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Innovation Levels In The Economies Of Central And Eastern Europe

Abstract

When the countries of Central and Eastern Europe entered the European Union, they were given the opportunity to become transformed into knowledge-based societies, with modern, innovation-oriented economies which build their strength and competitiveness on the development of native technical solutions and concepts. To achieve this, however, requires a lot of effort and radical and profound changes in comparison with the previous situation. New priorities and strategic objectives and methods of their implementation (including innovation strategies) must be developed, financial and in-kind resources reallocated, and social and technical infrastructure must be expanded and modernized. These are difficult challenges, but their effective implementation is essential so that the CEECs can avoid marginalization and become equal partners within the EU.

The statistical data presented in this paper indicates that the innovative position of the CEECs is still unfavourable and relatively weak, with the exception of Slovenia and Estonia. Poland is in a particularly difficult situation, with many signs of stagnation with respect to innovation, keeping it at a low level (next to Bulgaria and Romania).

***Keywords**: innovation, competitiveness, Central and Eastern Europe, European Union*

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1. Introduction

On 1 May 2004, eight Central and Eastern European countries (CEECs) became members of the European Union - The Czech Republic, Estonia, Lithuania, Latvia, Poland, Slovakia, Slovenia, and Hungary. In 2007, the next two CEE countries joined the group: Bulgaria and Romania, and in 2013 Croatia. In this way, most of the countries of Central and Eastern Europe were incorporated into a community which is one of the main economic and civilization centres of the world, next to North America (the USA) and Far East Asia (Japan).

It is generally accepted that the success of a far-reaching integration process depends on whether countries in the group are characterized by:

- a similar level of economic development (measured primarily by GDP per capita),
- a similar level of labour productivity,
- a similar production structure, with high diversification,
- strong internal ties, expressed by the size and structure of exports, with a high share of intra-industry trade,
- a similar demand structure and a high proportion of highly technical exclusive products.

Although between 2004 and 2012 the differences in the level of GDP per capita in relation to the EU average were generally declining, they still remain relatively high (with the exception of Slovenia). In Bulgaria the GDP per capita was 35% of the EU average in 2004, and 47% in 2012; in Romania, 34% and 50% respectively; in Latvia 47% and 64%; in Hungary 63% and 67%; in Poland 51% and 67%; in Estonia 58% and 71%; in Lithuania 52% and 72%; in Slovakia 57% and 76%; in the Czech Republic 78% and 81%; and in Slovenia 87% and 84% (based on Eurostat).

Similar relationships exist with respect to labour productivity. The level of exports is still low. The structure of demand is characterized by a large share of goods of a basic nature, minimally processed and of a low technical level. The production structure is characterized by a large share of traditional and declining sectors. The degree of diversification of production and exports looks slightly better. It should be noted, however, that there are significant differences within the CEEC group. Slovenia has a different situation and Bulgaria and Romania have other problems (Weresa 2013, 2013 b, Baczko 2013).

However, when trying to identify the characteristic structural features of the CEEC economies, the following characteristics must be noted above all:

A large share of employment in agriculture. This share is exceptionally high in Poland (14.4% in 2011), high in Lithuania (9.3%), Latvia (9%), Estonia (8.7%), Hungary (8.1%), and Romania (8.0%). The share of agriculture is very

low only in Slovenia (0.6%). The typical share of agriculture in the countries of the "old" EU ranges from 1-3%, although there are exceptions, such as Portugal (10.1%) and Greece (9.2%) (Statistical Yearbook of the Republic of Poland, 2013, pp. 818 -819).

The low share of the services sector in GDP. All CEECs rank last in the EU. Poland (63.6%) is ahead only of Romania, the Czech Republic, and Slovakia (Statistical Yearbook of the Republic of Poland, 2013, p. 891). This part of the economy, which by its very nature is characterized by a limited mobility, is relatively small. This situation should encourage the creation and promotion of mechanisms aimed at establishing high competition in the services sectors.

A large share of the so-called declining (or problem) sectors. The countries of the "old" EU have already managed to dramatically reduce the role of declining sectors in the economy and shift to a more advanced technology and higher technological level. This was done with the help of generous state aid, consisting of:

- comprehensive support for the development and dissemination of indigenous technical ideas,
- large subsidies for declining sectors with shrinking demand, due to, e.g., the decline in consumer interest, harm to the environment, and too high costs. The subsidies were primarily aimed at reducing the production potential and restoring the ability to compete on the open market at a lower potential.

Such state-aid activities in the CEECs are not sufficiently widespread and their effectiveness is limited, although the remains of the old, inefficient structures acquired from the previous system still play a large role (e.g., energy based on coal in Poland).

A weak financial sector. This applies mainly to the key element of the sector - banking. Banks are relatively small and rank very low in the world or even in Europe in terms of the size of their capital. Owing to the underdeveloped competition, banks achieve a satisfactory income using traditional methods and instruments, which in the current crisis has produced some positive results, as it reduced the degree of destabilization of their banking systems.

