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The Analysis of the Publications in the most Active Countries in Nanotechnology*

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Summary: Nanotechnology publications as one of the parameters of a country's level of nanotechnology (nanotech innovation), while nanotechnology innovations are considered the source of its competitive advantage. The country's competitiveness in the level of nanotechnology activity determine the total number of nanotechnology publications and the mean number of citations. In this paper, we have analyzed the scientific nanotechnology activity of the most active countries in this field (countries whose number of nanotechnology publications exceeds 1,000 annually). We used data on nanotechnology publications collected from Web of Science - WoS database and published by Nano Statistics - Nano Science, Technology and Industry Scoreboard. We analyzed the trend of the total number of published nanotechnology publications, the mean number of citations trend, trend of the relations of published nanotechnology publications and gross domestic product, and the trend of relations of published nanotechnology publications and the number of residents in the surveyed countries. Based on the regression-correlation analysis, we predicted the expected value of the total number of nanotechnology publications published in 2015 for China and the United States, because these are the countries that dominate in the total number of published nanotechnology publications in the world.

Keywords: competitiveness, nanotechnology innovations, publications, citations, regression-correlation analysis.

JEL M31, M21, C53

1. INTRODUCTION

According to International Standardization Organization (ISO, 2010, website), nanoscience is 'the study, discovery and understanding of matter in the nanoscale' (size range from approximately 1 nm[1] to 100 nm), 'where size- and structure-dependent properties and phenomena, as distinct from those associated with individual atoms or molecules or with bulk materials, can emerge', while nanotechnology is 'the application of scientific knowledge to manipulate and control matter in the nanoscalein order to make use of size- and structure-dependent properties and phenomena, as distinct from those associated with individual atoms or molecules or with bulk materials'. 'Nanoscience and nanotechnology are the study and application of extremely small things and can be used across all the other science fields, such as chemistry, biology, physics, materials science, and engineering" (U.S. NNI, website). Nanotechnology has been defined as 'a multidisciplinary field in support of a broad-based technology to reach mass use by 2020, offering a new approach for education, innovation, learning, and governance' (Roco, M. et al., 1999, in Roco, M. et al., 2011, p. 3557).

The origin of nanotechnology is associated with physicist Richard Feynman (see more: Feynman, R., 1960). The term ‚nanotechnology' was first used by professor Norio Taniguchi (the University of Tokyo, 1974).[2] Eric Drexler gave his contribution in shedding light on the phenomenon of ‚nanotechnology' by exploring it more closely during the 80s of the 20th century (see more: Drexler, E., 1986; Milanović, V. et al. 2014, p. 55). Nanoscience and nanotechnology have made big progress in the last three decades (1982: The invention of the scanning tunneling microscope; 1985: the discovery of fullerenes). A key stimulus to further

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[1] Nanometer=10^{-9} m; one-billionth of a meter.

[2] 'Taniguchi described the revolutionary possibilities of application of materials in ultra small dimensions of less than a billionth meter' (The Foresight Institute, in Milanović, V. et al., 2014, p. 55).

development of nanotechnology was provided by the inventions in the 80s of the 20th century.Since 2001 (by establishing the National Nanotechnology Initiative the USA) over 60 national governments have launched nanoscience initiatives and have begun to invest in research and development in this field (see: Roco, M., 2011). Many countries are incorporating nanotechnology in their innovation systems. A key factor for commercialized innovation and economic development is the nanotechnology development. Therefore, 'nanotechnology innovations are one of the sources of competitive advantage of a country' (Milanović, V., Bučalina, A., 2013, p. 69). The level of nanotechnology activity of countries continuously increases. It points to 'the capabilities and resources of a nation's engine for nanotech innovation' (Lux Research, 2010, website, in Milanović, V., Bučalina, A., 2013, p. 69). Nanotechnology publications are one of the parameters of nanotechnological activity levels (Lux Research, 2010). They are generally regarded as output indicators of basic research, but are also important input indicators for further applied research in the field of nanotechnology.

Economic effects ofapplied research into nanotechnology (Hullmann, A., 2006; Palmberg, C. et al., 2009; Shapira, Ph. et al., 2010; Lux Research, 2010; Cientifica, 2011; Roco, M., 2011; Roco,M. et al., 2011) have turned nanotechnology into a very promising scientific-research area in the field of economics, too. Rapid market growth of nanotechnology products (BCC Research, website) and the emergence of new competitor-countries in this field (Lux Research, 2010; Milanović, V., Bučalina, A., 2013; Milanović, V. et al., 2014) represent a challenge for further research.

According to Palmberg et al. (2009, p. 33), publications and their citations represent indicators of the public research system performance. The total number of nanotechnology publications mirrors quantity, rather than quality, of basic research in nanotechnology. Therefore, nanotechnology publications (as a quantitative output) are an indicator of nanoscientific excellence, while nanotechnology citations are indicators of nanotechnology publications' quality (Hullmann, A., 2006, p. 26). According to Hullmann and Meyer (2003, p. 509), with nanotechnology publications as indicators of nanoscientific performance, the previous development of nanotechnology can be presented, and future potentials predicted. However, since nanotechnology is an emerging technology, the forecast of its potential through nanotechnology publications does not necessarily have to be a key indicator of future events.

