Regional and Business Studies (2010) Vol 2 No 1, 1–21
Kaposvár University, Faculty of Economic Science, Kaposvár

THE INNOVATION POSITION OF FOUR NEIGHBOURING COUNTRIES AND HUNGARY BASED ON THE "EUROPEAN INNOVATION SCOREBOARD"

László SITÁNYI
South-Transdanubian Regional Development Agency, H-7401 Kaposvár, Szántó u. 5.

ABSTRACT

As we know innovation systems can be distinguished not only at national, but also at global or regional levels, and even in the local networks, industrial corporation groups and clusters of firms. Still, the system needs to be examined at a national level as well, because the national attributes from a given country's viewpoint may have an influence on the development of other levels (Pap and Sitányi, 2007). Although the global-local economic and social processes – taking effect in parallel – resulted in the weakening of the national level in the past two decades, Lundvall (1988) still deems their further analysis important because of the role of the common language and common culture. The author of this article attempts to draw the relative innovation path of the five neighbouring countries of In-Between Europe and also to demonstrate their position on the relative European innovation basis. For this the author has studied the European Innovation Scoreboard, EIS – established at the initiative of the European Union under the Lisbon Strategy – year by year. The comparative method defined and demonstrated in the article in full details can be applied to the demonstration of the relative position of any European blocks of countries or others outside Europe.

Keywords: Innovation, relative European innovation plan

INTRODUCTION

The Organization for Economic Cooperation and Development (OECD) has been developing the system of statistical methodologies, recommendations, and definitions promoting the measurement of innovation and research, development (R&D) since the mid-seventies. A manual-family is the basis of it, and the manuals were named (*OECD*, 1992; *OECD*, 1993; *OECD*, 1995) after the places where they had been accepted (Frascati, Oslo, Canberra).

The EU innovation statistic system and its database – established based on the resolution of the Lisbon Strategy of the European Council (*European Council*, 2000) – are based on the fundamental principles defined in the OECD documents. At the same time the European Council also established the institution of the European Innovation Scoreboard, EIS, which includes the innovation statistical data of the EU Member States, associated countries, candidate countries, Japan and the United States[1].

[1] Because of international comparability and to achieve the set goals in Lisbon by the European Council.

The system has been successful internationally; the preparations of the Italian National Research Council, (CNR-IRPPS) led to the establishment of the Global Innovation Scoreboard, (GIS) system, calculated first in 2006. The innovation performance of the 34 Countries, included in the EIS 2006 report – (25 EU Member States and nine more Countries[2]) – and beyond that 14 other Countries[3] spending the most on R&D were examined (*Archibugi et al.*, 2009, 13. p.). In this global summary, so-called GIS index, the number of indicators was decreased to its third, since some data were not accessible to the extended Countries. Thus in 2008 calculations were made based on 9 EIS-2008 indicators instead of 29 (*EIS*, 2008, 25. p.). Because of the above mentioned reasons in the present article we will dwell upon the EIS system since:

1.) The Global Innovation Scoreboard (GIS) – due to the reduced number of indicators – can show the innovation performance of a given country less accurately;
2.) We have to place our country primarily on the innovation map of Europe, and within it in the southern part of In-Between Europe[4], and to do so the EIS is a suitable base.

MATERIALS AND METHODS

Nowadays it has been generally accepted in relating literature that innovation and the innovation environment, milieu (*Camagni*, 1992) is a social and economic phenomenon, which is hard to be grasped or measured, and something which is also very complex and dependant on numerous factors. This statement is supported by the fact (and the statistical apparatus destined for measuring it since 2000) that the types of data and their collection, the method of comparing and analyzing them have been continuously developing, changing and refining (*EIS*, 2001-2009).

Not only the measurement, but also the institutions requested to collect data, make analyses (*Community Research and Development Information Service – CORDIS*, *Trendchart, Pro Inno Europe, UNU-MERIT*) changed during the nine years of EIS. Data used in the present article were available mostly on the homepages of the listed institutions. At present (July 2009) the Pro Inno Europe, the innovation initiation of the Directorate-General for Enterprise and Industry) is taking care of them. The majority of the summary annual reports, partial analyses, and methodological publications have been carried out by the *Maastricht Economic and Social Research and training centre on Innovation and Technology* (UNU-MERIT) from the very beginning with the help of various partners. A key to the success of EIS is that in the first decade of its history it preserved and still sticks to some of its basic principles passed when the institution was established (*Hollanders and van Cruysen*, 2008).

---

[2] Bulgaria, Croatia, Romania, Turkey, Iceland, Norway, Switzerland, the US and Japan

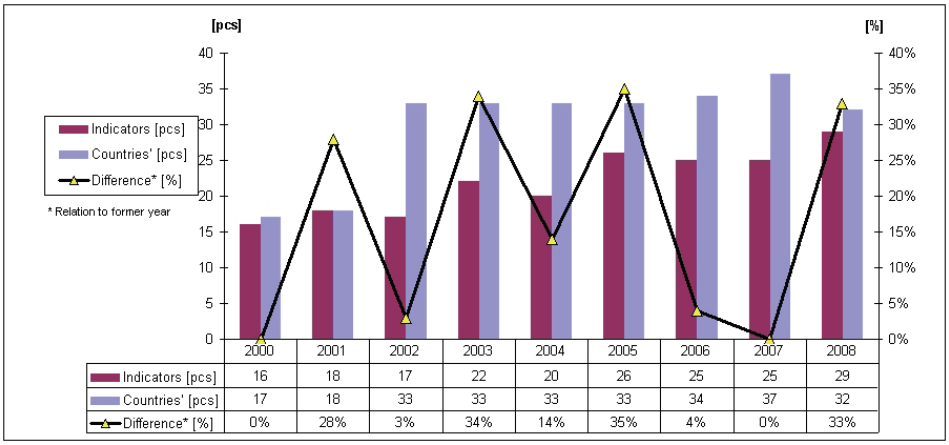
[3] China, Republic of Korea, Canada, Brazil, Australia, Israel, India, Russian Federation, Mexico, Singapore, Hong Kong, Argentina, South Africa, and New Zealand

[4] After *Pándi Lajos* (1995) the geographical strip, the "moving border" of the modern-age Europe, stretching from the Baltic Sea to the Aegean Sea is called In-Between Europe (*Pándi*, 1995).

- *Simplicity:* Only the necessary changes are carried out on innovation indicators, thus they can be compared with previous studies and the number of them could be limited[5] during the years (*Figure 1*).
- *Transparency, publicity:* all results can be recalculated, controlled; not only the annual reports, but also methodologies, calculation methods[6] are available on the Internet;
- *Continuity:* Even if there were significant changes in every 2-3 years, they have never exceeded by 1/3, therefore the data remained comparable, and the trends remained verifiable (*Appendix 1*, *Table 3*)
- Since researchers have been developing the system annually and/or taking new viewpoints into account, we can get the most thorough picture of EIS if we survey the changes, results one after the other by the short summary of the annual changes.

