HUNGARY AND THE NEIGHBOURING COUNTRIES' INNOVATION POSITION BASED ON EUROPEAN DATA

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ABSTRACT

With the present study I wanted to achieve three goals. Based on the secondary analysis – carried out in summer 2009 - of the data of the "European Innovation Scoreboard" between 2000 and 2008 I wanted to point out the importance of social capital, which among others has a significant role in establishing the networks necessary to the development of innovation. After that I wished to present a method. With this method the changes of many years in the relative position of each country can be demonstrated despite the annually modified indicators. And finally with the help of this method I wished to define the position of Hungary and the neighbouring countries on a *relative European innovation plane*.

JEL clasiffication: M12, M21

Keywords: Social capital, innovation, relative European innovation plane

INTRODUCTION

"*Hungary has set out on the path of convergence in the past few years*" could be read on page 7 in the 2009-2010 Hungarian Research Development and Innovation Action Programme (INNOVATIVE HUNGARY PROGRAMME 2009). Is it really like that? Or is it just the usual magic formula, i.e. if we keep saying it, maybe others will also believe it, and finally it will come true? It is good, if it is so, but if it is not true and we cherish illusions, it will be a problem in the long run. Because, if it is not like that, we can deceive only ourselves. The world, and by now our neighbours belonging to Europe (since all our neighbours belong to Europe from an economic point of view, no matter they are members of the European Union or not) are not interested in our by-gone glory[1]. Today people buy products and services

[1] "Between the two World Wars our country set an example to the world in research-development and in how to put the results successfully into practice after the appropriate selection of focus." (Innova-

in an ever accelerating competition, where a few months' difference can determine the market fate of each product. Revelation and sincere assessment of our position; these are the bases to initiate all developments. Every student studying regional development in higher education knows that. Let's take a look at where we are on this "path of convergence" and let's be realistic! Let us not compare ourselves to the world's most developed countries, but to our neighbours – who also do not have the most developed innovation achievements[2] in Europe and worldwide.

As we know innovation systems can be distinguished not only at national, but also at global, 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 N. – Sitányi L. 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 common language and common culture.

The author of this article attempts to draw the relative innovation path of the six neighbouring countries of In-Between Europe (Figures 15, 16 and 17) 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, and its major changes with the help of a graph (Figure 1) as well as the change of the innovation indicators in a table (Appendix 1 Table 5).

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.

tive Hungary Program 2009 pp.7.)

[2] Obviously we are aware that innovation and the increase of innovation performance itself is not a goal. However, we also know that corporate innovation improves the firms' innovation performance and efficiency. Similarly the countries' innovation activities and their support can improve their economic performance.

MEASURING INNOVATION PERFORMANCE IN THE EU

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).

At present forty studies and database can be found on the organization's home page (OECD 2009). On the one hand they include reports, innovation analyses, surveys, statistics, and data. On the other hand they are manuals, which recommend research methodologies and questionnaires, indicators. All innovation related writings of today are based on the principles defined in these documents, which greatly contribute to the measuring of the achieved results in the innovation improvement of different countries, blocks of countries and regions as well as to the comparison of these data.

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[3].

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[4]) – and beyond that 14 other countries[5] spending the most on R&D were examined. (ARCHIBUGI D. AT. AL. 2009, pp.13.). 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

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

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

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

calculations were made based on 9 EIS-2008 indicators instead of 29 (EIS[6] 2008 pp.25). 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[7], and to do so the EIS is a suitable base.

THE CHANGING OF THE EU'S INNOVATION STATISTICAL SYSTEM 2000-2010

Nowadays it has been generally accepted in relating literature that innovation and the innovation environment, milieu (CAMAGNI, P.R. 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 gathering, the method of comparing and analyzing them have been continuously developing, changing and refining (European Innovation Scoreboard, 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