'Publication databases are very large and can sometimes be poorly indexed, as they collect data from various journals relying on different indexing systems and nomenclatures' (Palmberg, C. et al., 2009, p. 34). That is why the database choice (the data sources) is of crucial importance. We believe that the data base used here, the ISI WoS by Nano Statistics - Nano Science, Technology and Industry Scoreboard (Nano Statistics, website), is sufficiently respectable.

Some authors believe that trends in nanotechnology publications, rather than their absolute number should be observed. This paper analyzes both the trends and absolute values, as well as some relative relations.

2. NANOPUBLICATIONS AS A TOPIC IN SCIENTIFIC ARTICLES OR STUDIES

Bibliometric analysis of nanotechnology publicationsis one of the topics of economics approach in nano-research. Table 1 (A-E) shows nanopublications as a topic in scientific articles or studies (selected articles, criterium: the number of citations to articles).

To analyze nanopublications from relevant nanopublication databases, different search methodologies have previously been used. Huang et al. (2010) classified approaches into four main groups: lexical queries, evolutionary lexical queries, citation analyses, and core journal strategies (see: Table 2).

We believe that Nano statistics - Nano Science, Technology and Industry Scoreboard database uses all four approaches to search.

3. METHODOLOGY

Scientific nanotechnology activity of the most active countries in nanotechnology is analyzed in the paper. The following trends were observed: the trend of the total number of published nanotechnology publications, the trend of average number of citations, the trend in the ratio between the number of published nanotechnology publications and gross domestic product (GDP), as well as the trend in the ratio between the number of published nanotechnology publications and the population. The most active countries in nanotechnology were determined to be those with more than 1,000 nanotechnology publications annually. These are: the United States (the USA), Canada, China, Taiwan, Japan, South Korea, India, Ger-

Table 1(A): Nanotechnology publications by countries/regions

Author/authors, Title, Journal, Volume, Number, Pages
Youtie, J., Shapira, P., Porter, A.L. (2008), „Nanotechnology publications and citations by leading countries and blocs“, *Journal of Nanoparticle Research*, Vol. 10, No. 6, pp.981
Kay, L., Shapira, P. (2009), „Developing nanotechnology in Latin America“, *Journal of Nanoparticle Research*, Vol. 11, No. 2, pp. 259–278, doi:10.1007/s11051
Tang, L., Shapira, P. (2011), „Regional development and interregional collaboration in the growth of nanotechnology research in China“, *Scientometrics*, Vol. 86, No. 2, pp. 299–315, doi:10.1007/s11192
Terekhov, A. I. (2012), „Evaluating the performance of Russia in the research in nanotechnology“, *Journal of Nanoparticle Research*, Vol. 14, No. 1, article 1250, doi:10.1007/S11051
Bhattacharya, S., Shilpa, Bhati, M. (2012), „China and India: The two new players in the nanotechnology race“, *Scientometrics*, Vol. 93, No. 1, pp. 59–87, doi:10.1007/s11192
Mohammadi, E. (2012), „Knowledge mapping of the Iranian nanoscience and technology: A text mining approach“, *Scientometrics*, Vol. 92, No. 3, pp. 593–608, doi:10.1007/s11192
Gorjiara, T., Baldock, C. (2014), „Nanoscience and nanotechnology research publications: a comparison between Australia and the rest of the world“, *Scientometrics*, Vol. 100, No. 1, pp. 121–148, doi 10.1007/s11192

Source: http://kobson.nb.rs/kobson.82.html

Table 1 (B): National nanotechnology publications (comparisons)

Author/authors, Title, Journal, Volume, Number, Pages
Kostoff, R.N., Koytcheff, R,G., Lau, C.G.Y. (2007), „Technical structure of the global nanoscience and nanotechnology literature“, *J Nanopart Res*, Vol. 9, pp. 701-724.
Kostoff, R.N. (2008), „Comparison of China/USA science and technology performance“, *Journal of Informetrics*, Vol. 2, No. 4, pp. 354–36.
Kostoff, R.N. (2012), „China/USA nanotechnology research output comparison-2011 update“, *Technological Forecasting and Social Change*, Vol. 79, No. 5, pp. 986–990.

Source: http://kobson.nb.rs/kobson.82.html

Table 1 (C): The positioning of countries relative to one another in scientific performance

Author/authors, Title, Journal, Volume, Number, Pages
Hullmann, A., Meyer, M. (2003), „Publications and patents in nanotechnology: an overview of previous studies and the state of the art“, *Scientometrics*, Vol. 58, No. 3, pp. 507–527.
Huang, Z., Chen, H., Yip, A., Ng, G., Guo, F., Chen, Z., Roco, C.M. (2003), „Longitudinal patent analysis for nanoscale science and engineering: country, institution and technology field“, *J Nanopart Res*, Vol. 5, No. 3-4, pp. 333–363.
Huang, Z., Chen, H., Yan, L., Roco, C.M. (2005), Longitudinal nanotechnology development (1991–2002): National Science Foundation funding and its impact on patents“, *J Nanopart Res*, Vol. 7, No. 4-5, pp. 343–376.
Miyazaki, K,, Islam, N. (2007), „Nanotechnology systems of innovation-An analysis of industry and academia research activities“, *Technovation*, Vol. 27, No. 11, pp. 661–675.