Figure 1

Changes of the EIS indicators and the studied countries, deviations compared to the previous year, 2000-2008



	2000	2001	2002	2003	2004	2005	2006	2007	2008
Indicators [pcs]	16	18	17	22	20	26	25	25	29
Countries' [pcs]	17	18	33	33	33	33	34	37	32
Difference* [%]	0%	28%	3%	34%	14%	35%	4%	0%	33%

Source: Based on *European Innovation Scoreboard*, 2000-2008

European Innovation Scoreboard, 2001

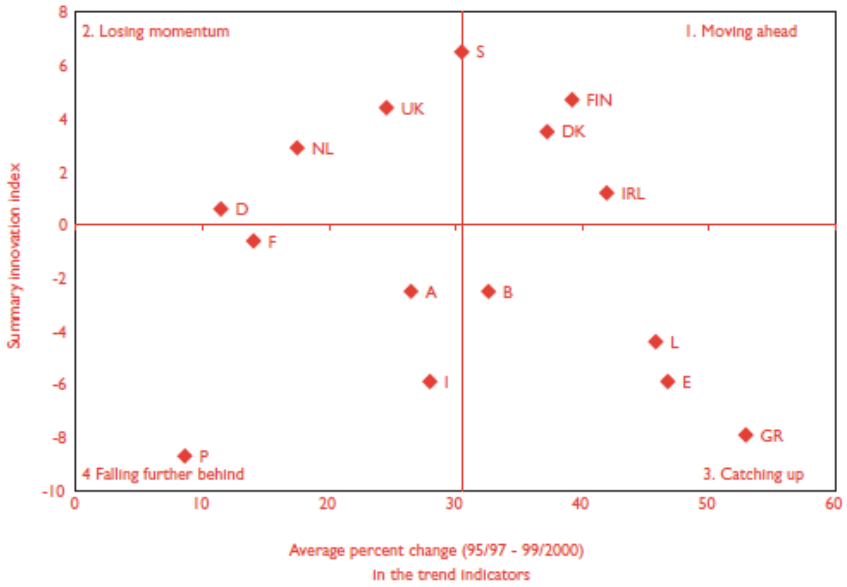
Following the 2000 pilot project the first entire report was published in 2001. The report covered 17 countries, the 15 EU member states, the United States, and Japan. In the first three years of EIS the analyses were carried out jointly by the research workers of UNU-MERIT and the Science and Technology policy research University (SPRU) and were published on the homepage of CORDIS (www.cordis.lu).

[5] For example the FORA Innov. Monitor (*FORA*, 2007) applies more than 170 indicators, most of them developed by itself.

[6] Most of the data are published in Excel format and it also supports calculability.

Figure 2

Summary innovation index and its change in 2001



Source: *European Innovation Scoreboard*, 2001. 12. p.

The indicators were grouped into four categories:

- Human resources;
- Knowledge creation;
- Transmission and adoption of the new knowledge;
- Innovation financing, output and markets.

The Summary Innovation Index (SII) was formed based on 18 innovation indicators (*EIS*, 2001 8. p.). In 2001 "trend indicators" and based on their changes – given in percentage – development directions, *average change in trend indicators* (*CTI*) were defined, from which the determinant trends in innovation performance of the member states were ascertained. According to *Szendrődi* (2003 5. p.) after two years of work this conclusion is rather early.

Even if it is true at that given time, later on the annual value of CTI has become a very significant aspect of examination, one of the main results of the program. The authors already describe the characteristic, synoptic EIS-graph (*Figure 2*), which shows the innovation position of the examined countries plotted against the changes of SII and CTI. A good point is that the position of countries can be assessed "in a blink"; countries with identical characteristics can be seen in one group.

In these years the sources of data originated from Eurostat's data for the previous two years, however, *among the indicators characterizing small and medium entrepreneurs there were five-year-old data* (*EIS*, 2001, 20. p.), therefore conclusions should be drawn carefully.

European Innovation Scoreboard, 2002

In 2002 the examination was extended to three associate[7] and 13 candidate countries[8], thus the studied geographical area grew significantly, extended beyond the borders of EU. The number of countries (33) nearly doubled (*Figure 1*), however, there were only minimal changes (3%) in the 17 indicators and their classification (*EIS*, 2002, 5. p.) compared to the previous year.

- Human resource supporting innovation (5 indicators),
- Creating new knowledge (3 indicators),
- Transmission and adoption of knowledge (3 indicators),
- Innovation financing, output and markets (6 indicators).

Because of the slight change the data could have been comparable with the previous year, however, in the 2002 report the *summary innovation index*, *SII* and its growth were not calculated. The exact reason for this was not described – with the exception of the experimental year it occurred only in that year – the reason for this probably is that the indicators were not accessible in all of the countries. Because of this the comparison of innovation performances is difficult, the accurate order could not be set, however, from the partial data it is clear that Hungary together with Slovenia and the Czech Republic was amidst the leaders among the candidate countries from several aspects. The report was completed with six professional dissertations, which are the following:

1.) EU member states and associate countries;
2.) Candidate countries;
3.) EU regions;
4.) Indicators and definitions;
5.) Thematic scoreboard: "Lifelong learning for innovation";
6.) Methodological report.

This practice, which is so useful for other researches as well, has continued in the coming years; namely to publish separate studies on current issues, and make them accessible on the Internet.

European Innovation Scoreboard, 2003

In 2003 the number of indicators grew from 17 to 22, and the method of calculating them has also changed significantly. The complete change compared to 2002 was 34% (*Hollanders and van Cruysen*, 2008). The indicators still weren't accessible in each examined country, therefore only two summary innovation indexes (*SII-1 and SII-2*) were created that year.

- *SII-1:* The index, made of all 22 indicators, is used to calculate the innovation performance of the 15 EU Member States and the associate countries (Iceland, Norway, and Switzerland).

[7] Associate countries: Iceland, Norway, Switzerland

[8] Candidate countries: Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia and Turkey

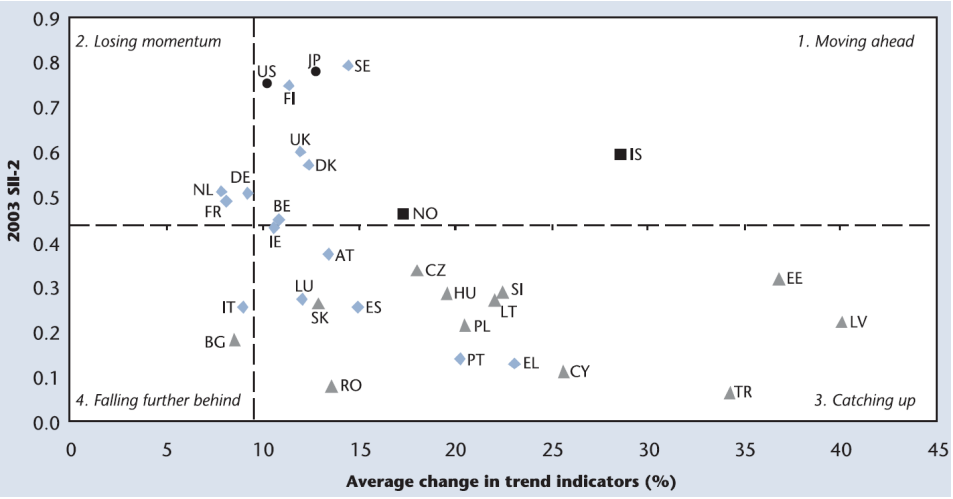
- *SII-2:* It is calculated based on indicators, which are accessible in each country (unfortunately it is just a little bit more than half of all the countries: 12 pieces), which is established for all the 33 countries included in the study.