Investment funds, trusts, venture capital, and insurance companies are still underdeveloped. The capital market is still small. Even the biggest securities exchanges in the region - in Warsaw, Prague, and Budapest - do not play a major role across the EU.

Low level of technical infrastructure. Technical infrastructure creates opportunities for the rapid movement of people and goods, and for communication. In most CEECs, (including Poland) infrastructure is still underdeveloped, and the process and pace of eliminating delays is inadequate. This does not create conditions conducive to innovative activity.

Most attention is focused on the construction of highways. According to Eurostat at the end of 2012 across the EU there were 69,300 km of highways, with the most in the following countries: Spain (14,701 km), Germany (12,879 km), and France (11,465 km). The leaders in this respect among the CEECs were Hungary (1,515 km), Poland (1,365 km), Croatia (1,254 km), Slovenia (769 km), and the Czech Republic (751 km). The CEEC countries had more than seven thousand kilometres of motorways, which accounted for about 10% of all motorways in the EU. In relation to the population and the area this is several times less than the EU average. In Poland, this adverse relationship will not improve in the near future. The government has announced a drastic decline in outlays for the construction of motorways.

The underdevelopment of air transport is even more noticeable. In 2012, there were 115,011 thousand air transport passengers in Great Britain, 110,576 thousand in Germany, and 60,158 thousand in France. During this time, the figures were 11,170 thousand in Hungary, 7,170 thousand in Poland, 3,914 thousand in Romania, and 3,595 thousand in the Czech Republic. In comparison to Poland, in 2012 Germany transported more than 15 times more passengers, France 8.5 times more, Spain almost 7 times more, and Portugal almost twice as many.

The real gap between the CEECs and the rest of the EU is the transport of goods by air (calculated in millions of tonne-kilometre or tkm). In 2012, for Germany it was 7,241 million of tkm, Great Britain 6,251 million, Netherlands 5,989 million, France 4,554 million, while in Poland it was only 123 million of tkm. And Poland was the only CEE country in which the goods transported by airplanes had some (albeit minor) importance, because it was followed by the Czech Republic, with only 11.1 million tkm, and Romania with 5.6 million tkm (in comparison to the leaders Romania had hundreds of times less) (Statistical Yearbook of the Republic of Poland 2013, p. 869).

The growth of the Internet in the CEECs is more successful. The CEECs still prevail in the group of countries with a low number of Internet users per 1000 inhabitants, but right next to them are Italy, Greece, Portugal, and Cyprus. It is worse with respect to subscribers of fixed broadband Internet access. The CEE countries rank last, with only Estonia, Slovenia and Hungary having a slightly better, but well below average, position (Statistical Yearbook of the Republic of Poland, 2013, p 872).

2. Measuring innovation

When examining the success of the CEECs during their systemic transformation, it is primarily their quantitative dimensions that are recognized: a generally high rate of growth for GDP, exports, and labour productivity. It should be recognized that even if these quantitative successes continue, it will not ensure the access of the group to the category of the most developed EU countries. In order to achieve this, qualitative successes are needed, resulting from highly-skilled workers, their creative activity, and innovation in the economy.

Only an economy based on knowledge and the type of truly original innovation which is sought after in the market creates attractive jobs with good prospects for career development and high income (wages), together with satisfactory profits for entrepreneurs (owners). This is the right path to take to increase the long-term competitiveness of a country's economy.

It is understandable that in the early stages of economic transformation emphasis was put on qualitative successes and increasing the level of modernity through innovation replacement (transferring solutions already known and used somewhere). After a long period of drastic shortages and primitive consumption, the public in the CEECs waited eagerly for a rapid and tangible improvement in their living conditions In this situation, any increase in supply and/or improvement in quality was a noticeable improvement. But these priorities, which were justifiable several years ago, need to be reviewed and adapted to the changing times. This is also necessary because in many economies (especially the most advanced) such verification processes and such changes take place intensively. Today, the major test for the CEECs (including Poland) for real, effective economic integration into the EU is their ability to radically shift their economies onto innovation, based on the creative activity of their own labour resources and creative solutions using native inventions. Only a full launch of such internal driving forces can put an end to the division of countries into better and worse, high speed and low speed, core and periphery, etc.

The illusory nature of assessments based on selective data (and superficially treated quantitative criteria) can best be seen in the example of Belarus. For nearly 20 years, Belarus has maintained the highest rate of GDP growth (during the last crisis it was a 'green island' too), has one of the highest growth rates in labour productivity, and a very low unemployment rate. It is also the leading European country in terms of number of students, hospital beds, and doctors per capita in the population. And none of the CEE countries has as many subscribers of fixed broadband internet connection per 1000 inhabitants as Belarus (2012) (Statistical Yearbook of the Republic of Poland 2013, p. 872). But are these successes enough to treat this country as a model worthy of emulation?

I assume in this article that in order to obtain a correct picture of innovation two parallel types of measurements should be used. One involves synthetic measures comprehensively covering all the important aspects that make up innovation, and the second approach boils down to a more detailed description of selected aspects of innovation of particular importance for the course of a particular analysed phenomena.

