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INTERNATIONAL TECHNOLOGY AND INNOVATION COMPETITIVENESS OF POLAND AS COMPARED TO OTHER CENTRAL AND EASTERN EUROPEAN COUNTRIES (EU-10)

Abstract

The main objective of this paper is to compare how international competitiveness of the economies of the new European Union member states (the countries of Central and Eastern Europe, EU-10) has been formed at the beginning of the 21st century, with particular emphasis on competitiveness in technology and innovation.

The paper opens with a brief presentation of the analyzed issues. Further on, the development of international competitiveness of the EU-10 economies is discussed in the light of reports drawn up by the world's leading scientific research centers. Next, international competitive capacity of these countries is analyzed, focusing on their ability to invent and to innovate. The paper closes with a summary and conclusion.

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Introduction

In the contemporary world economy, countries (and groups of countries) are more and more strongly competing with each other on an international scale. Many

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interesting discussions on the forming of international competitiveness of national economies of countries and their groups can be found in the literature on the subject (e.g. in the works of economists exploring the issues of international economic relations and location of economic activity in the world). So far, however, there have been no uniform and generally accepted theory of international competitiveness of a given country's national economy (a theory that could be verified with empirical analyses). Neither there is any clear-cut, unequivocal definition of „international competitiveness” because, as J. Misala says (2011, p. 63), „(...) in fact, this notion (...) has not been defined. As it turns out, it is understood in all the ways possible” (for more on the subject of multiple definitions of „international competitiveness” see e.g.: Bossak, Bienkowski 2004, Misala 2011).

In the formulated definitions, specific takes on competitiveness are distinguished. For example, H. Siebert and H. Klodt (1998, p. 2-5) have noted three aspects of competition: competing in the area of products, competing in the area of factors of production and the so-called institutional competition. J. Fagerberg, M. Knell and Shrolec (2004, p. 11-20), on the other hand, have distinguished the following:

- a) technology competitiveness – defined as the ability to effectively compete on the markets for new goods and services, with this type of competitiveness being closely tied to the innovativeness of the given country;
- b) capacity competitiveness – i.e. the ability to increase human capital resources, develop ICT (information and communications technology) infrastructure, implement new technologies quickly and create favourable institutional and social solutions;
- c) price competitiveness – i.e. competing in terms of costs of production and prices of the products offered;
- d) demand competitiveness – i.e. the given country's ability to adjust the structure of its production and exports to the changing structure of import demand in the global economy.

The lack of a universally accepted definition of international competitiveness has many different causes. One of them is equating three basic subcategories of competitiveness that are interrelated and interdependent, namely:

- a) international competitive capacity – i.e., according to J. W. Bossak (1984, p. 37), „the ability to compete for benefits associated with the country's participation in the international division of labour. This ability is relative in two senses; firstly, it is relative to other countries, and secondly, to the features of international competition characteristic of a given stage of development”. This mainly concerns two changing components of this capacity, namely the real component (own and foreign resources and economic infrastructure in a broad sense) and the institutional component (system of the functioning of the state);
- b) current international competitiveness (competitiveness in the strict sense) – i.e., as J. Misala (2011, p. 118) puts it, „the current state and the direction of changes of the real and institutional components of international competitive capacity

as countries compete for the benefits of their participation in the international division of labour”;

- c) international competitive position – i.e. „the state and changes of a given country’s participation in broadly defined international trading (of goods, services and factors of production – E.S.), as well as the evolution of this trading, including adequate quality changes” (Misala 2011, p. 118).

An important problem is the way of measuring international competitiveness. Many direct measures are used today as well as many measurement methods where various synthetic measures are constructed. The measures used, e.g. those assessing a given aspect of competitiveness, are both quantitative and qualitative.

Generally all those measures can be classified as follow:

- indicators of the general rate of economic development for a given country, GDP growth rate, unemployment rate, inflation rate, condition of the state budget, current account balance, the balance of payments, level of foreign trade reserves, internal and external debts,
- indicators informing about structural changes and changes in the effectiveness of usage of individual factors of production as well as freedom of mobility of factors of production domestically and internationally,
- indicators of education, knowledge and human resource development
- indicators of innovativeness, R&D, and especially ICT development,
- indicators informing about the degree of involvement in international trade

Numerous positive aspects of these measures can be mentioned, as well as some shortcomings (for more on this subject see e.g. Misala, 2007, p. 83-104).

Due to the scope of this paper, only selected indices and measures of competitiveness are used further on.

Technology, innovations, international competitiveness on the background of macroeconomic opportunities

The important factors of economy’s competitiveness are technical resources, the level of development and effective usage of technical knowledge, and knowledge in the fields of organization, management and marketing. These are the areas of activities which can be broadly defined as innovativeness of economy. The relationships between innovativeness and economy’s competitive ability are presented in Figure 1.

Innovativeness means a set of innovative actions which can take place in industry or services. They can refer to products (creating new ones or significant modifying of already existing products), production processes (making them more efficient) and production methods (development of new production technologies and techniques). Moreover, innovativeness includes also changes increasing efficiency and effectiveness of enterprise activities, thus it also refers to the spheres of organization, management, marketing and finance.