In the 2003 report it was the first time when the innovation position of the 33 countries was described together plotted against their *summary innovation index* SII-2, Y axis) and their *average Change in Trend Indicators*, CTI, X axis).

According to the 2003 assessment – calculated with the reduced SII-2, based on 12 indicators – Estonia, the Czech Republic, Lithuania, Hungary and Slovenia are the most innovative among the candidate countries (*EIS*, 2003, 11. p.) and as for CTI three countries, Estonia, Latvia and Turkey (Turkey at a very low level though) take the lead in the whole of Europe (*Figure 3*).

Figure 3

Summary innovation index and its change in 2003



Source: *European Innovation Scoreboard*, 2003, 10. p.

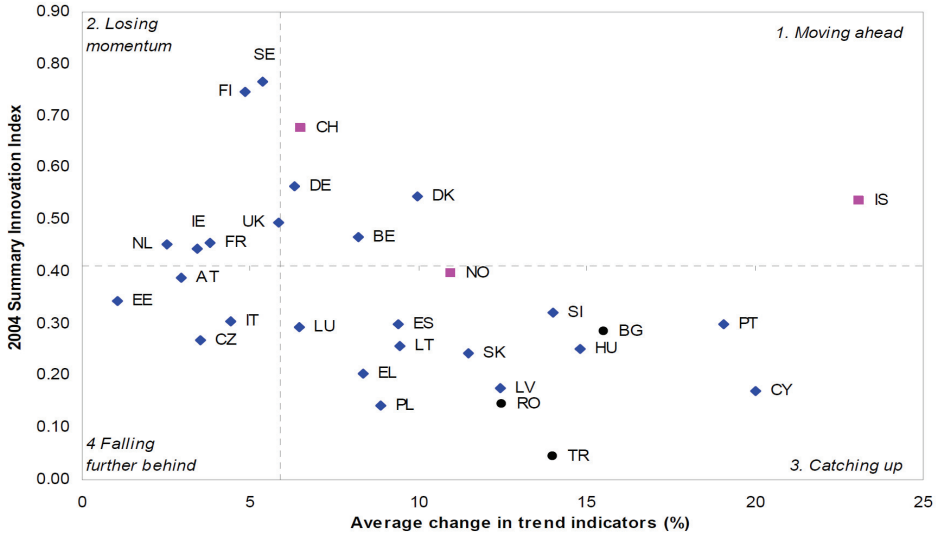
European Innovation Scoreboard, 2004

The number of countries (33) did not change that year, however, their "definition" did because of the ten new EU Member States. Besides the 25 EU Member States, the EIS report showed the innovation performance of Bulgaria, Romania, Turkey, Iceland, Norway, Switzerland, the United States, and Japan. The main indicator groups did not show any changes, but the number of indicators was reduced by 2 to 20 (*EIS*, 2004, 8. p.) in the following classification:

- Human resource supporting innovation (5 indicators),
- Creating new knowledge (4 indicators),
- Transmission and adoption of knowledge (4 indicators),
- Innovation financing, output and markets (7 indicators).

Figure 4

Summary innovation index (SII, Y axis) and its change (%, X axis) in 2004



Source: *European Innovation Scoreboard*, 2004, 10. p.

From the usual EIS figure (*Figure 4*) it is clear that Hungary in the quarter of catching up countries moved from the mid-list towards the leading countries and in terms of "average change" trend indicators Hungary was overtaken only by four countries (Bulgaria, Iceland, Portugal and Cyprus) in Europe.

European Innovation Scoreboard, 2005

In 2005 based on half a decade of experiences of EIS, and in close cooperation with the Joint Research Centre[9] of the European Commission, the number of indicators was increased from 22 to 26. The methodological change was considerably bigger since the number of indicators was not increased by four, but nine new indicators were introduced (*EIS*, 2005, 8. p.) and five redundant indicators, overlapping other indicators were ceased. It can be said it was the time when the method of calculating SII was restructured to the greatest extent in its history, the change was 35% compared to the previous year (*Hollanders and van Cruysen*, 2008).

Considering the period of EIS between 2000 and 2007 most indicators were used in 2005, the summary innovation index describes the innovation performance and its dynamics of each country based on 26 indicators (*Figure 5*). It was the year when the indicators were divided into two main categories, input and output main themes, and within that five qualifying dimensions were created (*Sajeva et al.*, 2005).

[9] Joint Research Centre (JRC), Unit of Econometrics and Statistical Support to Antifraud (ESAF) of the Institute for the Protection and Security of the Citizen (IPSC)

Input indicators[10]:

- Innovation drivers (5 indicators);
- New knowledge, knowledge creation (5 indicators);
- Innovation performance of firms (6 indicators).

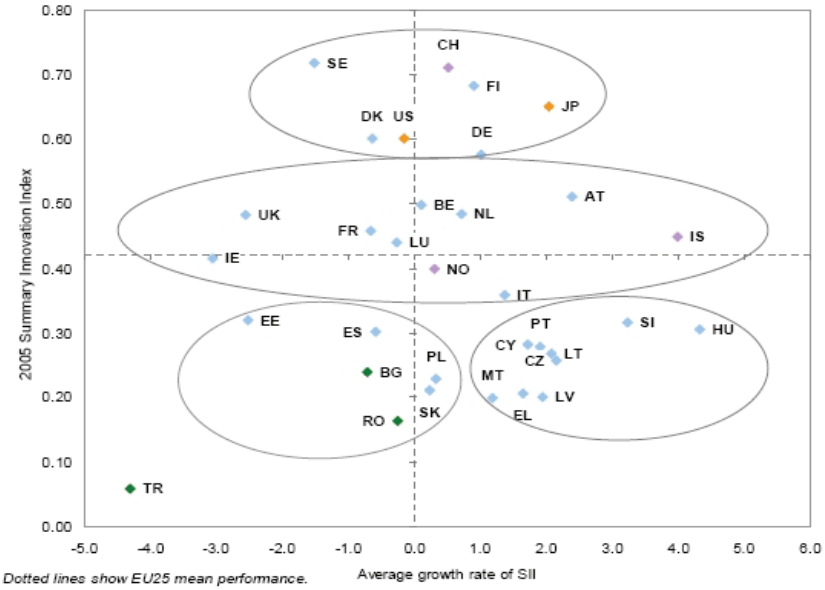
Output indicators[11]:

- Applying innovation (5 indicators);
- Intellectual property (5 indicators).