The fullest picture of innovation activity in the EU countries in the synthetic approach is provided by the reports prepared by the European Commission agencies. Particularly useful is the 'Innovation Union Scoreboard (IUS) 2013', containing information relating to the years 2008 to 2012, and the 'European Innovation Scoreboard, 2008: Comparative analysis of innovation performance', which includes information from the years 2004 to 2008.

It should be noted that results for 2008 are contained in both reports. They are not identical however, because the indicators used to calculate the Summary Innovation Index (SII) for the years 2008-2012 are a bit different than the ones used in the calculations for the years 2004 to 2008.

SII for the years 2008-2012 contains three main types of indicators (Enablers, Firm activities, and Outputs) and eight innovation dimensions, in total encompassing 24 indicators. The full list is presented in Table 1 below.

Table 1. Innovation Union Scoreboard indicators

Main type / innovation dimension / indicator
ENABLERS
Human resources
1.1.1 New doctorate graduates (ISCED 6) per 1000 inhabitants aged 25-34
1.1.2 Percentage of population aged 30-34 having completed tertiary education
1.1.3 Percentage of youth aged 20-24 having attained at least upper secondary level education
Open, excellent and attractive research systems
1.2.1 International scientific co-publications per million inhabitants
1.2.2 Scientific publications among the top 10% most cited publications worldwide, as a % of the total scientific publications of the country
1.2.3 Non-EU doctorate students as a % of all doctorate students
Finance and support
1.3.1 R&D expenditure in the public sector as % of GDP
1.3.2 Venture capital investment as % of GDP
FIRM ACTIVITIES
Firm investments
2.1.1 R&D expenditure in the business sector as % of GDP
2.1.2 Non-R&D innovation expenditures as % of turnover

Linkages & entrepreneurship
2.2.1 SMEs innovating in-house as % of SMEs
2.2.2 Innovative SMEs collaborating with others as % of SMEs
2.2.3 Public-private co-publications per million inhabitants

Intellectual assets
2.3.1 PCT patents applications per bln GDP (in PPS€)
2.3.2 PCT patent applications in societal challenges per bln GDP (in PPS€) (environment-related technologies; health)
2.3.3 Community trademarks per bln GDP (in PPS€)
2.3.4 Community designs per bln GDP (in PPS€)
OUTPUTS
Innovators
3.1.1 SMEs introducing product or process innovations as % of SMEs
3.1.2 SMEs introducing marketing or organisational innovations as a % of SMEs
3.1.3 High-growth innovative firms
Economic effects
3.2.1 Employment in knowledge-intensive activities (manufacturing and services) as a % of total employment
3.2.2 Contribution of medium and high-tech product exports to the trade balance
3.2.3 Knowledge-intensive services exports as a % of total service exports
3.2.4 Sales of new to market and new to firm innovations as a % of turnover
3.2.5 License and patent revenues from abroad as a % of GDP

Source: Innovation Union Scoreboard, 2013, p. 9.

The SIIs for the years 2008-2012, calculated on the basis of these data, are listed in Table 2. In addition to the members of the EU other European countries are presented: Switzerland, Norway, Iceland, Macedonia, Serbia, and Turkey. This provides a more comprehensive view of innovation in the region. The exceptionally strong position of Switzerland, with a significantly higher SII than all the countries surveyed, draws particular attention.

Table 2. Summary Innovation Index (SII) time series

	2008	2009	2010	2011	2012	Growth rate
EU-27	0.504	0.516	0.532	0.531	0.544	1.62%
BE	0.594	0.596	0.606	0.612	0.624	1.15%
BG	0.187	0.198	0.231	0.234	0.188	0.60%
CZ	0.365	0.371	0.408	0.413	0.402	2.57%
DK	0.643	0.660	0.698	0.696	0.718	2.67%
DE	0.677	0.694	0.710	0.705	0.720	1.75%
EE	0.415	0.458	0.460	0.484	0.500	7.09%
IE	0.549	0.567	0.544	0.587	0.597	0.66%
EL	0.364	0.338	0.362	0.334	0.340	-1.66%
ES	0.388	0.394	0.390	0.393	0.407	0.87%
FR	0.519	0.531	0.558	0.560	0.568	1.84%
IT	0.397	0.410	0.432	0.432	0.445	2.71%
CY	0.493	0.465	0.494	0.513	0.505	-0.69%
LV	0.188	0.206	0.216	0.225	0.225	4.39%
LT	0.244	0.248	0.255	0.271	0.280	4.95%
LU	0.585	0.615	0.595	0.581	0.626	0.71%
HU	0.301	0.301	0.329	0.335	0.323	1.35%
MT	0.301	0.322	0.338	0.300	0.284	3.31%
NL	0.577	0.585	0.588	0.594	0.648	2.70%
AT	0.582	0.596	0.571	0.584	0.602	0.68%
PL	0.268	0.278	0.273	0.283	0.270	0.45%
PT	0.378	0.400	0.427	0.425	0.406	1.67%
RO	0.234	0.250	0.233	0.252	0.221	1.24%
SI	0.448	0.473	0.489	0.517	0.508	4.09%
SK	0.285	0.295	0.281	0.291	0.337	3.29%
FI	0.657	0.673	0.675	0.681	0.681	1.94%
SE	0.725	0.731	0.733	0.735	0.747	0.65%
UK	0.579	0.588	0.623	0.621	0.622	1.18%
HR	0.275	0.286	0.308	0.317	0.302	2.13%
TR	0.188	0.195	0.201	0.209	0.214	3.56%
IS	0.593	0.609	0.588	0.612	0.622	2.64%
NO	0.449	0.458	0.478	0.470	0.485	0.89%
CH	0.805	0.816	0.826	0.827	0.835	0.50%
RS	0.255	0.248	0.290	0.279	0.365	6.80%
MK	0.191	0.216	0.219	0.220	0.238	2.61%