Source: http://kobson.nb.rs/kobson.82.html

many, the United Kingdom, France, Italy, Spain, and Russia.

The bibliometric method that involves the use of various quantitative and statistical analyses is used in the study. Bibliometric analysis of nanotechnology publications is important in the study of emerging technologies, involving nanotechnology. However, the analysis of bibliometric parameters can be carried out in various directions, and with a considerable amount of justification in each case. Therefore, the data on nanotechnology publications and citations in the observed countries and for a specific period of time (2005-2013), collected from WoS database, and published by Nano Statistics - Nano Science, Technology and Industry Scoreboard are used in this paper. For the time being, the WoS database is considered to be

TABLE 1 (D): Review of nano publications as a part of scientific articles or studies

Author/authors, Title, Journal, Volume, Number, Pages
Shapira, P., Wang, J. (2010), „Follow the money", *Nature*, Vol. 468, Issue 7324, pp. 627-628, doi:10.1038/468627a
Huang, C., Notten, A., Rasters, N. (2010), „Nanoscience and technology publications and patents: A review of social science studies and search strategies", *Journal of Technology Transfer*, Vol. 36, No. 2, pp. 145-172.
Hullmann, A. (2006), „The economic development of nanotechnology - An indicators based analysis", European Commission.
Palmberg, C., Dernis, H., Miguet, C. (2009), „Nanotechnlogy: an Overwiew based on Indicators and Statistics", STI Working Paper, No. 7, Statistical Analysis of Science, Technology and Industry. OECD.
Roco, C.M. (2011), "The long view of nanotechnology development: the National Nanotechnology Initiative at 10 years", *J Nanopart Res*, Vol. 13, pp. 427–445, doi: 10.1007/s11051-010-0192-z.
Lux research* (Reports - for example: „Commercialisation of Nanotechnology: Global Overview and European Position" by Raje, J., May, 30, 2011.)
PCAST** (Reports - for example "Nanotechnology Report", http://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST_2012_Nanotechnology_FINAL.pdf)
NNI*** (Reports - http://www.nano.gov/publications-resources)
CORDI**** (Reports -http://cordis.europa.eu/search/result_en?q=NANOTECH)

* 'Lux research is an independent research and advisory firm providing strategic advice and ongoing intelligence on emerging technologies' (http://www.luxresearchinc.com/)

** 'PCAST is President's Council of Advisors on Science and Technology' (http://www.whitehouse.gov/administration/eop/ostp/pcast/docsreports)

*** 'The NNI is a U.S. Government research and development initiative' (http://www.nano.gov/about-nni/what)

**** 'CORDIS is the European Commission's primary public repository and portal to disseminate information on all EU-funded research projects and their results in the broadest sense' (http://cordis.europa.eu/home_en.html)

SOURCE: http://kobson.nb.rs/kobson.82.html

TABLE 1 (E): Nanotechnology publications by countries/regions

Author/authors, Title, Journal, Volume, Number, Pages
Youtie, J., Shapira, P., Porter, A.L. (2008), „Nanotechnology publications and citations by leading countries and blocs", *Journal of Nanoparticle Research*, Vol. 10, No. 6, pp.981
Kay, L., Shapira, P. (2009), „Developing nanotechnology in Latin America", *Journal of Nanoparticle Research*, Vol. 11, No. 2, pp. 259–278, doi:10.1007/s11051
Tang, L., Shapira, P. (2011), „Regional development and interregional collaboration in the growth of nanotechnology research in China", *Scientometrics*, Vol. 86, No. 2, pp. 299–315, doi:10.1007/s11192
Tang, L., Shapira, Ph. (2011), „China–US scientific collaboration in nanotechnology: patterns and dynamics", *Scientometrics* Vol.88, No. 1, 1–16, doi 10.1007/s11192
Terekhov, A. I. (2012), „Evaluating the performance of Russia in the research in nanotechnology", *Journal of Nanoparticle Research*, Vol. 14, No. 1, article 1250, doi:10.1007/S11051
Bhattacharya, S., Shilpa, Bhati, M. (2012), „China and India: The two new players in the nanotechnology race", *Scientometrics*, Vol. 93, No. 1, pp. 59–87, doi:10.1007/s11192
Mohammadi, E. (2012), „Knowledge mapping of the Iranian nanoscience and technology: A text mining approach", *Scientometrics*, Vol. 92, No. 3, pp. 593–608, doi:10.1007/s11192
Gorjiara, T., Baldock, C. (2014), „Nanoscience and nanotechnology research publications: a comparison between Australia and the rest of the world", *Scientometrics*, Vol. 100, No. 1, pp. 121–148, doi 10.1007/s11192

SOURCE: http://kobson.nb.rs/kobson.82.html

the most authoritative source of data on publications in general, including nanotechnology publications.