Figure 5 shows the position of each country in a coordinates system where the summary innovation index is the vertical axis and the change of index is the horizontal axis. Again the studied countries can be divided into four groups, such as *leaders, average performers, catching up and losing ground* countries (*EIS*, 2005).

Figure 5

Summary innovation index (SII, Y axis)and its change (%, X axis) in 2005



Source: *European Innovation Scoreboard*, 2005

The above statements are remarkable – it is particularly interesting to see the changes, improvements and development policy in the coming years – since 2005 was that particular year when Hungary became the leading country in Europe regarding the average growth rate of the summary innovation index after years of catching up process (*Figure 5*).

[10] On the innovation input side expenses spent on education or R&D expenses can be found.

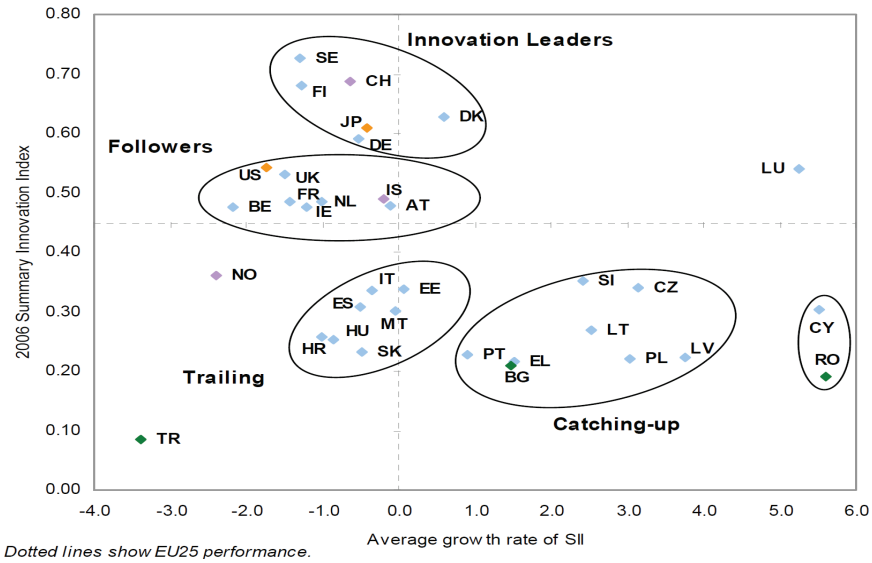
[11] On the innovation output side the number of patents, or the corporate sales coming from new innovative products can be mentioned as examples.

European Innovation Scoreboard, 2006

As you can see at first glance from *Figure 6*, the authors of the EIS report created a fifth group, the "*very rapidly growing group*" besides the usual four groups (leader, follower, catching up, trailing) in 2006. The fifth group was made up of Cyprus, one of the smallest countries of EU and Romania, which has the highest average growth rate in Europe in 2006, although at a very low SII level. Luxembourg, Norway and Turkey do not fit into any of the groups, therefore they remained separate.

Figure 6

Summary innovation index (SII, Y axis) and its change (%, X axis) in 2006



Source: *European Innovation Scoreboard*, 2006, 9, p.

Following the significant modification in the previous year there was only a slight 4% methodological change in 2006 (*Arundel and Hollanders*, 2006). One indicator was ceased, which was responsible for measuring the university R&D investments financed by the business sector. Two indicators were altered, thus the "*input*" side of innovation was measured with 15 characteristics, while its "*output*" was measured with 10; it means a total of 25 indicators. Considering this slight change it is even more striking how significant the change was in terms of the average growth rate of SII (*Figure 5* and *6*, X axis). From the lead Hungary slides back under the EU average, Cyprus and Romania get so far from the other countries that researchers have to form a fifth group.

Since in the case of four countries the number of available indicators is considerably smaller (Turkey 14, Croatia 13, USA 15, and Japan 16), conclusions referring to the relative position of these countries compared to the other countries calculated from these data must be drawn very carefully!

When comparing the countries it was concluded that leading countries do better than their weaker counterparts, especially in the fields of new knowledge and knowledge-creation, innovation performance of firms and intellectual property.

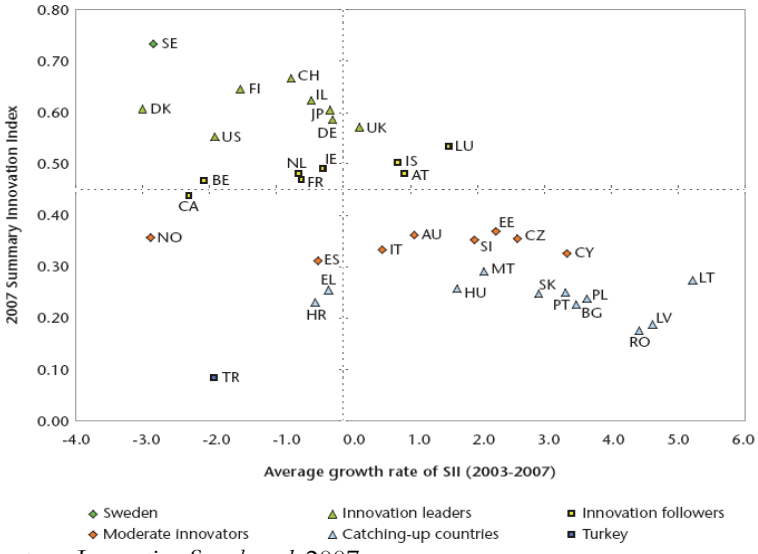
European Innovation Scoreboard, 2007

2007 is the first year in the history of EIS when no changes were made in the system of indicators, in the method of index calculation, therefore data can be well compared with the previous two years – between 2005 and 2006 there was only a minimal, a 4% change – thus progressions can be followed more accurately, without distorting the methodological changes. However, the number of countries was increased by three (Australia, Canada, Israel) to 37, and they returned to the usual classification of four (*leader, follower, moderate, catching-up*). That year the two countries possessing the highest and lowest value of SII (Sweden, Turkey) were not assigned to any groups (*Figure 7*).

The relative hierarchy changed inside, but passing through among groups was very rare between 2002 and 2007. Looking over the figures of the subsequent years it can be said that the innovation leader and the innovation follower groups were getting closer to each other. However, the gap, the separating field between the two "elite groups" and the *moderate* and *catching up countries,* is clearly perceptible and the extent of the gap does not diminish noticeably. The 2007 calculations seem even more reliable since the data of EU Member States, Iceland and Norway were collected uniformly by Eurostat and 90% of them originate from the previous three years (*EIS*, 2007).