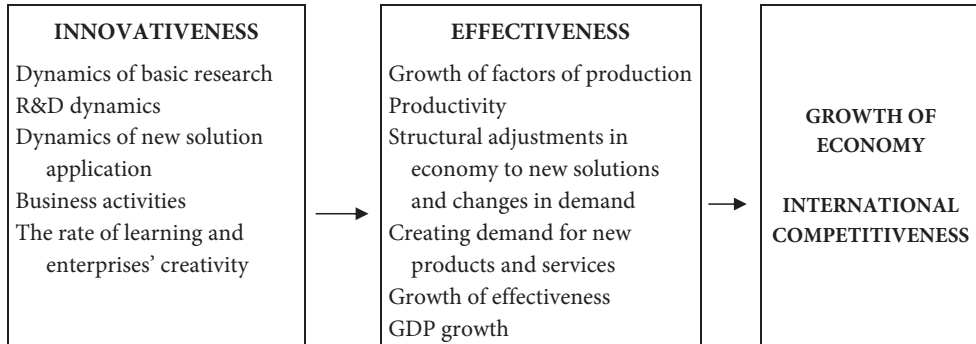


Figure 1. Innovativeness vs. international competitiveness

Source: Bukowski (2010, p.3).

National innovative capacity, characteristic of a given economy is a long-term capacity to create and commercialize the stream of new innovations. Thus, it means a long-term trend towards creative activity in different areas of economy and practical usage of its results. It is a function of material and intellectual resources, outlays indispensable for using these resources (outlays on basic research, R&D), innovative and economic policies of the state creating conditions for development of entrepreneurship and innovativeness, and market competition among enterprises (see: Stern, Porter, Furman, 2000, pp. 1-10; Weresa, 2003, p. 97).

Ability to create innovations has become one of the most important factors of long-term growth and economic development. Innovativeness is based on research and development activities, i.e. on works conducted in laboratories aiming at making production processes more efficient and improving them, developing and creating new technologies and products.

In modern economy, the growth in productivity of factors of production is mainly a consequence of the accelerated scientific and technological progress (outlays on scientific and technological development, R&D), the quality of human resources, entrepreneurship and innovativeness. The very outlays on scientific research measured by their share in GDP do not decide about future effects. A mechanism stimulating conversion of scientific solutions into practical applications in the form of new production methods and new products is indispensable.

The state, to a large extent, is able to influence the amount of outlays on research but it cannot cause that the research results are applied in economy. A mechanism of market competition is indispensable to this end. It enforces improvement of production methods and introduction of new products to the market. The state can create conditions for efficient functioning of the market and competition or it can restrict their activities and sometimes, in many areas, even replace them. However, the experience of many countries proved that such actions are not effective.

Overregulation of economy (including labour market) which is reflected in excessive bureaucratic restrictions in the form of regulations (governing activities in different economic areas), directives, bans and licences leads to limiting the stimuli of innovativeness and reducing productivity of factors of production. The latter is the result of fiscalism in the economic policy of the state accompanied by overregulation of economy. On a macroeconomic scale it is revealed by a high share of taxes and parafiscal charges in GDP and, on the other hand also in the high share of the state expenditures in GDP (the so-called fiscalism index). On a microeconomic scale fiscalism means high tax burden for enterprises as well as different levies of social nature and administrative charges. High fiscal burden reduces the rate of national savings in GDP and hence it has an adverse effect on economic growth. On the other hand, high state expenditures trigger the crowding-out effect, which means a drop in investments and private consumption (Bukowski, 2010).

Administrative intervention in the form of excessive restrictions regulating business activities leads to reduced flexibility of enterprises in adjustment to market signals and changes that occur in the world's economy.

Protectionism in foreign trade is another unfavourable factor affecting competitiveness of economic innovativeness. It leads to disturbances in the market mechanism of allocating resources of factors of production in economy, weakening of stimuli of effective management in enterprises and stimuli of technical and technological progress. Enterprises are deprived of competitive pressure from abroad (see: Bukowski, 2003, pp. 45-47).

The above mentioned factors (overregulation of economy, fiscalism and protectionism) lead to petrification of economic structures, reduced entrepreneurship and innovativeness, reduced management effectiveness and consequently lower productivity of factors of production, slow rate of economic growth and eventually lower competitiveness of economy in comparison to foreign countries. Figure 2 presents system-related determinants of international competitiveness of economy.

What is particularly important is assuring openness of property (ownership) rights. The open system of property rights means that there are no restrictions to undertake, run and benefit from business activities. This system includes different forms of ownership and treats them equally. Yet, it must be borne in mind that when there is freedom of undertaking business activities and competition, private ownership is the factor strengthening development of private sector which is more effective and efficient and innovative than the public sector based on non-capitalistic ownership (see: Bossak, Bienkowski, 2004, p. 64). Hence, privatization processes play a very important role in economy. These processes broaden the scale of economic freedom. As J. Bossak puts it: „privatization of economy means broadening the limits of economic freedom and competition and reducing market regulation, including ownership rights, finances, labour and foreign co-operation”.