Nanotechnology publications involve all publications in the field of nanotechnology, biotechnology, cognitivescience and information technology (on the convergence of nanotechnology: Roco, M., 2002, Roco, M., Bainbridge, S., 2002; Roco, M., 2003; Roco, M., Bainbridge, S., 2003; Roco, M., 2006; Roco, M.,

TABLE 2: Bibliometric search strategies used in the literature to harvest the publications

Search Approaches	Author/authors
lexical queries	Noyons, E. C. M., Buter, R.K., Van Raan, A.F.J. (2003), *Mapping excellence in science and technology across Europe nanoscience and nanotechnology*. Fraunhofer Institute Systems and Innovation Research, Germany. Glanzel, W., Meyer, M., Du Plessis, M., Thijs, B., Magerman, T., Schlemmer, B., Debackere, K., Veugelers, V. (2003), *Nanotechnology: Analysis of an emerging domain of scientific and technological endeavour*. Steunpunt O&O Statistieken. Porter, A.L., Youtie, J., Shapira, P., Schoeneck, J.D. (2008), „Refining search terms for nanotechnology", *Journal of Nanoparticle Research*, Vol. 10, No. 5, 5, pp. 715-728, doi: 10.1007/s11051-007-9266-y
evolutionary lexical queries	Mogoutov, A., Kahane, B. (2007), „Data search strategy for science and technology emergence: A scalable and evolutionary query for nanotechnology tracking", *Research Policy*, Vol. 36, No. 6, pp. 893–903.
citation analyses	Zitt, M., Bassecoulard, E. (2006), „Delineating complex scientific fields by an hubrid lexical-citation method: An application to nanosciences", *Information Processing and Management*, Vol. 42, pp. 1513–1531.
core journal strategies	Leydesdorff, L., Zhou, P. (2007), „Nanotechnology as a field of science: Its delineation in terms of journals and patents", *Scientometrics*, Vol. 70, No. 3, pp. 693–713, doi:10.1007/s11192-007-0308-0.

SOURCE: Huang et al., 2010.

2008; Porter, A., Youtie, J., 2009). The analysis of citations, i.e. percentage of nanotechnology publications related to specific thematic categories (Subject Categorys), revealed that the science of materials, physics and chemistry, as thematic categories, are dominant (see more in Porter, A., Youtie, J., 2009). In the attempt to achieve the greatest possible comprehensiveness, we chose NanoStatisticsdata, since they use theWoS-databaseas a data source.

First, an overview was made of the number of nanotechnology publications indexed in the ISIWoS database in the period 2005-2013 in the surveyed countries (Source: Nano Statistics, website). The overview pointed to two clusters within which the observed countries grouped. The countries with a significant number of published nanotechnology publications were positioned in the uppercluster, in relation to the countries that were in the bottom cluster. That was one of the reasons to perform further regression-correlation analysis for the countries from the uppercluster. Then we determined the average number of citations, i.e. the ratio between the number of citations and the number of published nanotechnology publications in the observed countries, also in the period between 2005 and 2013 (Source: Nano Statistics, website), since we believe that the citations represent one of the possible indicators of nanotechnology research quality. Yet, we are aware of the fact that the quality of research is certainly very difficult to assess.

Virtually all the countries observed in the paper are at the very top of the list of the countries ranked by GDP (The WorldBank,website), the difference inGDP (ppp) among these countries being significant. In this regard, we performed the analysis of the number of published nanotechnology publications per GDP (ppp) for the observed countries in the period 2005-2012 (Source: Nano Statistics, website). The observed countries were also differentiated according to their population, so that the analysis of the ratio between number of published nanotechnology publications and the number of population (Source: Nano Statistics, website) in the same period (2005-2012) was also performed.

By structuring our analysis in this way, we tried to gaininsight into the level of scientific nanotechnology activity in the observed countries, and possibly predict which countries could be expected to be most active in the field of nanotechnology scientific activity in the near future-until 2015.

4. TREND ANALYSIS OF SCIENTIFIC NANOTECHNOLOGY PUBLICATIONS AND THEIR CITATIONS

Chart 1 shows the total number of published nanotechnology publications in the surveyed countries in the period 2005-2013. The dominant position of China and the USA, forming the uppercluster, can be observed. Other countries from the lowercluster are significantly differently positioned.

It is interesting thatby 2008 the USA was dominant in relation to China, and that China has radically taken precedence since 2008, both in absolute number of published nanotechnology publications, and in the rate of growth.

Regression-correlation analysis shows that in the case of China the growth rate is linear (quadratic regression curve), while in the case of the USA, the growth rate is constant (linear regression curve) (Chart 2, Chart 3).

The degree of determination coefficient of regression for China is 0.996, and for the USA it is 0.995 (see: Chart 2, Chart 3).