Figure 7

Summary innovation index (SII, Y axis) and its change (%, X axis) in 2007



Source: *European Innovation Scoreboard*, 2007

European Innovation Scoreboard, 2008

It has become clear even on the basis of the brief review of eight years between 2000 and 2007 that the EIS report and its methodical instruments were acknowledged sources of measuring innovation performance of innovation tools, methods and countries (or regions in certain years) and an efficient indicator of the SII and CTI. It cannot be withhold though – which is not a surprise in the rapidly changing world of innovation – that EIS has been severely criticised due to its inflexibility to changes and due to that it applies not the most suitable statistical indicators for measuring innovation and leaves out of consideration the differences in economic structure of the increasing number of analysed countries. Recognising these, the researchers modified the EIS methods drastically in 2008 on the basis of collected criticisms and experiences of previous years. The objective was not to change the new methodology within three years. Greater attention is paid to Europe than in previous years; only five non-EU-27 countries are analysed[12]. The number of indicators was increased from 25 to 29, which is not a simple increase in the number of the indicators. Only 15 of them remained unchanged, 9 of them were supervised and other five were newly involved (*Hollanders and van Cruysen*, 2008). Also the grouping of the indicators changed; the previous five innovation dimensions changed to seven; while the two major innovation groups (input/output) were divided into the following three ones:

1.) *Enablers*, which drivers of innovation being external to the firm activities;
2.) *Firm activities*, efforts made by firms in innovation processes;
3.) *Outputs*, which are the results of the firms' innovation related activities.

The EIS underwent several changes over time, mainly in 2003 and 2005, (*Figure 1*) and only 13 indicators were used across all Scoreboards.

The 2008 year reform addresses the following challenges:

- measuring new forms of innovation;
- evaluation of overall innovation performance;
- improving comparability at national, regional and international levels;
- measuring processes and changes over time (*Hollanders and van Cruysen* 2008).

Due to innovation processes getting gradually more complicated, new factors were needed to be considered:

- increasing role of formal and informal networks in knowledge transfer;
- increasing role of service innovations parallel with the increasing share of service sector in economy;
- development of new indicators in order to measure new forms of innovation (open and user innovation, non-R&D innovations) (*Arundel et al.*, 2008).

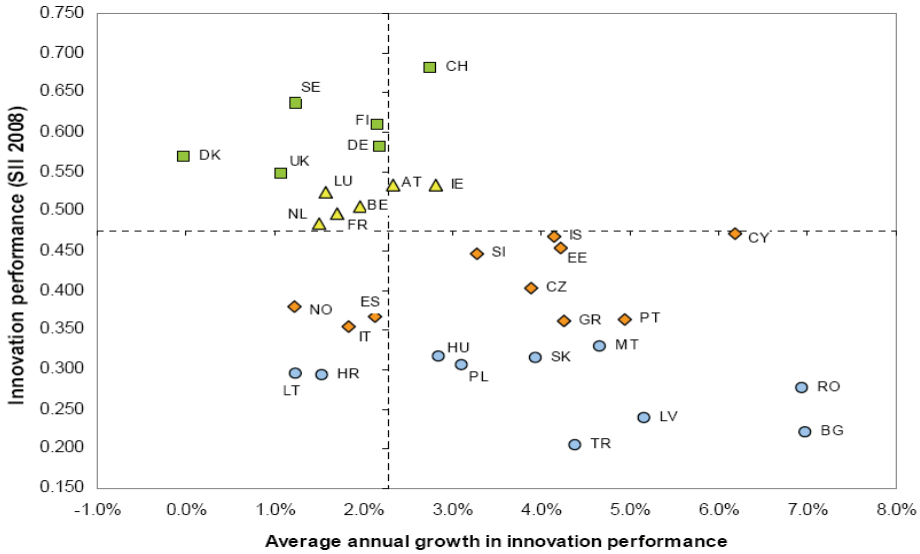
Although the change is higher than 30% similarly to that in 2003 and 2005, the consequence of the measuring method is shown by that the earlier four groups (*innovation leaders, innovation followers, moderate innovators and catching-up countries*) remained almost the same (*Figure 8*) and only three countries changed their

[12] Croatia, Turkey, Iceland, Norway and Switzerland

groups[13]. The gap between the most innovator and the least innovator groups is similarly visible to that in 2007 (*EIS*, 2008, 9. p.).

Figure 8

Summary Innovation Index (SII) and its average annual growth (%) in 2008



Source: *European Innovation Scoreboard*, 2008

General critics on the EIS reports 2001-2007

Apart from the undoubted certainties listed in the EIS reports' analyses and consequences – and reviewed in Point 3 Paragraph 1 and in the current point as well – several evident mistakes can be found as well. EIS researchers were criticised by experts. These can be summarised in the following:

- Methodology is not flexible to changes;
- The methodology lacks an underlying theoretical model that describes the input, transmitting and output parameters of innovation processes;
- It applies not the most suitable statistical indicators for measuring innovation;
- It leaves the differences of economic structures of the increasing number of involved countries out of consideration;
- The five innovation dimensions introduced in 2005 (*Sajeva et al.*, 2005) do not cover several aspects of the innovation processes[14].

[13] Leaders (1) remain the same, Iceland fell into the group 'moderate innovators'(2) from 'followers'(3), while Portugal and Greece stepped into the group 'moderate innovators' (3) from catching up countries(4).

[14] Especially it is relevant for non-tech and non R&D innovations, social-economic conditions and the financing of innovation activities.

Grupp (2006), *van Cruysen and Hollanders* (2008), *and Rammer* (2005) mention further interesting aspects in their work; the following are the most important of them:

- The use of a single composite indicator and of its growth rate leads to the threat that we miss the complexity of the process behind (*Grupp*, 2006). This is proven by the examples of Hungary mentioned above;
- Too many indicators measure innovation in high-tech industries. This would bias innovation performance in favour of those countries with industries specialised in high-tech industries, in particular in high-tech manufacturing;
- Many of the indicators are highly correlated and these indicators may thus capture and measure the same underlying aspect of the innovation process, which would thus create a bias towards these aspects;
- In case of numerous indicators data for countries are either not available or old[15], which runs the risk of comparing the innovation performance across countries fairly;
- A higher value of the indicator does not necessarily reflect a better innovation performance[16]. It is a relating question what is the optimal value for a given indicator resulting in the best innovation performance. In addition, these optimal values may also differ across countries (*Rammer*, 2005).