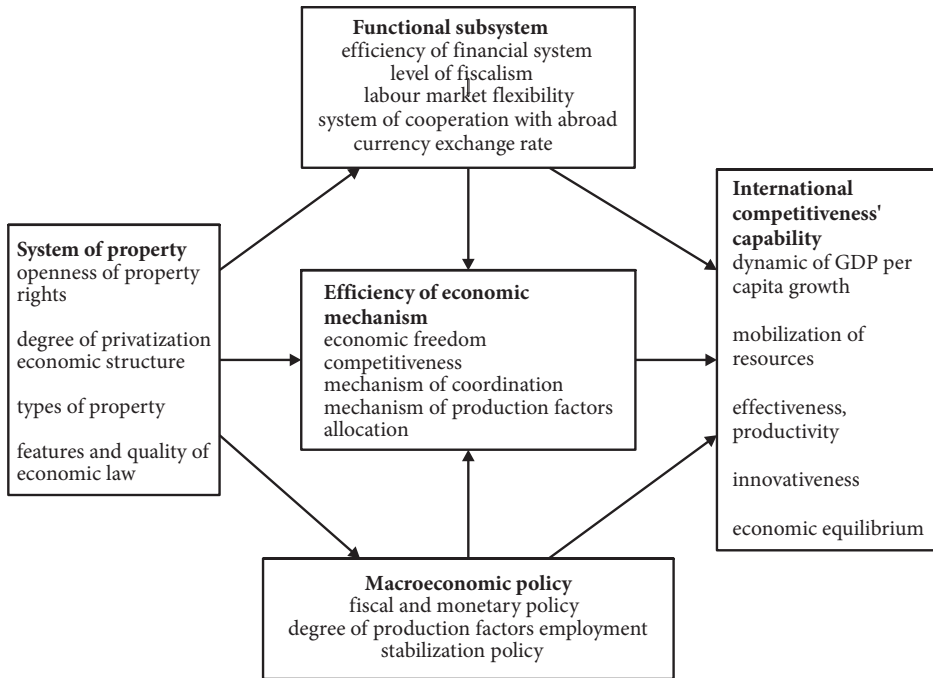


Figure 2. System-related determinants of international competitiveness

Source: Bossak (2001, p. 52).

Broadening of the range and intensity of market mechanism influence enhances selective and location functions of the market and thus mobility of resources (especially, labour mobility) and promotes higher economic effectiveness (see: Bossak, Bieńkowski, 2004, p. 64).

Macroeconomic policy based on deregulation of economy and liberalization of economic links with abroad as well as creating conditions for competition mechanisms among enterprises may favour the long-term economic growth based on innovativeness to a greater extent. Creation of institutional conditions enabling flexible market functioning, including labour market, is of crucial importance here. It is also important to ensure a high degree of economic freedom and freedom of competition mechanisms between domestic and foreign enterprises. Economic policy of the country may only correct effects of market mechanisms but it cannot replace them. It is essential to reduce fiscalism in economic policy which is measured by the share of taxes, contributions towards social insurance and other parafiscal charges in GDP. The state can support processes of economic growth by ensuring openness and protection to ownership rights, providing broad economic freedom and supporting entrepreneurship and innovativeness. In particular, the state can and should

care about development of infrastructure, society's education, development of the system of education at different levels and financing scientific research (first of all basic research which builds the foundation for progress in the sphere of technology and education and adjusting society and economy to challenges posed by foreign environment in the long-run) (Bukowski, 2010).

EU-10 countries in the selected rankings of international competitiveness

One of the world's leading academic centers doing research on international competitiveness of economies is the Institute for Management Development (IMD). The research results are published in the World Competitiveness Yearbook annual reports covering several dozen countries. IMD experts define the competitiveness of economy as the country's capacity to create added value and contribute to the increase of wealth through efficient management, attractive conditions for business operations and globalization and integration of all these factors into a single coherent social and economic model. The IMD research on competitiveness include an analysis of numerous factors determining its level, classified in four groups: macroeconomic results (including domestic economy, international trade, international investment, employment, prices), government efficiency (public finance, fiscal policy, institutional framework, business legislation and societal framework), efficiency of businesses (productivity, labour market, finance, management practice, attitudes and values) and the quality of infrastructure (basic infrastructure, technological infrastructure, scientific infrastructure, health and environment, education)¹.

In the IMD competitiveness rankings, the countries of Central and Eastern Europe have not ranked high, and in 2012 their position was lower than in 2008 (except for Poland). In 2012, IMD experts recognized Estonia, Czech Republic and Poland as the most competitive economies in the region. The positions of Bulgaria, Romania and Slovenia have deteriorated, with these countries ranking in the bottom ten.

A slightly different take on the aspects of competitiveness² is presented by the international competitiveness ranking developed by the experts of the World Economic Forum (WEF), with competitiveness understood as a country's capacity to achieve a constant high rate of the GDP per capita growth.

¹ More than 300 criteria are used to analyze these factors, including the so-called hard data (measurable, e.g. GDP) and soft data (non-measurable, e.g. management practices or life quality). For more on the ranking's methodology, see IMD (2012, p. 480-484).

² 12 pillars of competitiveness are analyzed, divided into three groups: basic requirements (institutions, infrastructure, macroeconomic stability, health and primary education), efficiency enhancers (higher education and training, goods market efficiency, labour market efficiency, financial market sophistication, technological readiness, market size) and innovation and sophistication factors (business sophistication, innovation).

Table 1. Positions of the EU-10 countries in IMD rankings (in terms of overall competitiveness and selected criteria) 2008-2012

	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Overall competitiveness										
2008 ^a	39	28	23	38	-	36	44	45	30	32
2009 ^b	38	29	35	45	-	31	44	54	33	32
2010 ^c	53	29	34	42	-	43	32	54	49	52
2011 ^d	55	30	33	47	-	45	34	50	48	51
2012 ^d	54	33	31	45	-	36	34	53	47	51
Economic Performance										
2008 ^a	38	20	23	39	-	28	31	35	32	25
2009 ^b	26	25	48	33	-	36	39	32	34	21
2010 ^c	46	29	52	40	-	57	24	47	54	42
2011 ^d	48	34	51	44	-	53	31	49	57	43
2012 ^d	49	29	38	35	-	46	30	52	55	43
Government Efficiency										
2008 ^a	29	33	10	47	-	36	49	48	31	43
2009 ^b	28	31	22	50	-	25	44	49	34	38
2010 ^c	32	33	24	51	-	34	36	50	41	53
2011 ^d	41	28	20	52	-	47	35	49	42	53
2012 ^e	44	30	24	51	-	37	36	52	43	53
Business Efficiency										
2008 ^a	48	34	28	45	-	41	50	47	26	32
2009 ^b	47	36	41	52	-	35	50	56	26	39
2010 ^c	56	40	36	47	-	41	38	49	43	57
2011 ^d	57	35	32	50	-	45	41	49	42	56
2012 ^d	59	41	38	49	-	36	39	52	43	57
Infrastructure										
2008 ^a	41	24	26	27	-	32	37	43	36	29
2009 ^b	43	25	28	33	-	29	39	53	37	27
2010 ^c	48	26	27	35	-	30	36	43	40	34
2011 ^d	53	29	33	35	-	36	34	42	41	31
2012 ^d	52	30	32	35	-	31	36	50	39	33

^a out of 55 countries analyzed; ^b out of 57 countries analyzed; ^c out of 58 countries analyzed; ^d out of 59 countries analyzed.