Source: Innovation Union Scoreboard, 2013, p. 74.

For individual coefficients a grading scale from 0 to 1 was adopted, where 0 is the worst score and 1 the best.

The strong differentiation of SIIs within the EU enables one to distinguish four groups of countries, depending on the level of their SII: innovation leaders, innovation followers, moderate innovators, modest innovators. Twenty seven EU countries were included (excluding Croatia). This is demonstrated in Table 3.

The first group includes innovation leaders: Sweden, Germany, Denmark, and Finland. The performance of innovation leaders is 20% or more above that of the EU 27 average. Innovation followers are in the second group: the Netherlands, Luxembourg, Belgium, Great Britain, Austria, Ireland, France, Slovenia, Cyprus, and Estonia (total 10 countries). Note, that two post-socialist countries; Slovenia and Estonia are in this group. The SII for innovation followers ranges between 20% above and 10% below the EU-27 average. The third group, the moderate innovators, includes: Italy, Spain, Portugal, Czech Republic, Greece, Slovakia, Hungary, Malta, and Lithuania. Four post-socialist countries are in the group. The SII for moderate innovators is less than 10% above but no more than 50% below the EU-27 average. The fourth group (modest innovators), with SIIs more than 50% below the EU-27 average, is comprised of only four post-socialist countries: Poland, Latvia, Romania, and Bulgaria. These are the weakest countries in the EU in terms of innovation.

Between 2008 and 2012, in each of the four distinguished groups processes took place which changed the position of individual countries and their perspectives in the quest to achieve greater innovation and a better competitive position. The fastest rate of positive changes took place in the analysed period in the group of moderate innovators (2.1%), and the lowest rate in the last group, with the lowest innovation (1.7%). While the difference is not very large, it shows that the countries in the EU-27 with average innovation take more effective actions to improve their position than countries with the lowest innovation. This can perpetuate and deepen the process of marginalization of those countries already most vulnerable, including Poland.

It can be seen that each of the four groups has a leader (or in the case of ‘innovation followers’, two leaders) who achieved a much higher rate of positive changes than the others, which strengthens their position and offers the prospect of transition to the next higher group. In three groups post-socialist countries are such leaders: Estonia, Slovenia, Latvia, and Lithuania. These four countries achieved the highest rate of positive changes in the EU-27. In each of these groups there are also countries where progress occurs most slowly (or even negatively). In the group of slow growers this country is Poland, the only CEE country to achieve such a low rating.

Table 3. European innovation Scoreboard 2008 – SII time series

Group	Growth rate 2008-2012	Growth leaders	Moderate growers	Slow growers
Innovation leaders	1.8%	Denmark (2.7%)	Finland (1.9%) Germany (1.8%)	Sweden (0.6%)
Innovation followers	1.9%	Estonia (7.1%) Slovenia (4.1%)	Netherlands (2.7%) France (1.8%) United Kingdom (1.2%) Belgium (1.1%) Luxembourg (0.7%) Austria (0.7%) Ireland (0.7%)	Cyprus (-0.7%)
Moderate innovators	2.1%	Lithuania (5.0%)	Malta (3.3%) Slovakia (3.3%) Italy (2.7%) Czech Republic (2.6%) Portugal (1.7%) Hungary (1.4%) Spain (0.9%)	Greece (-1.7%)
Modest innovators	1.7%	Latvia (4.4%)	Romania (1.2%) Bulgaria (0.6%)	Poland (0.4%)

Average annual growth rates as calculated over a five-year period.

Source: Innovation Union Scoreboard, 2013, p. 12.

It can therefore be concluded that there is a differentiation of the position of individual countries within the CEECs. The most successful are Estonia and Slovenia, and changes are also the quickest in those countries. At the other extreme is Poland, where stagnation continues at a low level. Also alarmingly poor is the position of Romania and Bulgaria. In contrast, the achievements of Latvia create the prospect of transition upward, from the group of modest innovators to moderate innovators, in a few years. However, this means that only three countries would remain in the weakest group: Poland, Romania, and Bulgaria.

