

Patents as Indicators of Innovative Environment

S. Karklina, I. Erins

Abstract—The main problem is that there is a very low innovation performance in Latvia. Since Latvia is a Member State of European Union, it also shall have to fulfill the set targets and to improve innovative results.

Universities are one of the main performers to provide innovative capacity of country. University, industry and government need to cooperate for getting best results.

The intellectual property is one of the indicators to determine innovation level in the country or organization, and patents are one of the characteristics of intellectual property.

The objective of the article is to determine indicators characterizing innovative environment in Latvia and influence of the development of universities on them.

The methods that will be used in the article to achieve the objectives are quantitative and qualitative analysis of the literature, statistical data analysis and graphical analysis methods.

Keywords—HEI, innovations, Latvia, patents.

I. INTRODUCTION

THE European Commission conducts on a regular basis the analysis of innovation performance of EU countries. The study “Innovation Union Scoreboard 2013” includes innovation development performance in eight spheres. Among 27 countries included in the analysis, Latvia takes the 25th place, just ahead Bulgaria and Romania. The innovation performance of these three countries, as well as of Poland is well below the EU average. In the previous study conducted in 2011, Latvia was the last – 27th. The immediate neighbors of Latvia in the Baltic countries took better positions: Lithuania – the 25th and Estonia – the 14th [13].

The European Union’s strategic plans include the target that the higher education institutions become more pronounced source of innovations according to jobs and growth strategy „Europe 2020”. One of the five targets of the European Union in the field of education to be achieved by 2010 is that at least 40% of people at the age of 30 to 34 have would obtain higher education. One more positive target should be noted in research and innovation field that will improve innovation environment – it is planned to invest in R&D 3% of EU GDP. [25], [28].

Since Latvia is a Member State of European Union, it also shall have to fulfill the set targets. The target amount of funding share invested in R&D to be achieved by 2020 is

1.5% of GDP. In 2012, this figure amounted to only 0.66% of GDP, as you can see in Table I [8].

TABLE I
FUNDING SHARE INVESTED IN RESEARCH AND DEVELOPMENT IN EUROPEAN UNION AND LATVIA 2006-2020

Year	2006	2007	2008	2009	2010	2011	2012	Aim in year 2020
EU (27)	1.84	1.84	1.91	2.01	2.01	2.05	2.07	3
Latvia	0.7	0.6	0.62	0.46	0.6	0.7	0.66	1.5

Latvian Convergence Programme for the years 2013–2016 is set towards the modernization of higher education. The main target is to provide high-quality, internationally competitive and science- based higher education that is implemented by effectively managed institutions with consolidated resources.

Knowledge and innovation are Latvian key resources to achieve national development targets. In contrast to the countries that have opportunity to choose from a number of resource types or combine them, Latvia actually has no other alternative way but human-based and human capacity building related development. In order to achieve such life quality of all society and of each individual that is incident for developed countries, the knowledge, as well as their efficient and targeted use is the most valuable resource of Latvia [18].

On 18 May 2005, the Law on Scientific Activity came into force, which states that annual increase in funding for scientific activity should be not less than 0.15% of GDP until State-allocated funding reaches 1% of GDP. Until 2006, the increase in State budget funding for scientific activity was negligible that resulted in activity of science system in survival mode. In the recent years, thanks to the possibility to receive financing from EU structural funds, the development can be observed in priority scientific areas.

The objective of the article is to determine indicators characterizing innovative environment in Latvia and influence of the development of universities on them.

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II. MOVING OF HIGHER EDUCATION INSTITUTIONS TOWARDS MODERNIZATION

In order to evaluate interaction of higher education institutions and innovations, it is necessary first to consider types of higher education institutions. There are several

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classifications how the scientists group the higher education institutions.