A high degree of determination coefficient of both-regressions-in China and in the USA supports this regression-correlation analysis.

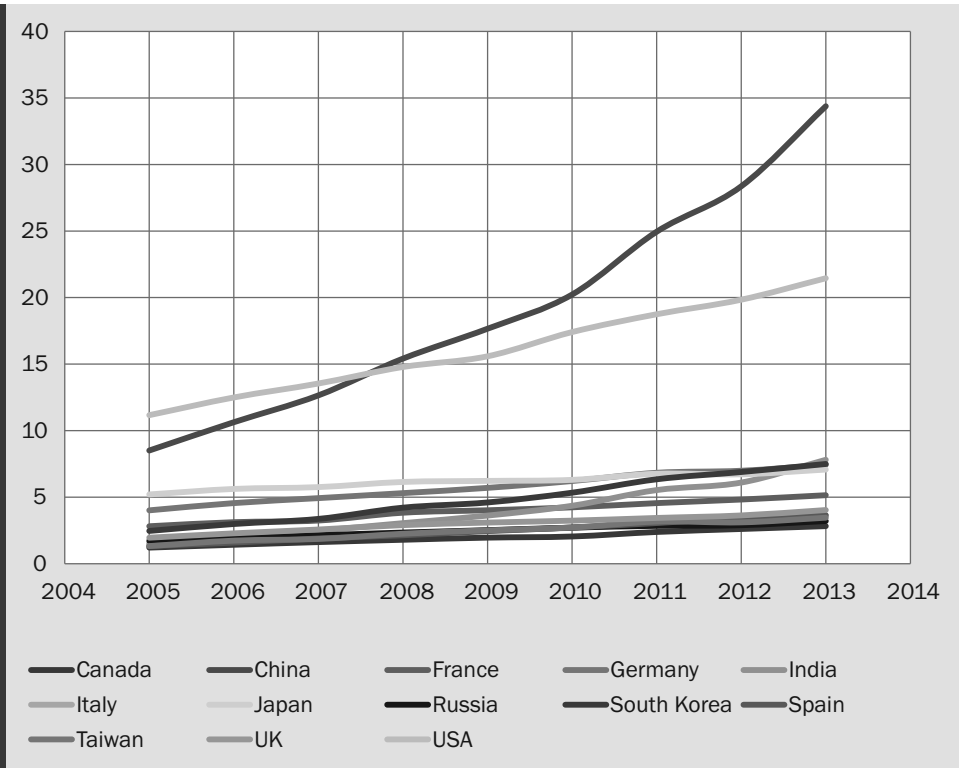
Also, according to this regression-correlation analysis, in 2015, the number of published nanotechnology publications of Chinese scientists is expected to be approximately twice as large as the number of published nanotechnology publications of scientists from the USA. The expected number of nanotechnology publications in 2015 from China is about 45,000, and from the USA it is about 23,000.

Other countries observed – those from the lower cluster (see Chart 1), show a tendency of linear growth in the number of nanotechnology publications with similar growth coefficient. It is important to note that the growth coefficients of the number of nanotechnology publications from South Korea and India are noticeably higher than the coefficient growth of the number of nanotechnology publications from other countries of the lower cluster (Chart 1).

According to Chart 4, which represents the average number of citations (the ratio of the number of citations and the number of published nanotechnology publications) in the observed countries in the period 2005-2013, all curves are declining, as expected.

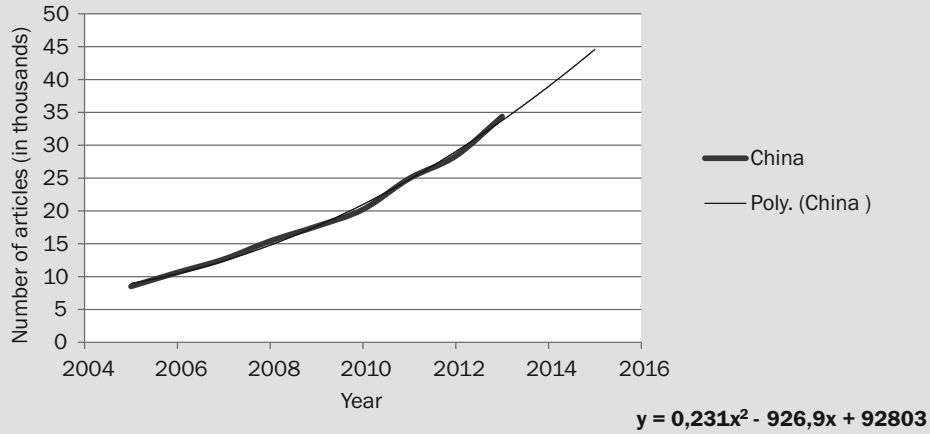
The curves are declining because every next year implies less time for potential citations of published nanotechnology publications. It should be noted that the number of nanotechnology citations was deter-

CHART 1: Number of nanotechnology publications (articles) indexed in ISI (WoS) during the period 2005-2013 (Unit: articles in thousands)