Table 4. Performance scores per dimension

	Human resources	Research systems	Finance and support	Firm investments	Linkages &entrepre-neurship	Intellectual assets	Innovators	Economic effects
EU-27	0.557	0.478	0.585	0.406	0.532	0.555	0.571	0.603
BE	0.644	0.737	0.527	0.417	0.809	0.534	0.722	0.585
BG	0.429	0.094	0.085	0.111	0.088	0.231	0.064	0.245
CZ	0.537	0.227	0.343	0.409	0.429	0.275	0.518	0.486
DK	0.605	0.800	0.729	0.569	0.831	0.828	0.632	0.671
DE	0.626	0.553	0.610	0.637	0.731	0.814	1.000	0.728
EE	0.565	0.289	0.760	0.594	0.604	0.483	0.606	0.409
IE	0.758	0.682	0.320	0.305	0.566	0.425	0.702	0.791
EL	0.506	0.294	0.151	0.220	0.485	0.122	0.676	0.347
ES	0.433	0.493	0.436	0.223	0.297	0.399	0.318	0.507
FR	0.669	0.664	0.631	0.347	0.498	0.516	0.532	0.611
IT	0.420	0.354	0.289	0.287	0.404	0.519	0.616	0.535
CY	0.577	0.378	0.198	0.479	0.731	0.427	0.494	0.543
LV	0.451	0.083	0.375	0.111	0.103	0.330	0.123	0.220
LT	0.645	0.144	0.563	0.396	0.229	0.128	0.227	0.214
LU	0.549	0.692	0.636	0.231	0.630	0.666	0.876	0.652

HU	0.452	0.169	0.271	0.244	0.217	0.250	0.131	0.590
MT	0.129	0.224	0.104	0.356	0.220	0.293	0.363	0.419
NL	0.648	0.864	0.720	0.339	0.753	0.649	0.621	0.603
AT	0.597	0.538	0.474	0.473	0.769	0.796	0.636	0.476
PL	0.550	0.094	0.383	0.319	0.094	0.271	0.078	0.324
PT	0.404	0.435	0.414	0.279	0.416	0.312	0.728	0.378
RO	0.421	0.087	0.218	0.137	0.083	0.101	0.124	0.433
SI	0.671	0.385	0.521	0.437	0.623	0.506	0.476	0.479
SK	0.746	0.116	0.302	0.210	0.301	0.155	0.289	0.470
FI	0.827	0.550	0.788	0.621	0.689	0.690	0.628	0.663
SE	0.900	0.775	0.829	0.659	0.802	0.767	0.693	0.612
UK	0.749	0.795	0.730	0.459	0.832	0.452	0.271	0.626

Source: Innovation Union Scoreboard, 2013, p. 75.

In Table 4 the innovation activity is shown in more detail. It is clear that some aspects of the innovation activity are particularly underdeveloped in most CEECs. This concerns, for example, research systems. The indicator for Poland, Romania, and Bulgaria is about 10 times lower than for the Netherlands (with 0.864). Only Slovenia (0.385) and Estonia (0.289) have some 'contact' with the leaders.

A similar diversity is seen in the 'innovators' dimension. Bulgaria's score is more than 15 times lower than Germany's, Poland's is 13 times lower, Latvia's, Romania's, and Hungary's are 8 times lower. Those in the most favourable situation - Estonia, the Czech Republic, and Slovenia - have indicators which reach about half that of Germany.

The smallest differences between the CEECs and the other EU countries relate to the dimension 'Human resources'. Slovakia (0.746), Lithuania (0.645) and Estonia (0.565) have coefficients exceeding the average level of the EU-27 (0.557) and Poland is very close thereto (0.550).

The information presented in Tables 2, 3, and 4 depicts the situation in recent years. The following two Tables contain information showing the state of affairs in the initial period after the accession of the CEECs to the EU. This makes it possible to evaluate the relative changes in the position of the CEECs in the EU in terms of innovative activity.

The SII values for the years 2004-2008 (Table 5) make it possible to distinguish four groups of countries with different innovative achievements (Table 6). The innovation leaders included countries with the highest SIIs, the innovation followers included other countries with SII above the EU-27 average, and the two remaining groups included countries for which the SII was below the EU-27 average (the 'catching up' countries achieved the lowest values of SII). Table 6 includes Switzerland, which does not belong to the EU but is the clear leader in innovation in Europe.