One of the classifications is Carnegie breakdown of higher education institutions that classifies the higher schools mainly by types of school graduates. Carnegie Classification for higher education institutions is made by Carnegie Commission. The Carnegie Classification has been the leading framework for recognizing and describing institutional diversity in U.S. higher education for the past four decades. Starting in 1970, the Carnegie Commission on Higher Education developed a classification of colleges and universities to support its program of research and policy analysis. Derived from empirical data on colleges and universities, the Carnegie Classification was originally published in 1973, and subsequently updated in 1976, 1987, 1994, 2000, 2005 and 2010 to reflect changes among colleges and universities [29], [2].

There are researchers, which state that the higher education institutions can be divided in groups more accurately. Summarizing this method of classification, four main types of universities can be distinguished:

- 1) *Research-Intensive universities;*
- 2) *Teaching-Intensive universities;*
- 3) *Communal-Intensive universities;*
- 4) *Professional-Intensive universities* [3].

Recently, the higher educational institutions are classified in a different way, taking into account their impact on science, innovativeness and entrepreneurship. Such higher educational institutions as the Third Generation Universities and Business Universities have been distinguished as the most advanced universities. Wissema Classification shows the special features of Third Generation Universities.

TABLE II
THE CHARACTERISTICS OF THE GENERATIONS OF UNIVERSITIES [35]

	1st generation	2nd generation	3rd generation
Objective	Education	Education + research	Education + research + know-how exploitation
Role	Defending the truth	Discovering nature	Creating value
Method	Scholastic	Modern science, monodisciplinary	Modern science, interdisciplinary
Creating	Professionals	Professionals + scientists	Professionals + scientists + entrepreneurs
Orientation	Universal	National	Global
Language	Latin	National languages	English
Organization	Nationes, faculties, colleges	Faculties	University institutes
Management	Chancellor	Part-time academics	Professional management

At present, the universities should strive to business development, making researches between a numbers of existing sectors or creating new research areas more attention paying to creativity and practical manifestations, regardless of nationality.

In Latvia, Riga Technical University is one of the universities that have included the progress and development as the Third Generation University in its strategy [27].

Another popular model for the entrepreneurial university is the “triple helix model” [6], [7] which is based on academic-industry-government linkages forming a spiral pattern of cooperation [10]. This model suggests new understandings and metrics for traditional teaching and research missions, internal organizational changes that are more conducive to collaboration (both internal and external), new modes of governance and management and new institutional capacities. On a closer look, this view is also resonates with the knowledge transfer view with emphasis on advancing economic development through the strategy of technological innovation. Whereas managerial processes are processes mainly of control, normality, and standardization, the “entrepreneurial” approach is about play, anomaly, and movement [11], [16].

In a knowledge society, the universities must move to such category of higher institutions as business universities. One of the models that describe the business university is “Triple Helix” model, which determinates the university-industry-state relationships and has a number of possible variations [5], [7].

Classical “Triple Helix” model and relationships among university, industry and state you can see in Fig. 1.

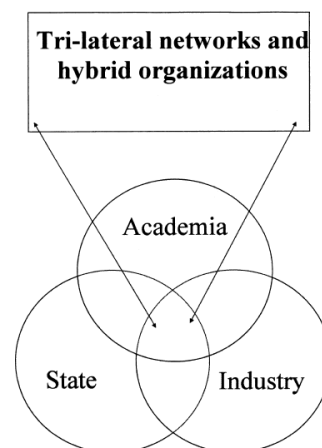


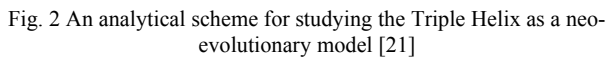
Fig. 1 Classical Triple-Helix model [7]

Entrepreneurial universities are expected to play a leading role in regional innovation and to encourage start-ups. Similarly, industry is expected to reorganize itself in a network mode to be more receptive to external inputs. Government is expected to develop programs cooperatively with the other actors to support enhancement of the university, industry and the links between them. The three spheres are expected to act as a common subject and cooperatively implement an economic growth strategy [6].