THE DATA SOURCE: Nano Statistics, website

CHART 2: China - quadratic regression



THE DATA SOURCE: Nano Statistics, website

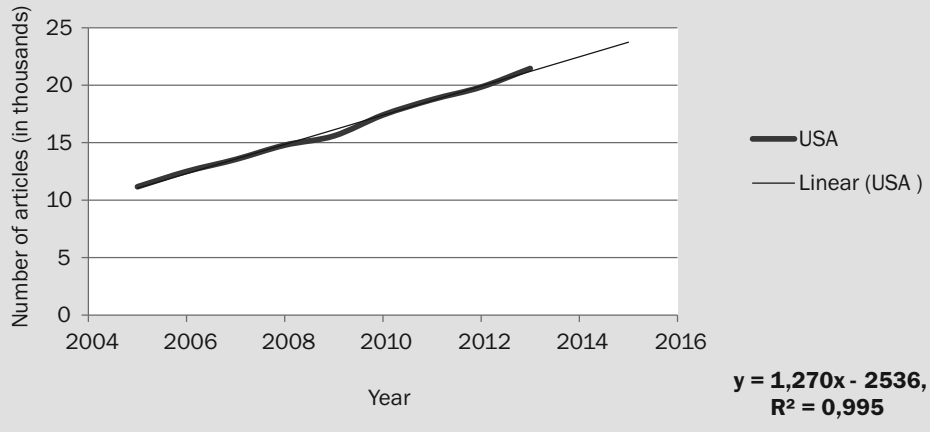
mined for the first half of 2014. According to that criterion, nanotechnology publications from the USA are of the highest quality (are most cited), while the quality of Chinese nanotechnology publications is at a significantly lower level (belonging to the lower cluster). Another best-positioned country, according to the criteria of the average number of citations, is the United Kingdom, while Canada is the third. As presented in Chart 4, the lowest positioned country is Russia,which suggests that its nanotechnology publications are least cited, i.e. that the articles by Russian authors are least cited.

Chart 5 presents the number of published nanotechnology publications per GDP (ppp) for the observed countries in the period 2005-2012.

The best ratio between the number of published nanotechnology publications and GDP throughout the whole observed period can be seen with South Korea and Taiwan. They stand out, and according to this criterion, are positioned in the upper cluster. The decline in the number of nanotechnology publications in relation to GDP in Taiwan in 2006 compared to 2005 is interesting. It requires a separate analysis and could be the subject matter of some futurere search.

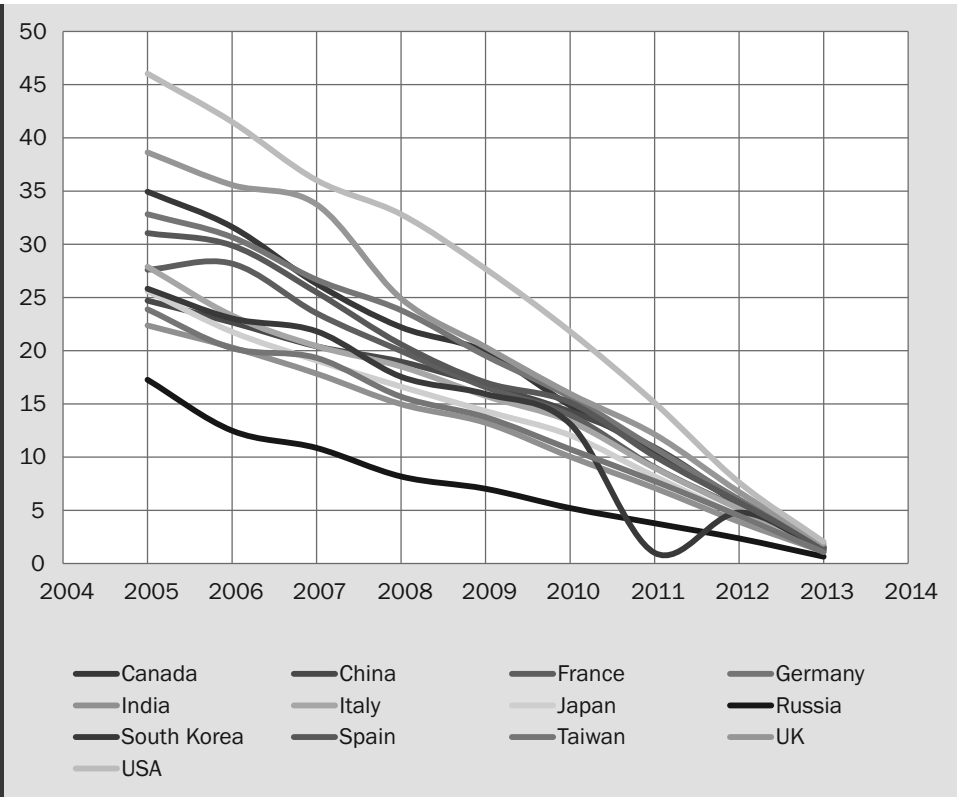
The fact is that all countries except Russia show the growth in the number of nanotechnology publications per GDP, which may be a result of a quality response of nanotechnology science to the increased investment init, or perhaps the increase of the obtained results' quality in previous years. The apparent slight decrease in the number of published nanotechnology publications per GDP in Russia indicates the lack of productivity of scientific research results. However, the fact that the number of published nanotechnology publications is always a measure of real quality cannot be accepted in advance, especially for Russia, because