Table 5. European Innovation Scoreboard 2008 – SII time series

	2004	**2005**	**2006**	**2007**	**2008**
EU-27	0.429	0.431	0.447	0.466	0.475
BE	0.467	0.477	0.486	0.498	0.507
BG	0.172	0.174	0.178	0.206	0.221
CZ	0.344	0.346	0.368	0.392	0.404
DK	0.566	0.572	0.605	0.602	0.570
DE	0.538	0.543	0.548	0.569	0.581
EE	0.413	0.409	0.421	0.443	0.454
IE	0.486	0.504	0.513	0.528	0.533
GR	0.271	0.279	0.295	0.332	0.361

ES	0.329	0.344	0.352	0.359	0.366
FR	0.460	0.461	0.465	0.495	0.497
IT	0.314	0.320	0.343	0.361	0.354
CY	0.370	0.363	0.381	0.433	0.471
LV	0.194	0.204	0.215	0.239	0.239
LT	0.264	0.273	0.287	0.294	0.294
LU	0.486	0.486	0.513	0.497	0.524
HU	0.266	0.273	0.287	0.305	0.316
MT	0.274	0.280	0.292	0.315	0.329
NL	0.450	0.447	0.458	0.474	0.484
AT	0.480	0.494	0.509	0.523	0.534
PL	0.264	0.272	0.282	0.293	0.305
PT	0.290	0.317	0.337	0.340	0.364
RO	0.209	0.205	0.223	0.249	0.277
SI	0.388	0.393	0.412	0.429	0.446
SK	0.257	0.273	0.298	0.299	0.314
FI	0.551	0.546	0.541	0.585	0.610
SE	0.607	0.610	0.637	0.630	0.637
UK	0.522	0.534	0.550	0.556	0.547
HR	0.278	0.286	0.282	0.289	0.293
TR	0.192	0.196	0.202	0.206	0.205
IS	0.381	0.389	0.415	0.452	0.467
NO	0.358	0.370	0.371	0.375	0.380
CH	0.612	0.615	0.632	0.661	0.681

Source: Innovation Union Scoreboard, 2013, p. 58.

Upon joining the EU, the innovative position of the CEECs was very unfavourable. A clear majority of these countries were included in the group with the smallest achievements (Malta was their only ‘old EU’ partner in the group). Slovenia, Estonia, and the Czech Republic were evaluated slightly higher. Although part of the CEECs achieved a relatively high rate of positive changes, none of these countries reached the average SII level for the EU-27. It seems that it is still a distant prospect for Bulgaria, Romania, and Poland. In Bulgaria and Romania a significant acceleration took place only after joining the EU, and it was short-lived, while in Poland stagnation is still visible.

Table 6. Innovation growth leaders

Group	Growth rate	Growth leaders	Moderate growers	Slow growers
Innovation leaders	1.6%	Switzerland	Germany, Finland	Denmark, Sweden, United Kingdom
Innovation followers	2.0%	Ireland, Austria	Belgium	France, Luxembourg, Netherlands
Moderate innovators	3.6%	Cyprus, Portugal	Czech Republic, Estonia, Greece, Slovenia	Italy, Spain
Catching-up countries	4.1%	Bulgaria, Romania	Latvia, Hungary, Malta, Poland , Slovakia	Lithuania

Average annual growth rates as calculated over a five-year period.

Source: Innovation Union Scoreboard, 2013, p. 11.

3. Determinants of innovative activity in the CEECs

The determinants of innovation in an economy are generally well recognized. One should, however, take into account that in different countries, depending on their stage of development, experience, and dominant doctrines, the weight of each factor may vary.

In this article I assume that the following factors are the most important:

1. Expenditure on R & D,
2. Development strategy implemented under the adopted economic policy,
3. The quality of state institutions.

In the CEECs, none of these factors creates favourable conditions for the development of innovation. This is clearly visible when comparing the situation in the CEE countries with that of most countries of the ‘old’ EU.

3.1. Expenditures on R&D

There are good reasons to believe that it is not possible to achieve a high technical level of an economy, based on original (not imitative) innovation, without incurring major financial outlays (at least at the average level incurred by the successful countries). This is also confirmed by observations of foreign experiences. For example J. Sarul (2013) writes that ‘the characteristic feature of all the leading innovative countries in the European Union is a large share of

expenditure on research and development, measured by the share of GDP, while the more innovative is the country the greater is the share of funding from private sector'. A similar opinion is also formulated by S. Marciniak (2013), who lists the scarcity of financial resources as one of the most important reasons for low innovation.

R&D spending as a share of GDP is the basic formula showing the country's real engagement in innovation. In 2012, the EU average was over 2% of GDP, and the leaders (including non-EU countries) spent 3-4% of GDP. Israel was the leader in this area, with 4.3-4.5% (not including spending on defence). (International Statistics Yearbook (2012), p. 284.) A high share of R&D expenditure in relation to GDP could be observed in Slovenia (2.8%) and Estonia (2.2%), which are clear leaders in innovation among the CEECs. In the Czech Republic it was less than 2% and in Hungary over 1%. In other CEECs these values ranged from 0.5% (Bulgaria) to 0.9% (Lithuania), and 0.76% in Poland (Statistical Yearbook of the Republic of Poland (2013), p. 810) Nauka i technika (2013), p. 54). Per capita expenditures in Poland were almost 10 times lower than in the advanced countries. China was already ahead of us by 2011, when it spent US$ 155 on R&D per inhabitant (Statistical Yearbook of the Republic of Poland (2013), p. 810).