Three selection environments are specified in the Triple Helix model:

- TABLE III
A (NEO-) INSTITUTIONAL VERSUS AN EVOLUTIONARY APPRECIATION OF THE
TRIPLE HELIX MODEL [21]

In the analytical model, the different perspectives of government, industry, and academia can first be spanned along orthogonal axes, and the observables can then be appreciated as interaction effects among the functions (Fig. 2). For example, since the second half of the 19th century, corporations have operated R&D laboratories, which contribute systematically to novelty production alongside academia. However, universities can also be considered as state apparatuses. Administrative innovations like patent legislation have reshaped the three environments by providing a nexus among them [30].



Since the patents are one of the indicators, by which the innovation level of the country, as well as university-industry-state interaction can be described, the essence of the patent and the situation in Latvia in the field of patents will be discussed below.

The intellectual property is one of the indicators to determine innovation level in the country or organization. Patents are one of the characteristics of intellectual property.

Usually term “patent” are used in legal field and research papers.



Patents reflect a country's inventive activity. Patents also show the country's capacity to exploit knowledge and translate it into potential economic gains. In this context, indicators based on patent statistics are widely used to assess the inventive performance of countries [8].

In order to determinate the innovative potential of Latvia, at first, it is necessary to view the application share at European Patent Office (EPO) per population of the country.

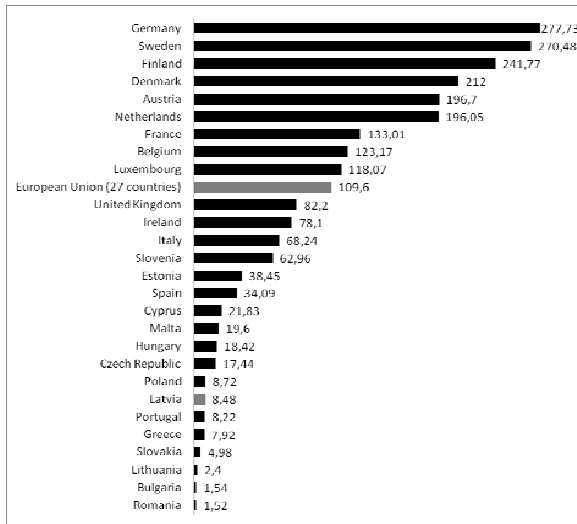


Fig. 4 Patent applications to the EPO at the national level per million of inhabitants, 2010 [8]

Considering the total number of patent application share in European Patent Office (EPO) per million residents (Fig. 4), Latvia takes one of the last places in Europe, far below the European Union average (almost 13 times). Latvia is behind the leading European country even 33 times in terms of applied patents. The increase in this indicator is affected by several factors, including the scientific infrastructure, research staff creativity, financial security, etc.

R&D funding is one of the main factors that influence the creation of new patents. In order to determine Latvian patent application creation potential, it is necessary to view application share at European Patent Office (EPO) per national R&D funding.

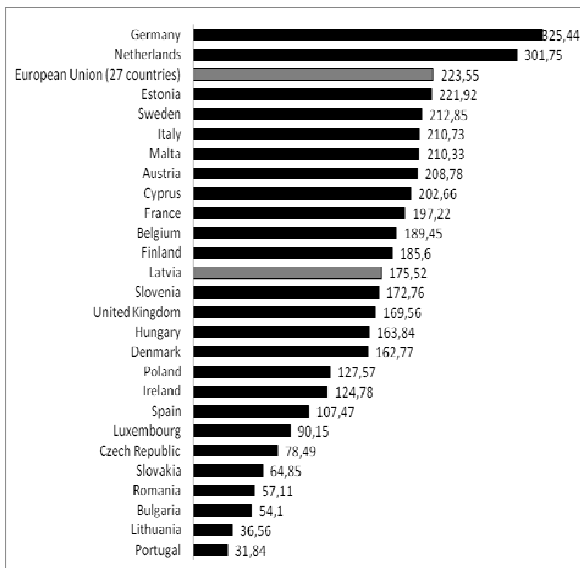


Fig. 5 Total number of patent applications to the EPO at the national level by milliard EUR of total R&D expenditure, 2010 [8]