CHART 3: USA- linear regression



THE DATA SOURCE: Nano Statistics, website

Chart 4: Number of nanotechnology citation/ articles during the period 2005-2013



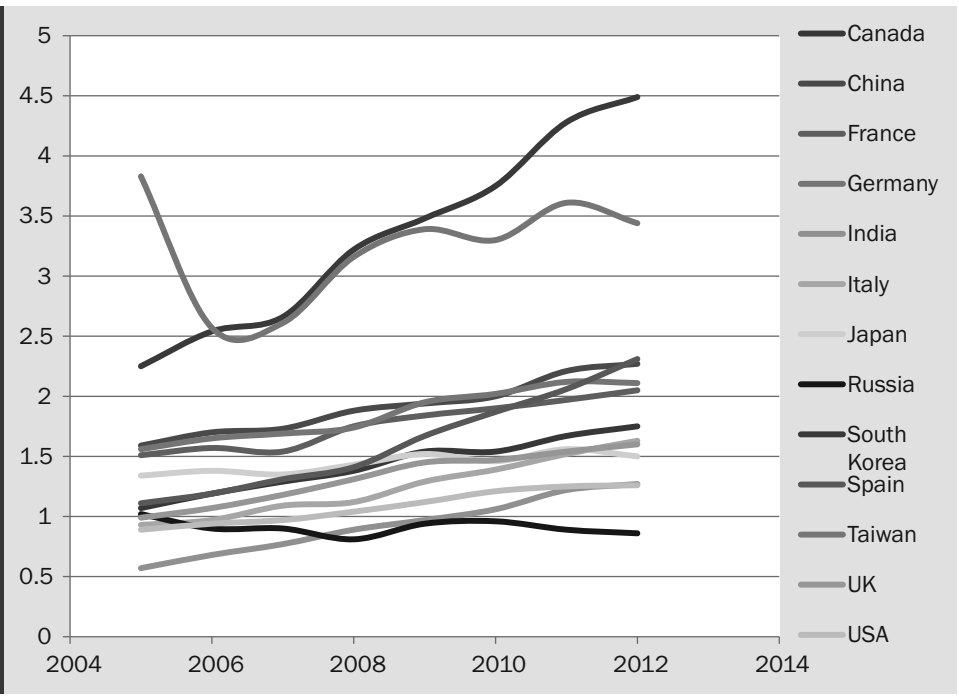
The data source: Nano Statistics, website

Russia has a well known history of avoiding to publish the results for security reasons.

Chart 6 shows the ratio of the number of published nanotechnology publications per capita.

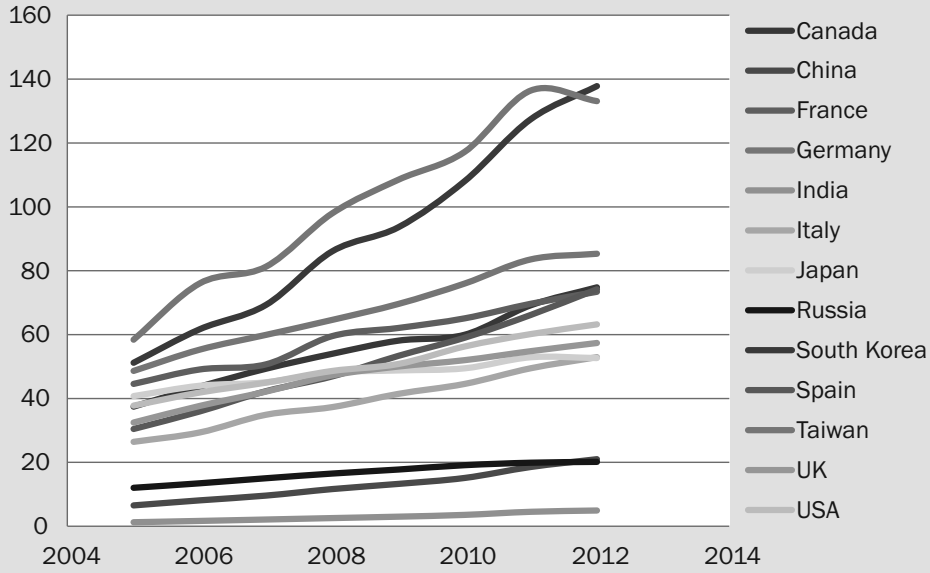
The best ratio of the number of published nanotechnology publications and population during the observation period is recorded with Taiwan and South Korea. They are the best positioned countries

Chart 5: Number of nanotechnology publications (articles) per GDP (ppp) during the period 2005-2012; GDP in billions



The data source: Nano Statistics, website

CHART 6: Number of nanotechnology publications (articles) per Million People during the period 2005-2012



if we consider the number of their published nanotechnology publications per capita, but also if we consider the growth of nanotechnology publications. All other countries observed, as well as the two leading ones have a positive rate of linear growth, but their growth rate is lower than the rate recorded by Taiwan and South Korea. According to this criterion, the lowest rankings are recorded by Russia, China and India. They have the fewest number of published nanotechnology publications per capita and the lowest rate of their growth. This is expected, given the number of-people in China and India, and even Russia.