CONCLUSIONS

The group of analysed countries

The geographic area analysed from the aspect of innovation is primarily Hungary, therefore, those countries and their innovation performance and environment were investigated that are comparable with Hungary in terms of their social, economic and geographic parameters. The author believes that a realistic picture on these South-Eastern European countries can be obtained when their innovation processes are examined in a comparative environment on the basis of data of similar countries. Hence, many common social-economic features influencing the innovation environment of these countries can be found (not diminishing the role of many other economic, historical and mental differences):

- All of these countries are situated on the Southern part of Eastern-Europe;
- They have experienced a socialist planned economy of four decades;
- In the nineties, they tried to catch up with Europe and create the preconditions of EU-accession in an environment continuously undergoing privatisation in ways that are different in details but typical as well for the transitional Eastern-European economy;

[15] Both of them can be illustrated with examples: the first one in the EIS 2006, the second in the EIS 2001 reports.

[16] Such an indicator can be for instance the proportional share of enterprises, which are supported from public funds for innovation purposes.

- These countries joined the EU in 2004[17], their society and economy have become open and they needed to harmonise their legal system with acquis communautaire.

Concluding from the above mentioned, it is advisable to analyse five countries: Bulgaria, Croatia, Hungary, Romania and Slovakia. Of course, it is possible to analyse the relative 'innovation cycle' of any other country group with the help of the method to be described in the following two chapters.

Illustration of processes of many years

Looking at the typical EIS graphs that illustrates the situation of the countries in a way that it is visible 'at first glance', the reader can figure out what innovation cycle the countries underwent. However, it is rather difficult to trace more countries; and a very good visual memory is needed in order to assess these countries' comparative situation that is changing from year to year. In addition, reviewing the summary of the EIS reports – which although is not long in time, but huge due to the continuous changes – will show that the calculations would be very complicated to illustrate the changes on one single graph.

The idea seems to be obvious that it would be good to picture these innovation paths and draw conclusions from it. Instead of abstract data, a graph provides a visible picture on the ways of how the innovation performance was influenced by the government' innovation-related activities, and on how the supporting systems of the national and regional innovation networks operate. This picture may help to dispel misbeliefs, evaluate a real situation and foster good development directions.

Analysts of EIS have partly done it 'officially': the SII index was annually recalculated according to the new methodology retrospectively for five years from year 2006, because these recalculations were done according to the applied methodology in the given year[18], these recalculated SII figures vary from those published in earlier EIS reports. In his analysis the author, presuming that the system of data collection and the way of calculation developed, considered the SII indices calculated for the last time in years, where figures were recalculated.

As the first year was 2002 when the six countries involved in the analysis appeared in the reports, the countries' SII indices in 2002 came from the retrospective recalculation in year 2006, those for 2003 from the EIS Report 2007, and – considering them to be the newest – those between 2004 and 2008 from the EIS Report 2008, as these data were recalculated retrospectively for five years according to the new results and methodology (*Table 1*).

Of course, the fact that the later calculated figures are closer to the reality is an assumption, but – as it will be seen in the following – it is not necessary to accept the 'retrospective calculation method' for the 'relative calculation method', either.

[17] Bulgaria and Romania in 2007, while Croatia is actually listed in the group of candidate countries and their data can be found in the EIS system from 2006. Unfortunately data are not available on Serbia and Bosnia.

[18] For example: "The SII has also been calculated retrospectively using the EIS 2008 methodology for the last five years to enable comparability of results; the SII time series is provided in Annex D" (*EIS*, 2008 p. 8, and p. 58)

Of course, if anyone disagrees with the retrospective calculations, data for any years can be produced by 'relative calculation' from the originally published data (by its nature).

Table 1

Summary Innovation Index for the six involved countries (SII) between 2002 and 2008

Year of calculation	According to EIS-	According to SII-2007	According to EIS-2008				
SII figures	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
BG	0.203	0.201	0.172	0.174	0.178	0.206	0.221
HR	0.262	0.240	0.278	0.286	0.282	0.289	0.293
HU	0.263	0.241	0.266	0.273	0.287	0.305	0.316
RO	0.155	0.156	0.209	0.205	0.223	0.249	0.277
SK	0.236	0.227	0.257	0.273	0.298	0.299	0.314
Min	*0.097*	*0.093*	*0.172*	*0.174*	*0.178*	*0.206*	*0.205*
Max	*0.762*	*0.817*	*0.612*	*0.615*	*0.637*	*0.661*	*0.681*

Source: Based on *European Innovation Scoreboard*, 2006, 2007, 2008; Annex D

For a given year the relative SII can be calculated for ***'i'*** *country* with the following formula:

$$SII_i^{rel}[\%] = \frac{SII_i - SII_{\min}}{SII_{\max} - SII_{\min}} * 100$$

where SII_{min} is the minimum, SII_{max} is the maximum SII figure and SII_i is the figure for *'i'* country (*Table 2*).

The innovation path of the analysed countries is pictured by the graph of the annual relative SII data (*Figure 9*).

Table 2

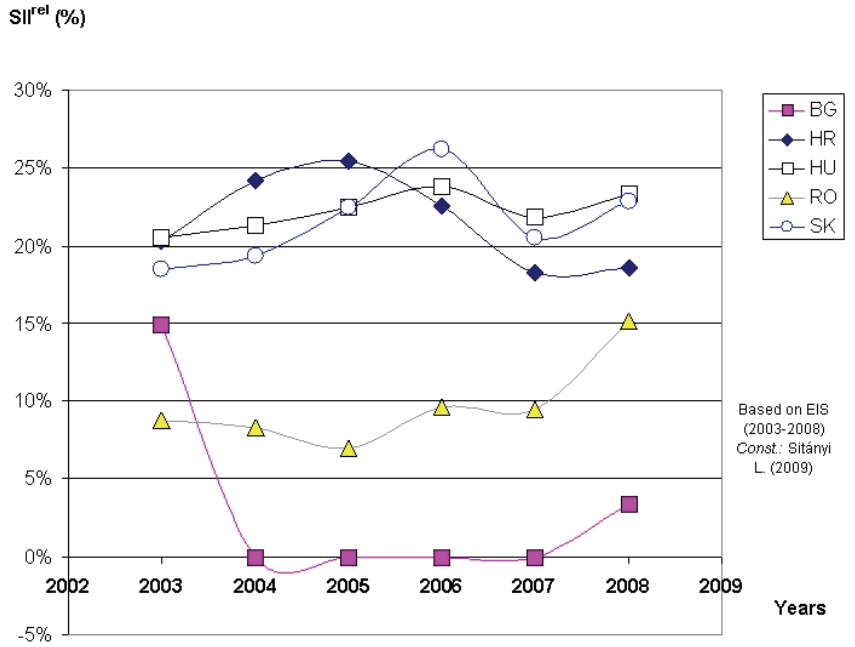
Relative SII (SII^{rel}) for the six involved countries between 2002 and 2008

Range	0.665	0.724	0.440	0.441	0.459	0.456	0.477
SII^{rel}	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
BG	15.96%	14.94%	0.00%	0.00%	0.00%	0.00%	3.44%
HR	24.79%	20.30%	24.15%	25.40%	22.52%	18.27%	18.55%
HU	25.02%	20.48%	21.25%	22.46%	23.78%	21.81%	23.32%
RO	8.73%	8.76%	8.32%	7.00%	9.65%	9.43%	15.18%
SK	20.99%	18.46%	19.35%	22.48%	26.17%	20.54%	22.86%

Source: Based on *Table 1*

Figure 9

Relative innovation performance (SII^{rel}) of the involved five countries between 2002 and 2008



Source: Based on *Table 2*

Figure 9 shows that the innovation performances of the analysed countries are varying in the lower quartile of the European SII level.