Source: IMD (selected editions).

In the WEF competitiveness rankings, the countries of Central and Eastern Europe have not ranked high, either. It was mostly the ability to invent and to innovate that received a relatively poor assessment. Poland was definitely outdistanced in the rankings by such countries as the Czech Republic, Estonia and Slovenia.

Table 2. Positions of the EU-10 countries in World Economic Forum rankings (in terms of overall competitiveness and selected criteria) from 2008 to 2012

		Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Overall index	2008 ^a	76	33	32	62	54	44	53	68	46	42
	2009 ^b	76	31	35	58	68	53	46	64	47	37
	2010 ^c	71	36	33	52	70	47	39	67	60	45
	2011 ^d	74	38	33	48	64	44	41	77	69	57
	2012 ^e	62	39	34	60	55	45	41	78	71	56
Basic requirements	2008 ^a	82	45	30	64	55	46	70	87	52	38
	2009 ^b	80	45	34	58	60	47	71	86	54	29
	2010 ^c	72	44	25	59	61	52	56	77	53	34
	2011 ^d	74	45	27	55	66	49	56	89	60	39
	2012 ^e	65	44	26	55	54	49	61	90	62	39
Efficiency enhancers	2008 ^a	65	26	26	48	47	43	41	54	32	37
	2009 ^b	62	24	27	45	51	47	31	49	34	37
	2010 ^c	65	28	34	41	63	49	30	54	37	46
	2011 ^d	59	29	36	42	54	48	30	62	44	51
	2012 ^e	59	34	31	52	48	46	28	64	51	55
Higher education and training	2008 ^a	61	25	19	40	33	26	34	52	45	22
	2009 ^b	60	24	21	35	34	30	27	52	47	19
	2010 ^c	67	24	22	34	35	25	26	54	53	21
	2011 ^d	70	30	23	45	34	26	31	55	53	21
	2012 ^e	63	38	25	49	42	26	36	59	54	23
Technological readiness	2008 ^a	53	33	17	40	41	38	46	48	36	30
	2009 ^b	56	30	16	40	47	36	48	58	33	32
	2010 ^c	48	32	24	37	51	33	47	58	34	35
	2011 ^d	50	31	27	36	46	34	48	60	37	32
	2012 ^e	52	31	25	49	38	33	42	59	45	34
Innovation and sophistication factors	2008 ^a	92	25	40	55	84	49	61	75	53	33
	2009 ^b	89	26	42	61	86	53	46	75	57	30
	2010 ^c	95	30	45	51	77	48	36	91	63	35
	2011 ^d	96	32	37	52	64	50	57	99	71	45
	2012 ^e	97	32	33	58	68	47	61	106	74	36
Innovation	2008 ^a	96	25	31	45	93	55	64	69	58	33
	2009 ^b	91	25	37	45	88	58	52	70	68	29
	2010 ^c	92	27	37	41	77	51	54	87	85	34
	2011 ^d	93	33	30	34	59	48	58	95	96	40
	2012 ^e	92	34	30	37	64	43	63	102	89	32

^a out of 134 countries analyzed, ^b out of 133 countries analyzed, ^c out of 139 countries analyzed, ^d out of 142 countries analyzed, ^e out of 144 countries analyzed.

Source: WEF (selected editions).

The EU-10 countries are building international competitive capacities of their economies at various stages of economic development. However, while the Czech Republic and Slovenia have already entered the stage of building and developing the so-called innovation-driven economy (where fundamental importance is attached to developing the residents' ability to invent and innovate by means of education and development of international business ties), the remaining countries (especially Bulgaria and Romania) are still at the stage of building efficiency-driven economy (where fundamental importance is attached to the striving for the improvement of economic efficiency by increasing the productivity of the factors of production used, especially by perfecting the quality of human resources, improving the functioning of the markets and advancing the level of technology).

An important factor determining a country's opportunities for economic development and for improving its competitiveness is the so-called degree of economic freedom. The easier it is to achieve and sustain a higher competitive position relative to other countries, the higher the degree of economic freedom. Overall economic freedom is measured with a model consisting of ten components³ scored on a scale from 0 to 100%. When calculating the overall index, these components are treated as equally significant.

In the light of the Heritage Foundation rankings, Poland's international competitiveness measured according to the Index of Economic Freedom (IEF) has not been particularly elevated, especially when compared to other EU-10 countries. In 2008, the IEF for Poland and Slovenia was the lowest among the analyzed countries, barely exceeding 60%, which put Poland in the group of economies of rather limited economic freedom. The rest of the EU-10 countries had a higher IEF and could be thus classified as countries of medium economic freedom. As the 2013 ranking shows, the IEF exceeded 60% in almost all the EU-10 countries, and in the case of Estonia and Lithuania it was even over 72%. Nevertheless, there were still some problems with property rights protection in the countries of Central and Eastern Europe (especially in Bulgaria, Romania, Latvia and Slovakia) and the corruption index was relatively high.