In Latvia, the invested research and development funding in relation to GDP is very low compared with EU requested achievable performance. But the relation of the number of patent application to invested research and development funding is, in its turns, satisfactory as you can see in Fig. 5. It means that, despite the low funding, Latvian scientists are capable to develop innovations and create new patents. However, it is necessary to invest in Latvian research and development a larger share to be able to restore scientific infrastructure that is required for advanced, world-class researches, in particular, in engineering sciences.

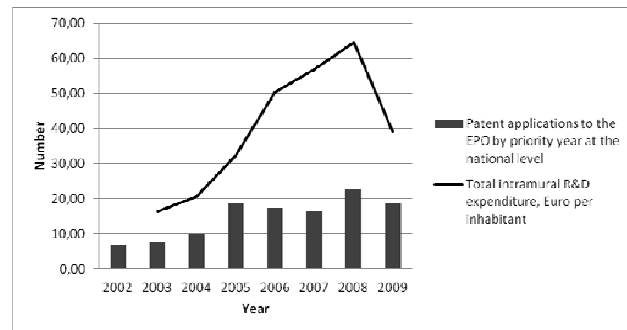


Fig. 6 Patent applications to the EPO at the national level per million of inhabitants and total intramural R&D expenditure in Latvia, 2002-2009 [8]

Funding towards research and development can be correlated with an increase in the number of patents as you can see in Fig. 6, but it takes a certain time lag, as, in order to prepare a patent application, time is required for innovative research. In other words, increasing R&D funding, the returns from it will be after a certain time period, until the equipment will be renewed, more knowledgeable and more creative staff will be involved, the research will be performed in respective field and the innovation will be developed.

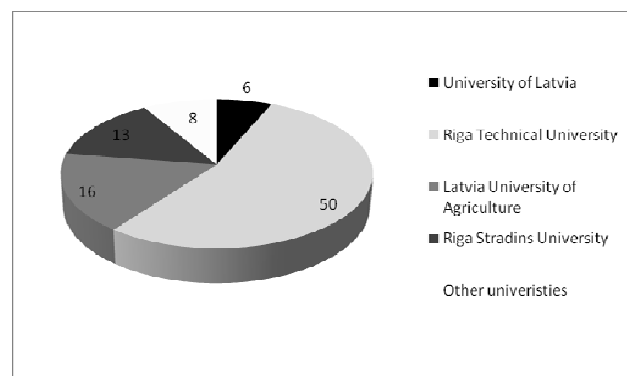


Fig. 7 Number of patents and licenses in Latvia, 2011 [26]

Higher education and research institutions are the base, where most of the research processes take place and new patents are created.

As it can be seen from the diagram (Fig. 7), the major applicant of patents and licenses is Riga Technical University,

which is the leading university of engineering sciences in Latvia. Besides, this university is the only higher education institution in Latvia that has included the movement and development as a Third Generation University in its strategy, as mentioned above. So it can be seen that the university is on the right way forward.

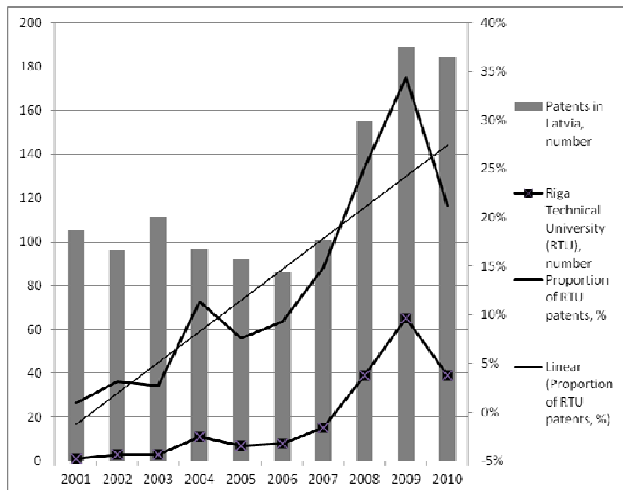


Fig. 8 Number of patents and licenses in Latvia and Riga Technical University, 2001-2010 [15]

