simple regression analysis, showing the impact of indicators within the Innovation pillar on the competitiveness of the EU countries grouped into clusters.

Table 5. The influence of the indicators within the Innovation pillar on the value of the GCI observed by groups (clusters) of the EU countries

Indicators within the Innovation pillar	Cluster 1	Cluster 2	Cluster 3
Capacity for innovation	0.537	0.815	0.341
Quality of scientific research institutions	0.701	0.156	0.168
Company spending on R&D	0.437	0.969	0.380
University-industry collaboration in R&D	0.368	0.192	0.226
Government procurement of advanced tech products	0.386	0.140	0.279
Availability of scientists and engineers	0.153	-0.162	-0.015
PCT patent applications	0.002	0.003	0.004
Dependent Variable: GCI			

Source: Authors' calculation

Based on the results shown in Table 5, it can be concluded that the countries in the second and third clusters should devote the greatest attention to improving Availability of scientists and engineers. There is the negative value of regression coefficient in the second and third cluster when it comes to this indicator and improvement of these segments of innovation activities can the most significantly affect the growth of the level of competitiveness.

5. Conclusion

Innovations, the quality of innovation policy and the efficiency of innovation activities stand for the vital factors of national economy competitiveness. Focus on the so-called "smart growth" in the contemporary business environment implies growth that is based on the resources of knowledge, intellectual property and innovations. In an era of knowledge economy, which stands for the developmental stage of the world economy, knowledge, in the broadest sense of the word, is becoming the key resource of everything that is produced nowadays. At the same time, a realization of innovations is becoming the key process that adds and creates value.

In the course of this research, correlation analysis determines a strong direct correlation between the GCI and the Innovation pillar in the case of the EU countries. Also, there is a strong positive correlation between the GCI and six out of seven analyzed indicators within the Innovation pillar (Capacity for innovation, Quality of scientific research institutions, Company spending on

R&D, University-industry collaboration in R&D, Government procurement of advanced tech products and PCT patent applications). Moderate positive correlation is recorded between the GCI and indicator Availability of scientists and engineers.

The regression analysis of the impact of the indicators within the Innovation pillar on the GCI showed the positive influence of five out of seven analyzed indicators in the EU countries. Negative influence in the EU is identified in the case of the following indicators: University-industry collaboration in R&D and Availability of scientists and engineers. The authors separate these two indicators as a critical factor of innovative activities of the EU countries which improvement can contribute to the level of their competitiveness. In order to confirm this claim, the authors analyze the impact of indicators within the Innovation pillar on the GCI according to a group of countries determined by cluster analysis.

The research results point to that the most critical factors which must have priority in the EU countries' development policies are: University-industry collaboration in R&D and Availability of scientists and engineers. A vital area on which the governments of the EU countries should focus within their innovation and development policies is the base of scientists and engineers and the collaboration between scientific institutions (universities) and business sector. The scientific institution's development has centred on greater participation of scientists in the innovative and R&D projects in companies. High quality in scientific institutions is vital for achieving the highest level of research. EU countries should focus on the scientist and engineer base development through scientific-research institutions and the higher incentives for the involvement of foreign researchers, in the form of better conditions and higher investments in the technical equipment of scientific institutions. By participating in the work of scientific institutions in the EU countries, foreign scientists will invest their implicit knowledge, competences, specialized expertise and experience acquired in the work with other scientific institutions.

References

- Anderlini, L., Felli, L., Immordino, G., & Riboni, A. (2013). Legal Institutions, Innovation, And Growth. *International Economic Review*, Vol. 54(3), 937-956.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, Vol. 17(1), 99-120.
- Bedford, A. D. (2013). Expanding the Definition and Measurement of Knowledge Economy: Integrating Triple Bottom Line Factors into Knowledge Economy Index Models and Methodologies. *Journal of Modern Accounting and Auditing*, Vol. 9(2), 278-286.