The share of institutional sectors in the total expenditure on internal R&D is unusual in most CEECs. The share of the corporate sector is low, and the share of government and higher education sectors is high, indicating a relatively low interest of businesses in innovation activities (Nauka i technika 2013, p. 58). The structure of expenditures on R&D is affected by three main factors:

a) the results of basic research are of little use for economic practice,
b) the solutions transferred from external research institutes and universities to companies are of a small, fragmentary nature, and hence their implementation does not require large expenditures,
c) the companies themselves do not implement large R&D projects.

The scarcity and fragmentation of funds show that large research programs which could be a technical or market success are not implemented in the CEECs (Wróblewski, 2012). There are no such programs even in those segments of the economy which have potential, and for which more modern technologies are very necessary, indeed essential, for example, mining and processing of coal, energy, telecommunications, and pharmaceuticals.

3.2. The development strategy

Based on the experiences of many countries, two types of strategy can be identified (with some simplifications). Both attach high importance (at least declaratively) to innovative activity as an important factor enabling long-term development.

The first type of strategy involves several characteristic elements:

- a relatively high or high tax burden,
- a well-developed technical infrastructure based largely on public investment,
- a very good education system,
- a large role of the state in initiating and supporting (e.g., financially) strategic innovation initiatives,
- large state spending on R&D,
- care for social stability, manifested, inter alia, in the functioning of socially acceptable mechanisms for developing wages and profits.

Such strategies are characteristic of economically developed countries, with high technology and high innovation activity (Krajewski 2009, pp. 267-277). They focus on providing economic entities with external conditions which facilitate and support innovation. The ability to produce goods accepted and sought after in the market (both at home and abroad), and which others are not able to offer, is the basis of competitiveness. Therefore, native (original) innovation plays a key role in this model. Entities operating in such economies achieve an innovation advantage, which allows them to charge high prices, ensuring high profits and wages.

The second type of strategy involves the following characteristic features.

a) Low taxes on:
   - income of enterprises and entrepreneurs,
   - property,
   - inheritance,

b) tolerance of a grey economy,

c) high income and wealth inequality,

d) low activity of the state in initiating and supporting strategic innovation,

e) low state spending on innovation activities and on the creation of favourable conditions for the development of innovation.

In this type of strategy, competitiveness is built on the basis of low wages and low taxes, keeping prices relatively low. But the market offer is mainly based

on products already known, often produced by many other companies, coming mainly from not very modern or traditional sectors of the economy. This is not a strategy to be a leader of innovation. This model is dominated by imitative innovation. Such strategies are implemented fairly often in countries with a low level of development, mostly post-socialist countries (including Poland) in which, owing to recent past experience, there is a large distrust and dislike of the state, and at the same time a probably excessive faith that market entrepreneurship will best cope with problems, including innovation. Hence, under such an approach the main condition to ensure success is to severely reduce state interference and provide businesses with high disposable income, hoping that it will be used to a large extent on innovation activities.

These expectations, however, did not materialize. It turned out that the economic operators in these conditions are able to pursue their economic goals to a satisfactory degree while allocating only slight resources for innovation activities. One cannot blame them if they act in accordance with their particular interests and microeconomic rationality. They have been provided with a set of conditions of operation, and therefore they make use of them. To achieve the objectives the operators usually purchase machinery and equipment of a newer generation (but unprotected by patents) and carry out small R&D works on their own.

Cooperation between companies and individual entities in the R&D base is poor because:

- companies rarely engage in projects that would require such cooperation,
- the R&D base units have few offers that might interest enterprises,
- the ability of the R&D units to collaborate on ambitious project is limited because they have outdated and worn scientific and research apparatuses, they have poor personnel (the best employees often leave, and there is no supply of attractive new young cadres), and small and fragmentary orders dominate and do not promote science (Krajewski 2013).

The domestic market in the CEECs remains, in most segments, undemanding, in part due to the low income of consumers. The export of goods is dominated by outdated goods, with a low degree of processing (high-tech products usually represent only a small percentage of exports).

The grey economy creates large possibilities to obtain easy benefits (especially in small enterprises) and, in practice, goes almost completely unpunished.

The expectations that a significant improvement in innovation activity could be achieved through EU aid have been fulfilled only to a small extent. Firstly, contrary to appearances the size of the aid is not large - its share in the total expenditures on R&D generally does not exceed several percent. Enterprises were acquiring only a small portion of these funds, and the main beneficiaries are

colleges and the government sector. Secondly, the funds are spent primarily on the implementation of small fragmentary projects without any coherent concept and without many features indicative of originality.

The problems which the large differences in development levels of individual countries within the EU pose for the development of a consistent and coherent innovation policy have become more visible in the current crisis. D. Gołębiowska-Tadaj (2013) considers, for example, that '... a source of weakness in combating the crisis was artificial integration of countries with dramatically different indicators of productivity, institutions and different cultures.' And Sarul J. (2013) expresses the view that there has been no success in reducing the innovation gap between the EU countries with different levels of economic development, partly because it is difficult to develop a common innovation policy. In his opinion, 'The experiences of the 'old' European Union, particularly the Scandinavian countries, show that higher taxation, and thus a high level of social protection, a low budget deficit, and the resulting low level of interest rates are conducive to the development of innovation… Blocking the possibility of price competition encourages entrepreneurs to take difficult, but fruitful in the long term, innovative types of competition...' Such peripheral countries as the CEECs, including Poland, pursue a neo-liberal economic policy, and generally provide conditions for competition based on prices, and reproductive innovation. It is therefore necessary to make innovation-oriented changes in their macroeconomic policies.