As it can be seen from the increase in the patent share of Riga Technical University in the total number of the Latvian patents shown in the diagram (Fig. 8), the trend is rapidly progressive. The increase in the number of patents is facilitated by financing from European Union structural funds leveraged for research and development growth. The decrease in the year 2010 is a consequence of financial crisis in Latvia in 2008 – 2009, that was followed by the decrease also in funding for research and development.

IV. CONCLUSION

There is a very low innovation performance in Latvia; according to the studies it takes 25th place among all EU countries. As an EU Member country, it shall have to achieve targets set in EU, including those that can help develop innovative environment – the funding from total GDP shall be increased and an environment of universities shall be improved, as it is a base for innovative activities. The movement of the higher educational institutions towards the Third Generation University type is one of the elements for improving of innovation potential.

At present, the universities should strive to business development, making researches between a numbers of existing sectors or creating new research areas more attention paying to creativity and practical manifestations, regardless of nationality.

The intellectual property is one of the indicators to determine innovation level in the country or organization, and patents are one of the characteristics of intellectual property. They can be considered both at public level and at the level of

individual universities. Patents are one of the indicators, by which the innovation level of the country, as well as university-industry-state interaction can be described.

There exist contradictory opinions about the patent as an innovative element. The major part of scientists believes that patents reflect a country's inventive activity. Patents also show the country's capacity to exploit knowledge and translate it into potential economic gains. But there are scientists that believe that patent counts are very imperfect measures of innovative output.

Latvia lags behind the average European Union innovation development performance also by factors affecting the innovation environment: both by the number of patent applications and by research and development funding.

At the level of higher education institutions, the greatest contributions in the development of Latvian innovations are made by Riga Technical University with the largest number of applied patents. This university is the only higher education institution in Latvia that has included the movement and development as a Third Generation University in its strategy, in that way clearly defining its movement to research excellence.

REFERENCES

- [1] Al-Aali, A. Y., & Teece, D. J. (2013). Towards the (Strategic) Management of Intellectual Property: Retrospective and Prospective. *California Management Review*, 55(4), 15-30.
- [2] Brint, S. A Priori and Empirical Approaches to the Classification of Higher Education Institutions: The United States Case. – *Pensamiento Educativo. Revista de Investigación Educativa Latinoamericana* 2013, vol. 50, No. 1, 2013, pp. 96-114.
- [3] Chen, J. K., & Chen, I. (2008). VIKOR Method for Selecting Universities for Future Development Based on Innovation. *Online Submission*.
- [4] Cotropia, C.A. What is the "invention"? in William and Mary Law Review, vol. 53, No. 6, 2012, pp. 1855-1914.
- [5] Dzisah J., Etzkowitz H. Triple helix circulation: the heart of innovation and development. – *International Journal of Technology Management and Sustainable Development*, vol. 7, No. 2, 2008, pp. 101 – 115.
- [6] Etzkowitz H., Zhou C. Triple Helix twins: innovation and sustainability. – *Science and Public Policy*, vol. 33, No. 1, 2006, pp. 77–83.
- [7] 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*, 29(2), 109-123.
- [8] Eurostat Statistics Database. European Commission - <http://epp.eurostat.ec.europa.eu/>
- [9] General Information Concerning Patents. United States Patent and Trademark Office, 2011, pp. 36.
- [10] Goldstein, H. A. (2010). The 'entrepreneurial turn' and regional economic development mission of universities. *The Annals of Regional Science*, 44 (1), 83-109.
- [11] Hjorth, D. (2003a). Rewriting Entrepreneurship – for a new perspective on organizational creativity, Liber – Abstrakt – Copenhagen Business School.
- [12] Idris, K. Wipo Intellectual Property Handbook: Policy, Law and Use. Geneva: WIPO publication, 2008, (489).
- [13] Innovation Union Scoreboard 2013. – European Commission, 2013, http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013_en.pdf
- [14] Kartusa, R., & Kukrusb, A. (2013). Innovation, product development and patents at universities. *Estonian Journal of Engineering*, 19(1), 4-17.
- [15] Kristapsons J., Tjuņina Ē., Kozlovskis M. Patentu statistika: Skats uz Latvijas zinātni, Zinātnes Vēstnesis, 20th June 2011, http://www.lza.lv/index.php?option=com_content&task=view&id=1245&Itemid=47.
- [16] Kyrö P., Mattila J. Towards future university by integrating Entrepreneurial and the 3rd Generation University. – 2012.