Another method for measuring the competitiveness of economies is the KAM (Knowledge Assessment Methodology). It has been developed by the World Bank Institute experts within the Knowledge for Development Program in order to analyze the possibilities for the transformation of individual countries towards knowledge-based economy. The method assumes that the opportunity to use and create knowledge in a given country is the key driving force for its long-term growth and development. The method's main objective is to facilitate the identification of problems

³These are the following: freedom of business activity, the extent of trade liberalization, fiscal burden, government intervention, monetary policy, foreign investment, banking and finance, property rights, freedom from corruption, labour rights. See Heritage Foundation (<http://www.heritage.org>).

and opportunities already present in the area of technological advancement. Using this method makes it possible to determine the right directions for economic policy and investment measures that would facilitate the future development of knowledge-based economy.

Table 3. The Index of Economic Freedom for the EU-10 countries from 2008 to 2013

	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Overall score										
2008	63.7	68.1	77.9	67.6	68.3	70.9	60.3	61.7	70.0	60.2
2009	64.6	69.4	76.4	66.8	66.6	70.0	60.3	63.2	69.4	62.9
2010	62.3	69.8	74.7	66.1	66.2	70.3	63.2	64.2	69.7	64.7
2011	64.9	70.4	75.2	66.6	65.8	71.3	64.1	64.7	69.5	64.6
2012	64.7	69.9	73.2	67.1	65.2	71.5	64.2	64.4	67.0	62.9
2013	65.0	70.9	75.3	67.3	66.5	72.1	66.0	65.1	68.7	61.7
Property Rights										
2008	30	70	90	70	55	50	50	30	50	50
2009	30	70	90	70	55	50	50	35	50	60
2010	30	65	80	65	55	55	55	40	55	60
2011	30	65	80	65	50	60	60	40	50	60
2012	30	70	80	70	50	60	60	40	50	60
2013	30	70	85	65	50	60	60	40	50	60
Freedom from corruption										
2008	40	48	67	52	47	48	37	31	47	64
2009	41	52	65	53	48	48	42	37	49	66
2010	36	52	66	51	50	16	46	38	50	67
2011	38	49	66	51	45	49	50	38	45	66
2012	36	46	65	47	43	50	53	37	43	64
2013	33	44	64	46	42	48	55	36	40	59

Source: Heritage Foundation, <http://www.heritage.org/index> [accessed 5 April 2013].

According to the World Bank experts, beside the degree of economic freedom, the primary determinants of technological advancement of a given country include: an effective innovation system (the capacity of companies, research centers, universities and other institutions to create scientific and technological knowledge and implement it in practice), the education level and resources of skilled human capital (able to create and adapt technological knowledge) and state-of-the-art ICT infrastructure (various tools facilitating the transfer and processing of the created or imported scientific

and technological knowledge). These factors are taken into account when constructing the so-called Knowledge Economy Index – KEI⁴. The value of the KEI ranges from 0 to 10, with higher values indicating a more advanced knowledge-based economy.

Table 4. The Knowledge Economy Index for the EU-10 countries in 2008 and 2012

	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia	
Score KEI	2008	6.72	7.92	8.3	7.88	7.61	7.7	7.52	6.18	7.44	8.27
	2012	6.8	8.14	8.4	8.02	7.41	7.8	7.41	6.82	7.64	8.01
Economic Incentive and Institutional Regime	2008	7.01	7.77	8.68	8.39	8.04	7.94	7.39	6.87	7.93	8.11
	2012	7.35	8.53	8.81	8.28	8.21	8.15	8.01	7.39	8.17	8.31
Innovation System	2008	6.42	7.59	7.48	8.13	6.38	6.58	6.91	5.65	6.85	8.31
	2012	6.94	7.9	7.75	8.15	6.56	6.82	7.16	6.14	7.3	8.5
Education and Human Resources	2008	7.37	8.1	8.46	7.82	8.51	8.42	8.82	7.21	7.21	8.26
	2012	6.25	8.15	8.6	8.42	7.73	8.64	7.76	7.55	7.42	7.42
ICT	2008	6.07	8.29	8.57	7.15	7.52	7.87	7.52	6.16	7.7	8.42
	2012	6.66	7.96	8.44	7.23	7.16	7.59	6.7	6.19	7.68	7.8

Source: World Bank, <http://info.worldbank.org/etools/kam2> [accessed 10 April 2013]

In the analyzed period, the EU-10 countries improved or retained their position in the area of building knowledge-based economy. The indices for innovation, education and scientific and technological infrastructure have improved, which indicates positive trends as to the possibilities of absorbing more and more advanced technological solutions.

In recent years, Poland has noted a visible progress in the process of developing the basics of knowledge-based national economy. Nevertheless, as far as the advancement

⁴ KEI takes into account 12 variables grouped in four dimensions: economic incentive and institutional regime (tariff & nontariff barriers, regulatory quality, rule of law), innovation system (royalty and license fees payments and receipts, patent applications granted by the US Patent and Trademark Office, scientific and technical journal articles), education and human resources (average years of schooling, secondary enrollment, tertiary enrollment) and information and communication technology – ICT (telephones per 1,000 people; computers per 1,000 people; internet users per 10,000 people).

of this process is concerned, Poland still cannot match not only the countries that are highly developed economically (e.g. Germany) but also other countries of Central and Eastern Europe, especially Slovenia and Estonia, which have joined the group of producers and exporters of cutting-edge technological solutions (the so-called innovation followers). This is confirmed by the results of *Innovation Union Scoreboard 2011*, a report drawn up by the Maastricht Economic and Social Research Institute on Innovation and Technology under the PRO INNO Europe Initiative⁵.