3.3. The quality of state institutions

In most of the CEECs, innovativeness of the economy is not treated by the state as a priority. A low level of activity and engagement by state institutions can be seen in this field (apart from verbal declarations). These institutions are incapable of setting appropriate goals for the economy and society and properly allocating scarce resources. Consequently, generally there is a severe shortage of funds for R&D.

State institutions have so far failed to create efficient and effective mechanisms to encourage economic entities and R&D entities to engage in highly innovative activities. One cannot blame the entities at the microeconomic level for such a lack of activity. They act rationally from their own point of view and within the conditions and systemic solutions which have been created for them.

The state insufficiently initiates and participates in the implementation of strategic objectives of R&D and large innovation programs, and the microeconomic

level entities are too weak to be able to act in this role. As a consequence, there are an insufficient number of such objectives and programs. One of the consequences of the low activity of state is the insufficient rate of change in the structure of the economy and in the evolution of innovative activity. A unique (in the world, apart from South Africa) example of this is the petrification of energy based on coal in Poland and its inability to reduce CO2 emissions to the extent deemed necessary by the EU.

State and local governments distribute aid from the EU mainly according to formal and bureaucratic criteria. They prefer small programs, because there is less risk that they will end up without achieving the desired objectives, and failures are not so conspicuous. The programs also have short implementation periods, so they are easier to settle. Such programs usually end up with imitating (replacement) innovation, with limited application possibilities.

According to Kleer (2013), it is evident that state institutions prefer imitative innovation which bring some short- and medium-term benefits, but do not ensure long-term economic and civilization development. The long-term development must be strongly supported by native innovation. This support should concern not only the economic sphere, but above all the civilization sphere. 'This is the plane on which the conflict between innovation and imitation takes place. ... How this native innovation will be launched depends mainly on the policy and strategy of the state. The experience of the last several decades, both in Europe and on other continents, proves that in this respect there is an extremely differentiated approach on the part of individual states. At the same time there is no clear correlation between the size of the state, per capita income, and expenditure on research and development sector. It is purely the effect of the professed philosophy of politics and economic theory.' The CEECs clearly prefer the development of imitation innovation.

4. Summary

When the countries of Central and Eastern Europe entered the European Union, they were given the opportunity to become transformed into knowledge-based societies, with modern, innovation-oriented economies which build their strength and competitiveness on the development of native technical solutions and concepts. To achieve this, however, requires a lot of effort and radical and profound changes in comparison with the previous situation. New priorities and strategic objectives and methods of their implementation (including innovation strategies) must be developed, financial and in-kind resources reallocated, and social and technical infrastructure must be expanded and modernized. These are

difficult challenges, but their effective implementation is essential so that the CEECs can avoid marginalization and become equal partners within the EU.

The statistical data presented in this paper indicates that the innovative position of the CEECs is still unfavourable and relatively weak, with the exception of Slovenia and Estonia. Poland is in a particularly difficult situation, with many signs of stagnation with respect to innovation, keeping it at a low level (next to Bulgaria and Romania).

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Streszczenie

INNOWACYJNOŚĆ GOSPODAREK EUROPY ŚRODKOWO-WSCHODNIEJ

Wchodząc do Unii Europejskiej, kraje Europy Środkowo-Wschodniej (CEEC) uzyskały szanse na przyspieszone przekształcenie się w społeczeństwa oparte na wiedzy, mające nowoczesne, proinnowacyjne gospodarki, które swoją siłę i konkurencyjność budzą na rozwoju rodzimej myśli technicznej. Osiągnięcie tego wymaga jednak dużego wysiłku i radykalnych oraz głębokich zmian w porównaniu ze stanem dotychczasowym: sformułowania nowych priorytetów oraz celów strategicznych i sposobów ich realizacji (w tym strategii innowacyjnych), dokonania realokacji zasobów finansowych i rzeczowych, rozbudowy i unowocześnienia infrastruktury społecznej i technicznej. Są to wyzwania trudne, ale ich skuteczna realizacja jest niezbędna, aby CEEC uniknęły marginalizacji i stały się równoprawną częścią UE.

Dane statystyczne przedstawione w artykule wskazują, że pozycja innowacyjna CEEC jest ciągle niekorzystna i relatywnie słaba, z wyjątkiem Słowenii i Estonii. W szczególnie trudnej sytuacji jest Polska, w której występuje najwięcej (obok Bułgarii i Rumunii) oznak stagnacji innowacyjnej na niskim poziomie.

Słowa kluczowe: *innowacyjność, konkurencyjność, Europa Środkowo-Wschodnia, Unia Europejska*