- [17] Lanjouw, J. O., Pakes, A., & Putnam, J. (1998). How to count patents and value intellectual property: The uses of patent renewal and application data. *The Journal of Industrial Economics*, 46(4), 405-432
- [18] Latvian Convergence Programme for the years 2013–2016. - http://ec.europa.eu/europe2020/pdf/nd/cp2013_latvia_lv.pdf
- [19] Lavas J. Patents. – General Library, pp. 6 – <http://www.library.auckland.ac.nz/subject-guides/bus/docs/patents.pdf>
- [20] Lee P. Patents and the University. – *Duke Law Journal*, vol. 63, No. 1, 2013, pp. 87
- [21] Leydesdorff L., Meyer M. Triple Helix indicators of knowledge-based innovation systems. – *Research policy* Vol. 35, 2006, pp. 21
- [22] Online Etymology Dictionary - <http://www.etymonline.com/index.php?term=patent>
- [23] Patents and Innovation: Trends and Policy Challenges. – Organization for Economic Co-operation and Development (OECD), 2004.
- [24] Patents: Basic Facts. Intellectual Property Office, United Kingdom, 2013, pp. 20
- [25] Program for modernizing higher education in Europe. Citizens' summary. – European Commission, http://ec.europa.eu/education/higher-education/doc/cs_lv.pdf
- [26] Scientific performance of HEIs: Survey of year 2012. Statistics and research about science. – Ministry of Education and Science of the Republic of Latvia, http://izm.izm.gov.lv/upload_file/Zinatne/AZD_2012.pdf
- [27] Strategy of Riga Technical University, year 2013 – 2030.
- [28] Targets of "Europe 2020". – European Commission, http://ec.europa.eu/europe2020/targets/eu-targets/index_lv.htm
- [29] The Carnegie Classification of Institutions of Higher Education. – Carnegie Foundation for the Advancement of Teaching - <http://classifications.carnegiefoundation.org/>
- [30] Van den Belt H., Rip A. The Nelson-Winter-Dosi Model and Synthetic Dye Chemistry, 1988, pp. 135 - 158
- [31] What is a patent? – Intellectual Property Office of Singapore. – <http://www.ipos.gov.sg/AboutIP/TypesofIP/WhatIsIntellectualProperty/WhatIsapatent.aspx>
- [32] What is a patent? – World Intellectual Property Organization, Switzerland, http://www.wipo.int/export/sites/www/freepublications/en/patents/450/wipo_pub_1450pa.pdf
- [33] What is a patent? Intellectual property and science. – Thomson Reuters - <http://ip-science.thomsonreuters.com/support/patents/patinf/patentfaqs/patent/>
- [34] What is a patent? Intellectual Property Office, United Kingdom – <http://www.ipo.gov.uk/p-what.htm>
- [35] Wissema, J. G. (2009). *Towards the third generation university: managing the university in transition*. Edward Elgar Publishing.

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