Unfortunately, the average CTI indicators (Change Trend Indicators) were not calculated retrospectively according to the new methodology; but the method of 'relative calculation' can be used here as well – similarly to the case of SII and according to the following formula:

$$CTI_i^{rel}[\%] = \frac{CTI_i - CTI_{\min}}{CTI_{\max} - CTI_{\min}} * 100$$

where CTI_{min} is the minimum, CTI_{max} is the maximum CTI figure and CTI_i is the figure for ***'i'*** country (*Table 3*).

The 'relative change of trend indicator' of the analysed countries (*Table 4*) is pictured by the graph of the annual relative CTI (CTI^{rel}) data (*Figure 10*), which show greater variation than SII paths.

The multi-year changes of SII and CTI graphs published in EIS reports can be illustrated in a way that the position of each country is marked in each year in a rectangle of a *"relative plane'*. The four boundary lines of this rectangle are assigned by the *highest and lowest figures of the two dimensions, the SII and the CTI indices*. The relative position of the countries can be specified compared to these figures. By

laying these layers on top of each other and by linking the points assigning the position of the countries we can draw up the "innovation path' of the countries within the relative SII-CTI plan (*Figure 11*).

Table 3

Innovation trend indicators in the involved six countries (CTI^{rel}) between 2003 and 2008

CTI	2003	2004	2005	2006	2007	2008
BG	8.60%	15.50%	-0.71	0.26	3.48	6.98%
HR	-	-	-	-0.20	-0.42	1.53%
HU	19.40%	14.80%	4.32	-0.22	1.69	2.85%
RO	13.60%	12.50%	-0.25	0.95	4.42	6.95%
SI	22.40%	14.00%	3.23	0.72	1.96	3.28%
SK	12.90%	11.50%	0.24	-0.29	2.91	3.94%
Max.	*40.00%*	*23.10%*	*4.32*	*2.11*	*5.23*	*6.98%*
Min.	*8.20%*	*1.00%*	*-4.31*	*-0.95*	*-3.01*	*0.00%*

Source: Based on *EIS*, 2003-2008

Table 4

Relative change of innovation trend indicators of six countries (CTI^{rel}) between 2003 and 2008

Range	0,318	0,221	8,631	3,064	8,235	0,070
CTI^{rel}	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
BG	1.26%	65.61%	41.73%	39.57%	78.84%	100.00%
HR	-	-	-	24.50%	31.41%	21.97%
HU	35.22%	62.44%	100.00%	23.83%	57.06%	40.86%
RO	16.98%	52.04%	47.10%	62.08%	90.24%	99.54%
SI	44.65%	58.82%	87.45%	54.59%	60.28%	46.97%
SK	14.78%	47.51%	52.73%	21.44%	71.92%	56.50%

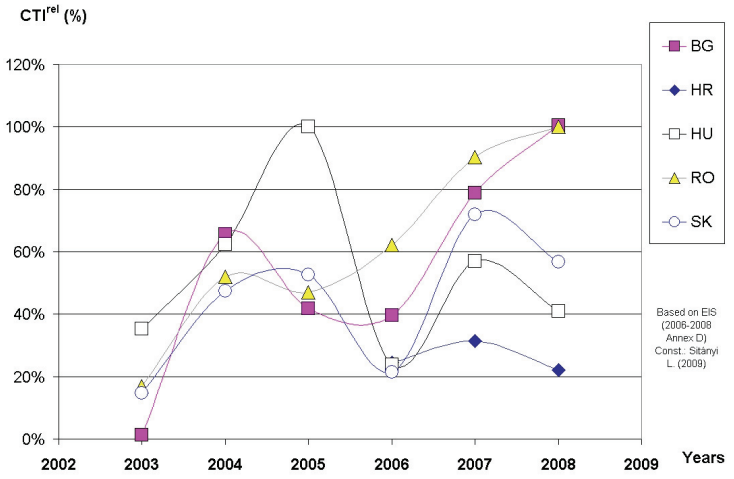
Source**:** Based on *Table 3*

Comparative development paths of innovation

As it can be seen in case of Hungary and Slovakia in *Figure 9* and especially in *Figure 10*, these curves show wavering performance without any obvious directions. After a relatively better starting position there cannot be seen any development even in comparison with Bulgaria and Romania that lag far behind the EU average.

Figure 10

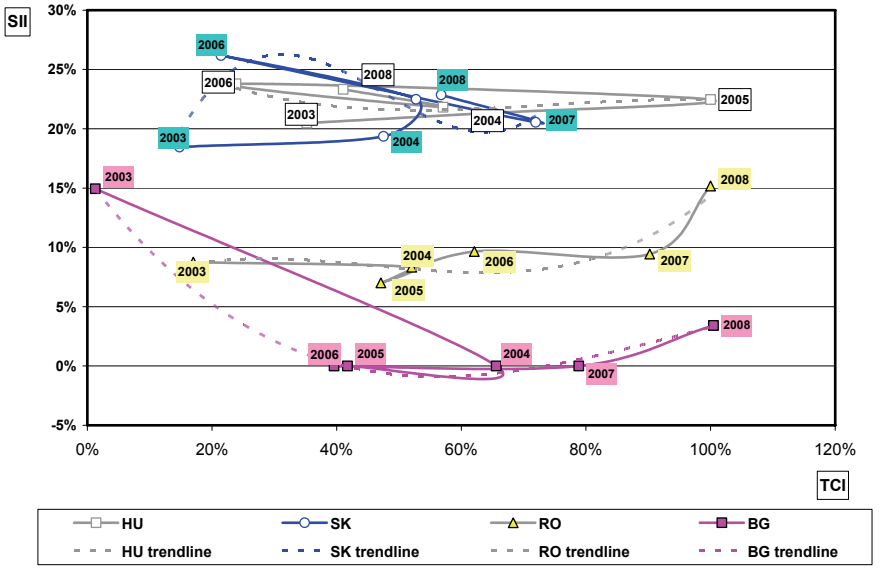
Relative change of innovation trend indicators of five countries (CTI^{rel}) between 2003 and 2008



Source: Based on *Table 4*

Figure 11

Innovation paths and third order trend lines of four countries in the relative SII (SII^{rel}) – CTI (CTI^{rel}) plan between 2003 and 2008



Source: Based on *Table 2* and *Table 4*

This can be seen well when the figures[19] of the four countries are illustrated in the relative SII-CTI (*Figure 11*). The similarity of the paths of Hungary and Slovakia is eye-catching, which paths do not show development and 'turn back into themselves'. It is especially well visible when the comparison is made to the development paths of Romania and Bulgaria, where a well defined development starting from 2005 can be seen – although from a much lower level. The following deals with the conclusions and recommendations on the basis of the facts published in the EIS reports.