- Cainelli, G., Evangelista, R., & Savona, M. (2004). The impact of innovation on economic performance in services. *The Service Industries Journal*, Vol. 24(1), 116-130.
- Carlaw, K. I., & Lipsey, R. G. (2006). Gpt-Driven, Endogenous Growth. *The Economic Journal*, Vol. 116(508), 155-174.
- Carneiro, A. (2000). How does knowledge management influence innovation and competitiveness?. *Journal of Knowledge Management*, Vol. 4(2), 87-98.
- Castellacci, F. (2008). *Innovation and the competitiveness of industries: comparing the mainstream and the evolutionary approaches*. MPRA Paper No. 27523. Retrieved from <http://mpra.ub.uni-muenchen.de/27523/> (07/01/2015).
- Chandra, S., & Menezes, D. (2001). Applications of Multivariate Analysis in International Tourism Research: The Marketing Strategy Perspective of NTOs. *Journal of Economic and Social Research*, Vol. 3(1), 77-98.
- Chen, D., Lin, W. C., & Huang, M. (2007). Using Essential Patent Index and Essential Technological Strength to evaluate industrial technological innovation competitiveness. *Scientometrics*, Vol. 71(1), 101-116.
- Chen, M. X., & Iyigun, M. (2011). Patent protection and strategic delays in technology development: Implications for economic growth. *Southern Economic Journal*, Vol. 78(1), 211-232.
- Clancy, M. S., & Moschini, G. (2013). Incentives for innovation: Patents, prizes, and research contracts. *Applied Economic Perspectives and Policy*, Vol. 35(2), 206-241.
- Cvjetković, M. (2015). Knowledge and quality as the factors of the business operations and competitiveness promotion - research results from Serbia. *Industrija*, Vol. 43(2), 53-72
- Department of Commerce (DOC) (2008). *Advisory Committee on Measuring Innovation in the 21st Century Economy, Innovation Measurement: Tracking the State of Innovation in the American Economy*. Report to the Secretary of Commerce. Retrieved from <http://www.esa.doc.gov/Reports/innovation-measurement-tracking-state-innovation-american-economy> (20/08/2015).
- Edvinsson, L., Dvir, R., Roth, N., & Pasher, E. (2004). Innovations: the new unit of analysis in the knowledge era: The quest and context for innovation efficiency and management of IC. *Journal of Intellectual Capital*, Vol. 5(1), 40-58.
- Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations. *Research Policy*, Vol. 29(2), 109-123.
- European Commission. (2010). *EUROPE 2020 A strategy for smart, sustainable and inclusive growth*. Brussels: European Commission. Retrieved from <http://ec.europa.eu/eu2020/pdf/COMPLETE%20EN%20BARROSO%20%20%2007%20-%20Europe%202020%20-%20EN%20version.pdf> (10/09/2015).
- European Commission. (2011). *Innovation Union Competitiveness report*. Retrieved from <http://ec.europa.eu/research/innovation-union/pdf/competitiveness-report/2011/iuc2011-full-report.pdf#view=fit&pagemode=none> (10/08/2015).
- European Commission. (2012). *Industrial Performance Scoreboard and Member States' Competitiveness Performance and Policies*. Commission staff working document. Brussels: European Commission. Retrieved from http://ec.europa.eu/enterprise/policies/industrial-competitiveness/monitoring-member-states/files/ms_comp_report_2012_en.pdf (10/09/2015).