Table 5. The Summary Innovation Index (SII*) in the EU-10 countries from 2007 to 2012

Year	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
2007	0.173	0.397	0.395	0.314	0.191	0.265	0.284	0.226	0.295	0.431
2008	0.192	0.404	0.410	0.316	0.205	0.272	0.293	0.242	0.309	0.454
2009	0.205	0.386	0.476	0.320	0.215	0.242	0.292	0.265	0.307	0.485
2010	0.216	0.400	0.492	0.333	0.213	0.258	0.304	0.259	0.322	0.499
2011	0.239	0.436	0.496	0.352	0.230	0.255	0.296	0.263	0.305	0.521
2012	0.188	0.402	0.500	0.323	0.225	0.280	0.270	0.221	0.337	0.508

* the SII value ranges from 0 to 1, with higher index value indicating a higher level of a country's innovativeness.

Source: IUS (2012, p. 70; 2013, p. 73).

According to the *Innovations Union Scoreboard 2013 report*, Poland belongs to the group of moderate innovators. Bulgaria, Lithuania, Latvia and Romania come at the end of the list and are described by the authors of the report as modest innovators, or countries who are catching up.

International competitive capacity of the EU-10 countries

The EU-10 is a group of countries that differ in terms of area, population or GDP creation structure. Poland undoubtedly has the greatest economic potential among them. It is, however, no match for most of them in terms of GDP per capita.

⁵ Summary Innovation Index (SII) distinguishes between 3 main types of indicators and 8 innovation dimensions, capturing in total 25 different indicators: Enablers (capture the main drivers of innovation performance external to the firm and cover 3 innovation dimensions: 'Human resources', 'Open, excellent and attractive research systems' as well as 'Finance and support'), Firm activities (capture the innovation efforts at the level of the firm, grouped in 3 innovation dimensions: 'Firm investments', 'Linkages & entrepreneurship' and 'Intellectual assets'), Outputs (cover the effects of firms' innovation activities in 2 innovation dimensions: 'Innovators' and 'Economic effects'). See: IUS (2012, p. 6).

Table 6. The area, population, GDP per capita and the structure of economy according to added value of the EU-10 countries in 2010

	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Area (thousands km ²)	110.9	78.9	45.2	93	64.6	65.3	312.7	238.4	49	20.3
Population (millions)	7.6	10.5	1.3	10	2.2	3.3	38.2	21.5	5.4	2
GDP per capita (thousands of euro)	4.8	14.2	10.7	9.7	8.6	8.4	9.3	5.8	12	17.3
Economy structure (in % in 2009)										
Agriculture	4.8	1.9	2.8	3.4	3.8	2.8	3.6	7.2	3.1	2.4
Industry	22.1	30.2	19.8	24.6	15.8	21.3	24.6	26.8	25	23.1
Services	73	67.9	77.4	71.6	80.4	75.9	71.8	66.1	71.9	74.5

Source: Eurostat data, <http://epp.eurostat.ec.europa.eu> [accessed 10 April 2013].

In the period analyzed, the EU-10 countries differed also in terms of the extent of participation in the international division of labour. This concerned their engagement in the international exchange of both goods and services.

In the analyzed period, the EU-10 countries' share in global trading of goods and services was scarce, despite a clearly visible growth tendency. In 2000 these countries' total share in global exports of goods was about 2%, rising to about 4% by the end of 2012. Their share in global imports of goods was running at a similar level. It is worth adding that as much as half of this trading was generated by two of the analyzed countries, namely Poland and the Czech Republic.

There is no doubt that the process of integration of Central and Eastern European countries with the European Union has had a positive effect on the development of their foreign trade. It should be noted, however, that in the analyzed period in Poland and other EU-10 countries (except for the Czech Republic) the exports to imports ratio in the trading of goods was below 100%, which meant they had a disadvantageous competitive position in this trading. In some of the countries, though, surpluses in foreign trading of services played an important role in the process of toning down the trade balance deficit (e.g. in Latvia, Slovenia and Estonia).

From the perspective of shaping the countries' competitiveness, and their technological competitiveness in particular, an adequate export structure is of great importance, especially the significance of processed goods in this structure, with particular emphasis on goods that are technologically intensive.

Table 7. The participation of the EU-10 countries in the global trading of goods and services in selected years between 2000 and 2012

	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Share in global exports of goods										
2000	0.07	0.45	0.06	0.44	0.03	0.06	0.49	0.16	0.18	0.14
2005	0.11	0.74	0.07	0.60	0.05	0.11	0.85	0.26	0.30	0.18
2008	0.14	0.91	0.07	0.67	0.06	0.15	1.06	0.31	0.44	0.21
2011	0.15	0.90	0.09	0.61	0.07	0.15	1.03	0.34	0.44	0.19
2012	0.15	0.85	0.09	0.57	0.08	0.16	1.00	0.32	0.44	0.18
Share in global imports of goods										
2000	0.10	0.48	0.07	0.48	0.05	0.08	0.73	0.19	0.19	0.15
2005	0.17	0.70	0.09	0.61	0.08	0.14	0.94	0.37	0.19	0.19
2008	0.22	0.86	0.10	0.66	0.10	0.19	1.26	0.51	0.45	0.22
2011	0.17	0.82	0.09	0.56	0.09	0.17	1.13	0.41	0.42	0.19
2012	0.18	0.76	0.10	0.51	0.09	0.17	1.06	0.38	0.42	0.17
Share in global exports of services										
2000	0.14	0.45	0.10	0.39	0.08	0.07	0.70	0.12	0.15	0.13
2005	0.18	0.47	0.13	0.51	0.09	0.12	0.65	0.20	0.17	0.16
2008	0.20	0.57	0.13	0.52	0.12	0.12	0.92	0.33	0.22	0.19
2011	0.18	0.53	0.13	0.51	0.10	0.12	0.88	0.25	0.16	0.17
2012	0.16	0.50	0.12	0.45	0.10	0.13	0.87	0.22	0.16	0.15
Share in global imports of services										
2000	0.11	0.37	0.06	0.32	0.05	0.04	0.61	0.13	0.12	0.10
2005	0.14	0.43	0.09	0.47	0.06	0.08	0.65	0.23	0.17	0.12
2008	0.16	0.48	0.09	0.49	0.09	0.11	0.83	0.33	0.25	0.14
2011	0.11	0.47	0.09	0.44	0.07	0.09	0.77	0.28	0.18	0.12
2012	0.10	0.47	0.09	0.38	0.06	0.10	0.77	0.21	0.16	0.10

Source: WTO data, <http://stat.wto.org> [accessed 11 April 2013] and the author's own calculations.