5. CONCLUSION

Relying on bibliometric indicators, this paper aims to show the quantity and quality of scientific nanotechnology activity in the most active countries in nanotechnology-the USA, Canada, China, Taiwan, Japan, South Korea, India, Germany, The United Kingdom, France, Italy, Spain, and Russia.

Bibliometric analysis of nanotechnology publications is a good choice considering that it is an emerging technology, and a convergent discipline (convergence of multipledisciplines). The WoS database of nanotechnology publications is the authoritative source of data, given that this is a convergent discipline.

The trend and number of published nanotechnology publications point to the quantity, while the average number of citations to the quality of scientific nanotechnology activities. The trend and number of published nanotechnology publications per GDP, i.e. by population, point to scientific and innovation nanotechnology potential of the observed countries.

Results indicate that China and the USA are the leaders in the quantity of nanotechnology publications, as measured by the total number of nanotechnology publications published by these countries. In 2008 China radically took the primacy from the USA, both in the absolute number of published nanotechnology publications, and the growth rate. Other countries observed show a tendency of linear growth of the number of nanotechnology publications, with generally little difference between their coefficients of growth, with the exception of South Korea and India, who have a higher coefficient growth in relation to others.

The USA is a leader in quality of nanotechnology publications, as measured by the average number of citations. It is followed by the United Kingdom and-Canada. Among the observed countries, China occupies a middle favorable position, with Russia occupying the least favorable one. One of the reasons why Russia is lagging behind in quality of nanotechnology activity is that the nanotechnology initiative of Russia (Rusnano) was established only in 2007.

The leaders of the ratio between the number of published nanotechnology publications and GDP throughout the whole period of observation, as well as the ratio between the number of published nanotechnology publications and population are South Korea and Taiwan. The lowest score among the observed countries, concerning the ratio between the number

of published nanotechnology publications and GDP was scored by Russia. As already mentioned, it is a new player in the field of nanotechnology, which is one of the reasons for its lagging behind in this indicator. South Korea and Taiwan show a positive rate of linear growth of the ratio between published nanotechnology publications and population, which is significantly higher than the rate of other observed countries. The countries with larger population, such as China, India, and even Russia have a fewer number of published nanotechnology publications per capita and a lower growth rate. India is also a new player in the field of nanotechnology, and the country with a large population, as is the case with China. The trend and number of nanotechnology publications published by per GDP, i.e.per population are a measure of scientific and innovation nanotechnology potential of countries, but they do not necessarily have to be so.

Finally, based on the regression-correlation analysis performed, it was predicted that in 2015 China will be the most active in nanotechnology, as measured by the total number of the expected nanotechnology publications. The USA is expected to fall to the second place, with significantly poorer performance compared to China.

This paper confirms that the competitive status of country in nanotechnology is determined by the level of its nanotechnology activities - the total number of published nanotechnology publications and the average number of citations.

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Sažetak:

Analiza publikacija u zemljama najaktivnijim u nanotehnologiji

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Nanotehnološke publikacije su jedan od parametara nivoa nanotehnološke aktivnosti zemlje (nanotehnoloških inovacija), dok se nanotehnološke inovacije smatraju izvoromnjene konkurentske prednosti. Konkurentnost zemlje u nivou nanotehnološke aktivnosti determinišu ukupan broj nanotehnoloških publikacija i srednji broj citiranosti. U ovom radu smo upravo analizirali naučnu nanotehnološku aktivnost najaktivnijih zemalja u ovom polju (zemalja čiji broj nanotehnoloških publikacija prelazi 1.000 na godišnjem nivou). Koristili smo podatke o nanotehnološkim publikacijama prikupljene iz Web of Science - WoS baze podataka i objavljenim od strane Nano Statistics - Nano Science, Technology and Industry Scoreboard. Analizirali smo trend ukupnog broja objavljenih nanotehnoloških publikacija, trend srednjeg broja citiranosti, trend odnosa objavljenih nanotehnoloških publikacija i bruto domaćeg

proizvoda, i trend odnosa objavljenih nanotehnoloških publikacija i broja stanovnika u posmatranim zemljama. Na osnovu izvršene regresiono-korelacione analize, predvideli smo očekivane vrednosti ukupnog broja objavljenih nanotehnoloških publikacija za 2015. godinu za Kinu i SAD, jer je reč o zemljama koje dominiraju u ukupnom broju objavljenih nanotehnoloških publikacija u svetu.

Ključne reči: konkurentnost, nanotehnološke inovacije, publikacije, citiranost, regresiono-korelaciona analiza

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