- Grossman, G. M., & Helpman, E. (1994). Endogenous innovation in the theory of growth. *Journal of Economics Perspectives*, Vol. 8(1), 23-44.
- Guan, J., Yam, R., Mok, C., & Ma, N. (2006). A study of the relationship between competitiveness and technological innovation capability based on DEA models. *European Journal of Operational Research*, Vol. 170(3), 971-986.
- Houghton, J., & Sheehan, P. (2000). *A Primer on the Knowledge Economy*. Working Paper. Melbourne: Victoria University.
- Hult, G., Snow, C., & Kandemir, D. (2003). The role of entrepreneurship in building cultural competitiveness in different organizational types. *Journal of Management*, Vol. 29(3), 401-426.
- INSEAD. (2011). *The Global Innovation Index 2011 - Accelerating Growth and Development*. Retrieved from http://www.globalinnovationindex.org/gii/main/previous/2010-11/FullReport_10-11.pdf (05/08/2015).
- Karo, E., & Kattel, R. (2011). Should "open innovation" change innovation policy thinking in catching-up economies? Considerations for policy analyses. *Innovation: The European Journal of Social Science Research*, Vol. 24(1-2), 173-198.
- Kraft, J., & Kraftova, I. (2012). Innovation–Globalization–Growth (Selected Relations). *Inzinerine Ekonomika-Engineering Economics*, Vol. 23(4), 395-405.
- Krisciunas, K., & Daugeliene, R. (2006). The Assessment Models of Knowledge-Based Economy Penetration. *Inzinerine Ekonomika-Engineering Economics*, Vol. 5(50), 36-44.
- Krstić, B., & Stanišić, T. (2013). The influence of knowledge economy development on competitiveness of southeastern Europe countries. *Industrija*, Vol. 41(2), 151-167.
- Krstić, B., Jovanović, S., Štarc, J., & Stanišić, T. (2015). The Development of a Knowledge Economy as a Factor in the Competitiveness of Central and East European Countries. *Argumenta Oeconomica Cracoviensia*, (12), 67-83.
- Lucas, R. E. (2009). Ideas and growth. *Economica*, Vol. 76(301), 1-19.
- Mole, K., & Worrall, L. (2001). Innovation, business performance and regional competitiveness in the West Midlands: Evidence from West Midlands Business Survey. *European Business Review*, Vol. 13(6), 253-364.
- Nowarth, D. (2007). Internal Policies: Reinforcing the New Lisbon Message of Competitiveness and Innovation. *Journal of Common Market Studies*, Vol. 45(1), 89-106.
- Porter, M. (1990). *The Competitive Advantage of Nations*. London: Macmillan.
- Quintane, E., Casselman, R. M., Reiche, B. S., and Nylund, P. A. (2011). Innovation as a knowledge-based outcome. *Journal of Knowledge Management*, Vol. 15(6), 928-947.
- Radas, S., Dabić, M., & Andrejević – Matovac, V. (2009). Destiny or decision: Competitive performance and its relationship to innovation. *International Journal of Business Performance Management*, Vol. 11(4), 292-312.
- Rutkauskas, A. V. (2008). On the sustainability of regional competitiveness development considering risk. *Technological and Economic Development of Economy*, Vol. 14(1), 89-99.
- Sedziuviene, N., & Veinhardt, J. (2010). Competitiveness and innovations: role of knowledge management at a knowledge organization. *Inzinerine Ekonomika-Engineering Economics*, Vol. 21(5), 525-536.

Krstić B. et al.: *The Impact of Innovativeness Factors on the EU Countries'...*

- Smith, D. (2010). *Exploring Innovation*. United Kingdom: McGraw – Hill Education.
- Stahle , P., Stahle, S., & Lin, C.Y.Y. (2015). Intangibles and national economic wealth – a new perspective on how they are linked. *Journal of Intellectual Capital*, Vol. 16(1), 20-57.
- Tang, J.M. (2006). Competition and innovation behavior. *Research Policy*, Vol. 35(1), 68-82.
- Tebaldi, E., & Elmslie, B. (2013). Does institutional quality impact innovation? Evidence from cross-country patent grant data. *Applied Economics*, Vol. 45(7), 887-900.
- Tee, L.T., Low, S.W., Kew, S.R., & Ghazali, N.A. (2014). Financial Development and Innovation Activity: Evidence from Selected East Asian Countries. *Prague Economic Papers*, Vol. 23(2), 162-180.
- Tellis, G. J. (2008). Important research questions in technology and innovation. *Industrial Marketing Management*, Vol. 37(6), 629-632.
- Thomson, R. (2011). Economic Perspectives on Innovation. *The Australian Economic Review*, Vol. 44(4), 480-489.
- Trott, P. (2005). *Innovation Management and New Product Development*. London: Pearson Education Limited.
- Verspagen, B. (2006). University research, intellectual property rights and European innovation systems. *Journal of Economic Surveys*, Vol. 20(4), 607-632.
- Vives, X. (2008). Innovation and Competitive Pressure. *The Journal of Industrial Economics*, Vol. 56(3), 419-469.
- World Economic Forum. (2013). *The Global Competitiveness Report 2013-2014*. Switzerland: World Economic Forum. Retrieved from http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2013-14.pdf (15/11/2015).
- Zachariadis, M. (2003). R&D, innovation, and technological progress: a test of the Schumpeterian framework without scale effects. *Canadian Journal of Economics/Revue canadienne d'économique*, Vol. 36(3), 566-586.

Krstić B. et al.: The Impact of Innovativeness Factors on the EU Countries'...