The Czech Republic and Hungary, and to a lesser extent Slovakia, Slovenia and Poland, have so far based their exports expansion mostly on exporting processed industrial goods, especially machines and transportation equipment. This was due to the reallocation of manufacturing from Western Europe to relatively less economically developed countries, a practice known as offshoring and outsourcing. This largely concerned the manufacturing of parts, units and sub-assemblies for automotive and machine industry. In some countries, such as Hungary and Slovakia, the effect was a considerable share of technologically intensive products in exports.

Table 8. The share of selected groups of goods in the exports of the EU-10 countries in selected years between 2000 and 2011

	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Share of ICT products in exports										
2000	0.8	4.6	25.3	25.7	0.9	4.8	4.1	5	3.3	1.9
2005	1.5	11.1	17	25.6	2.0	5.3	4.0	2.2	9.4	1.3
2008	2.2	14.1	5.4	22.7	4.6	3.0	7.0	4.5	16.9	2.1
2010	2.5	15	7.9	25.6	5.8	2.7	9.5	8.4	19.3	2.2
2011	2.1	16.4	12.7	22.8	4.7	2.3	7.2	8.3	15.8	3.4
Share of chemicals (SITC 5) in exports										
2000	10.0	7.1	3.3	6.5	6.4	8.4	6.8	5.8	7.6	11.0
2005	7.6	6.0	5.1	7.3	6.3	8.7	6.8	5.7	5.7	12.4
2008	8.0	6.0	6.3	8.3	9.2	13.7	7.8	6.1	4.7	13.4
2010	7.9	5.8	5.0	9.5	9.2	13.0	8.3	5.8	4.7	17.8
2011	8.3	6.3	5.9	10.8	7.8	13.0	9.1	6.8	4.8	16.1
Share of machines and transportation equipment (SITC 7) in exports										
2000	9.6	44.4	33.2	59.1	7.1	15.5	34.2	18.9	39.3	35.9
2005	14.3	50.6	35.1	58.7	13.1	20.5	39.1	25.4	44.1	39.0
2008	15.5	53.8	29.5	60.2	21.3	19.0	41.4	35.9	53.9	41.2
2010	16.8	50.2	26.3	60.7	21.3	18.0	40.5	42.3	55.0	48.3
2011	17.8	56.4	33.6	61.7	19.2	16.9	39.8	44.6	51.7	40.7

Source: WTO data, <http://stat.wto.org> [accessed 11 April 2013] and the author's own calculations.

The significance of Poland as an exporter of processed and technologically advanced products, as compared to other EU-10 countries, was not particularly crucial in the analyzed period. The situation was slightly different when it comes to the direct export of technological knowledge through the exportation of production capital that is accompanied by the export of this knowledge, to a larger or smaller degree. Although the share of the EU-10 countries in the global flows of capital in the form of foreign direct investment (FDI) has been relatively small, in Poland these flows were still the most intense in the region.

Since the early 1990s, the situation of Poland has been disadvantageous as compared to other new EU member states with respect to the size of the acquired FDI per capita. In 2011, the value of the accumulated size of FDI acquired by Poland per capita was only about 4,500 USD, which was tantamount to ranking towards the bot-

tom of the list of all the analyzed countries (above Romania and Lithuania). Much better results were achieved by Estonia (about 13,700 USD), the Czech Republic (about 8,700 USD) and Hungary (about 7,600 USD).

Table 9. The EU-10 countries' share of global flows in the form of FDI in the selected years between 2000 and 2011 (in %)

	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Inward FDI										
2000	0.07	0.36	0.03	0.20	0.03	0.03	0.67	0.08	0.14	0.01
2005	0.40	1.19	0.29	0.79	0.07	0.10	1.05	0.66	0.25	0.06
2008	0.55	0.36	0.10	0.35	0.07	0.11	0.83	0.78	0.26	0.11
2010	0.12	0.47	0.12	0.17	0.03	0.06	0.68	0.22	0.04	0.03
2011	0.12	0.35	0.02	0.31	0.10	0.08	0.99	0.18	0.14	0.07
Outward FDI										
2000	0.00	0.00	0.01	0.05	0.00	0.00	0.00	0.00	0.00	0.01
2005	0.03	0.00	0.08	0.25	0.01	0.04	0.39	0.00	0.02	0.07
2008	0.04	0.22	0.06	0.11	0.01	0.02	0.22	0.01	0.03	0.07
2010	0.02	0.08	0.01	0.09	0.00	0.01	0.38	0.00	0.02	-0.01
2011	0.01	0.07	-0.09	0.27	0.01	0.01	0.35	0.00	0.03	0.01

Source: UNCTADstat data, <http://unctadstat.unctad.org> [accessed 11 April 2013].

In the analyzed period, the share of global capital flows as well as the size of capital resources given out by Poland and other countries of the region in the form of outward FDI was much smaller than the size of the acquired resources. In 2011, the accumulated value of outgoing flows per capita was about 1,000 USD in Poland, while it amounted to about 4,600 USD in Estonia, 3,200 USD in Slovenia and 2,500 USD in Hungary.