REFERENCES

Archibugi, D., Denni, M., Filippetti, A. (2009): The Global Innovation Scoreboard 2008: The Dynamics of the Innovative Performances of Countries. Italian National Research Council, [online] <URL: http://www.proinno-europe.eu/index.cfm?fuseaction=page.display&topicID=5&parentID=51> [07.12.2009] 51 p.

Arundel, A., Hollanders, H. (2006): Trend Chart Methodology Report: Searching the forest for the trees: "Missing' indicators of innovation. Maastricht Economic Research Institute on Innovation and Technology [online] <URL: http://www.proinno-europe.eu/doc/eis_2006_methodology_report_missing_indicators.pdf> [08.04.2009] 27 p.

Arundel, A., Bordoy, C., Kanerva, M. (2008): Neglected innovators: How do innovative firms that do not perform R&D innovate? Results of an analysis of the Innobarometer 2007 survey No. 215, INNO Metrics 2007 report, European Commission, DG Enterprise, Brussels, 38 p.

Camagni, P.R. (1992): The concept of innovative milieu and its relevance for public policies in European lagging regions. Paper, presented at the 4th World Congress of RSA, Palma de Mallorca

van Cruysen, A., Hollanders, H. (2008): Rethinking the European Innovation Scoreboard: A New Methodology for 2008-2010. Maastricht Economic and social Research and training centre on Innovation and Technology (UNU-MERIT), Inno Metrics, Maastricht, [online] <URL: http://www.proinno-europe.eu/index.cfm?fuseaction=page.display&topicID=437&parentID=51#> [07.12.2009.] 43. p.

European Innovation Scoreboard, EIS (2001): European Commission, Enterprise Directorate-General, Innovation Directorate, Communication and Awareness Unit. Luxembourg, [online] <URL: http://www.proinno-europe.eu/index.cfm?fuseaction=page.display&topicID=5&parentID=51> [07.12.2009.] 42 p.

European Innovation Scoreboard, EIS (2002): European Commission, Enterprise Directorate-General, Innovation Directorate, Communication and Awareness Unit. Luxembourg, 30 p.

European Innovation Scoreboard, EIS (2003): European Commission, Enterprise Directorate-General, Communication and Awareness Unit. Luxembourg, 37 p.

[19] Croatia is left out of the comparison because its CTI index has been available since only year 2006.

European Innovation Scoreboard, EIS (2004): Comparative Analysis of Innovation Performance. Commission Staff Working Paper, European Commission, Luxembourg, 46 p.

European Innovation Scoreboard, EIS (2005): Comparative Analysis of Innovation Performance. Commission Staff Working Paper, European Commission, Luxembourg, 46 p.

European Innovation Scoreboard, EIS (2006): Comparative Analysis of Innovation Performance. Maastricht Economic Research Institute on Innovation and Technology (MERIT) and the Joint Research Centre (JRC, Institute for the Protection and Security of the Citizen) of the European Commission, Luxembourg, 46 p.

European Innovation Scoreboard EIS (2007): Comparative Analysis of Innovation Performance. European Commission, Directorate-General for Enterprise and Industry, Office for Official Publications of the European Communities, Luxembourg, 60 p.

European Innovation Scoreboard, EIS (2008): Comparative Analysis of Innovation Performance. Maastricht Economic Research Institute on Innovation and Technology (UNU-MERIT), Luxembourg, 58 p.

European Council (2000): Presidency Conclusions 'Lisbon Strategy', Lisbon, [online] <URL: http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/00100-r1.en0.htm> [07.12.2009.] 26 p.

FORA (2007): Innovation Monitor 2007. Danish Enterprise and Construction Authority's Division for Research and Analysis, Copenhagen, 225 p.

Grupp, H. (2006): How robust are composite innovation indicators for evaluating the performance of national innovation systems? University of Karlsruhe and Fraunhofer Institute for Systems and Innovation Research, Karlsruhe

Hollanders, H. (2006): European Regional Innovation Scoreboard. Maastricht Economic and social Research and training centre on Innovation and Technology (MERIT) Luxembourg, 41 p.

OECD (1992): Oslo Manual – Proposed Guidelines for Collecting and Interpreting Technological Innovation Data. Paris

OECD (1993): Frascati Manual – The Measurement of Scientific and Technological Activities. Proposed Standard Practice for Surveys of Research and Experimental Development. Paris

OECD (1995.): Canberra Manual – The Measurement of Human Resources devoted to S&T. OECD GD(95)77, Paris

Pap N., Sitányi L. (2007): The Role of Innovation in the Area Development. (In Hung.) László M., Pap N. (szerk.): Bevezetés a terület- és településfejlesztésbe, Lomart, Pécs, 115-139. p.

Rammer, C. (2005): Comments on EIS Improvements for 2005. Centre for European Economic Research (ZEW), Mannheim,

Sajeva, M. at al. (2005): Methodology Report on European Innovation Scoreboard. European Commission, Enterprise Directorate-General, JRC and MERIT, Luxembourg, 71 p.

Sitányi L. (2008): Competitiveness of Carpathian-Balkan Countries Based on Innovation Milieu. (In Hung.) Reményi P., Szebényi A. (szerk.): V. magyar politikai földrajzi konferencia: A nagy terek politikai földrajza, PTE TTK Földrajzi Intézet, Pécs, 445-459 p.

Szendrődi L. (2003): Annual Report about Science and Technology. (In Hung.) Oktatási Minisztérium Kutatás-fejlesztési Helyettes Államtitkárság, Brüsszel, 54 p.

Corresponding author:

László SITÁNYI
H-7400 Kaposvár, Szántó u. 5.
Tel.: +36-825-27984, Fax: +36-82-527-998
e-mail: sitanyi@somogy.hu

Annex 1

Country abbreviations

AT	Austria	FI	Finland	NL	Netherlands
AU	Australia	FR	France	NO	Norway
BE	Belgium	HR	Croatia	PL	Poland
BG	Bulgaria	HU	Hungary	PT	Portugal
CA	Canada	IE	Ireland	RO	Romania
CH	Switzerland	IL	Israel	SE	Sweden
CY	Cyprus	IS	Iceland	SI	Slovenia
CZ	Czech Republic	IT	Italy	SK	Slovakia
DE	Germany	JP	Japan	TR	Turkey
DK	Denmark	LT	Lithuania	UK	United Kingdom
EE	Estonia	LU	Luxembourg	US	United States
EL	Greece	LV	Latvia		
ES	Spain	MT	Malta		