All the EU-10 countries are undoubtedly still at the stage of building knowledge-based economy, with Hungary, the Czech Republic, Estonia and Slovenia being the most advanced, as can be confirmed by the share of research and development spending in the GDP, which has been consistently growing in these countries.

The EU-10 countries saw a slow but gradual increase of involvement in creating technological knowledge and in the process of internationalization of scientific research and the related transfer of disembodied technology. The transfer of technology in such a form was largely associated with big transnational corporations and their policy of using and acquiring Polish scientific and engineering solutions.

Table 10. Research and development (R+D) spending as a GDP percentage in the EU-10 countries in selected years between 2000 and 2011 (in %)

Year	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
2000	0.51	1.17	0.60	0.81	0.45	0.59	0.64	0.37	0.65	1.38
2005	0.46	1.35	0.93	0.94	0.56	0.75	0.57	0.41	0.51	1.44
2008	0.47	1.41	1.28	1.00	0.62	0.79	0.60	0.58	0.47	1.65
2010	0.60	1.56	1.62	1.16	0.60	0.79	0.74	0.47	0.63	2.11
2011	0.57	1.84	2.38	1.21	0.70	0.92	0.77	0.48	0.68	2.47

Source: Eurostat, <http://epp.eurostat.ec.europa.eu> [accessed 11 April 2013].

Between 2006 and 2010 the analyzed countries saw a consistent rise in the number of patents granted. Although according to the World Intellectual Property Organization (WIPO) technological advancement in the world is determined by scientists from three countries (United States, Japan and Germany), the role of scientists from the countries of Central and Eastern Europe, especially from the Czech Republic, Hungary, Poland and Slovenia, is becoming more significant by the year.

Table 11. The number of patents granted in the EU-10 countries between 2006 and 2011 according to the World Intellectual Property Organization

Year	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
2006	21	96	11	131	12	10	96	28	25	40
2007	29	129	29	161	21	13	102	29	38	86
2008	28	152	34	170	21	19	127	11	39	106
2009	25	178	30	141	24	22	173	12	34	137
2010	33	137	45	172	26	11	199	19	44	126
2011	28	148	35	140	17	25	235	26	59	125

Source: WIPO (selected editions).

From 2000 to 2008, in the EU-10 countries the percentage of domestic inventions remaining under the control of foreign companies was relatively high. For the large part, these inventions were „exported”, so to speak, to the home countries of the foreign investors. The rate of foreign ownership of domestic inventions remained at a relatively high level and was about 85% in 2008. Such a high value points to a big potential and high quality of human capital that is being more and more widely used by foreign entities, e.g. through outsourcing and offshoring transactions.

In the analyzed period, the control of companies from the EU-10 countries over foreign inventions was distinctly lower. The highest efficiency in using foreign technological and scientific solutions to create domestic inventions could be seen in Bulgaria, the Czech Republic, Hungary, Poland and Slovenia.

Table 12. Patents grants at the US Patent and Trademark Office (USPTO) in the EU-10 countries in selected years between 2000 and 2009*

	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Slovenia
Foreign ownership of domestic inventions										
2000	6	68	9	99	15	12	57	12	17	40
2005	51	78	7	76	10	12	73	27	20	26
2008	5	77	5	25	2	6	38	39	7	3
2009	4	30	4	18	0	2	16	13	3	2
Domestic ownership of inventions made abroad										
2000	7	21	1	41	2	2	12	2	5	19
2005	14	17	3	21	3	3	31	3	7	23
2008	1	14	2	1	1	2	11	2	2	2
2009	0	3	1	0	0	2	2	1	0	0

* no data for 2010-2012.

Source: OECD data, <http://stats.oecd.org/> [accessed 11 April 2013].

Conclusions

The EU-10 is a diverse group of countries, with differences determined by numerous factors, both economic (structural, technological and resulting from current economic situation) and non-economic (political, institutional and instrumental). It is worthwhile, however, to compare the experiences of these countries, since they can serve as inspiration for searching solutions contributing to the enhancement of international competitiveness of national economies, including that of Poland.

The EU-10 countries do not rank high in various competitiveness rankings prepared by international research centers. However, their competitive position has been improving by the year. It is noted that adequate processes of international competitiveness development proceed more slowly in Poland than in other countries of the region (e.g. Estonia, Slovenia or Czech Republic). This is also – or perhaps above all – true for technological development and broadly defined innovation.

The share of the EU-10 countries in global trading of goods and services is slight, and as a result the benefits they derive from this trade are relatively small, disproportionately low compared to these countries' potential and resources, e.g. of human capital. Inflowing production capital in the form of FDI has been allocated to the sectors of technologically advanced goods and services production for just a few years, but the share of technologically intensive products in manufacturing and exports of most of these countries is still unsatisfactory.

Competitive capacity of the EU-10 countries in terms of innovativeness of their national economies remains at a relatively low level. Although the Czech Republic, Slovenia and Estonia can be considered leaders in this area, nevertheless, when compared to the countries of the European Union's core (such as Germany or Sweden), the technological gap can be plainly seen. Relatively low spending on research and development, scarce number of patents and inventions and the failure of businesses to cooperate with scientific research centers are just a few problems faced by the countries of the region.

Poland's ability to invent and innovate is at a relatively low level when compared to other European Union countries, including the countries of Eastern and Central Europe. It thus seems necessary to strengthen the suitable ties between the public and private sectors. Moreover, it is necessary to attach more significance to the protection of intellectual property and to increase the number of innovative business enterprises and other economic entities.

We can formulate also conclusion in form of hypothesis that main reasons of above mentioned state of innovativeness and international competitiveness is overregulation of the Polish and the most of analyzed economies and lack of good macroeconomic incentives for innovativeness. But it is task for following investigation which the authors will develop.

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