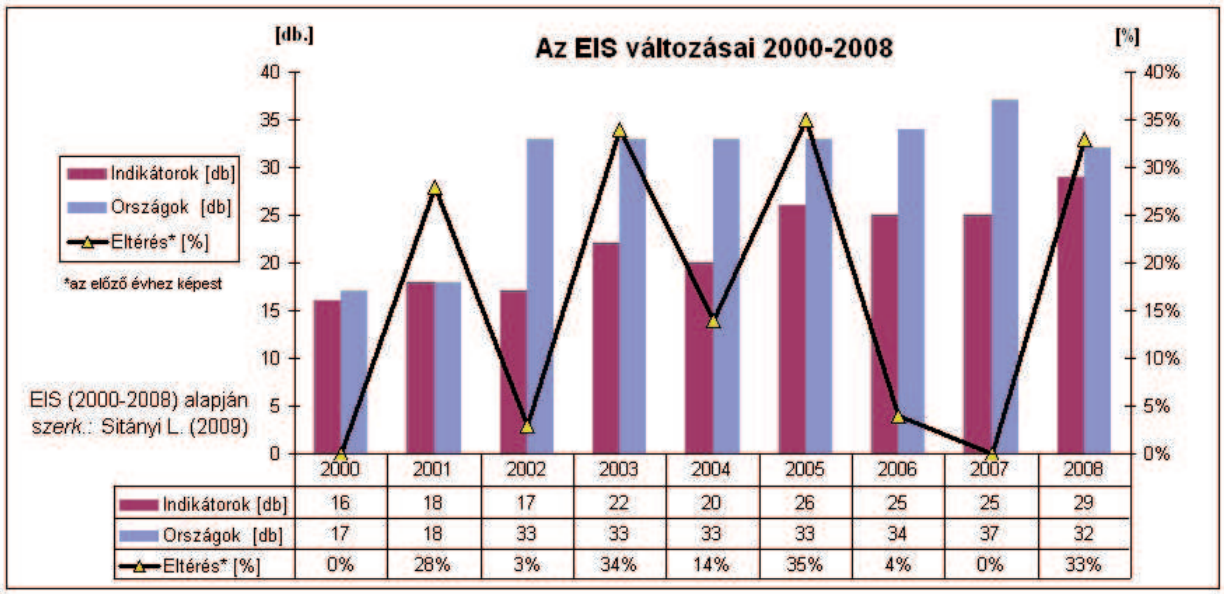
[6] Published: EIS, European Innovation Scoreboard (2008) Comparative Analysis of Innovation Performance. Maastricht Economic Research Institute on Innovation and Technology (UNU-MERIT), Luxembourg, p.58

[7] 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 L. 1995)

its basic principles passed when the institution was established (HOLLANDERS, H. – VAN CRUYSEN, A.).

- *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[8] during the years (*Figure 1.*).
- *Transparency, publicity:* all results can be recalculated, controlled; not only the annual reports but also methodologies, calculation methods[9] 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.)

1. Figure: 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
Indikátorok [db]	16	18	17	22	20	26	25	25	29
Országok [db]	17	18	33	33	33	33	34	37	32
Eltérés* [%]	0%	28%	3%	34%	14%	35%	4%	0%	33%

Source: construction by Sitányi L. (2009) based on EIS (2000-2008) [EIS 2000-2008 and HU.xls]

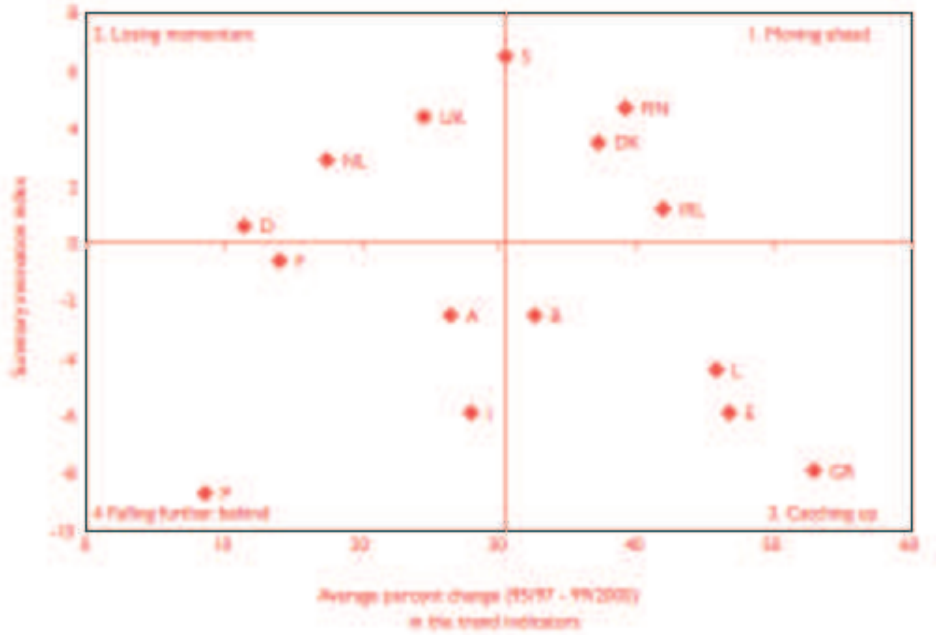
[8] For example the FORA Innovation Monitor (FORA, 2007) applies more than 170 indicators, most of them developed by itself.

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

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.

EUROPEAN INNOVATION SCOREBOARD, 2001

2. Figure: Summary innovation index and its change in 2001



Source: European Innovation Scoreboard, (2001. pp.12.)

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). 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 (European Innovation Scoreboard[10] 2001 pp.8). 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 pp.5) 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. 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* (European Innovation Scoreboard, 2001. pp.20.) therefore conclusions should be drawn carefully.

European Innovation Scoreboard, 2002

In 2002 the examination was extended to three associate[11] and 13 candidate countries[12], 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[13] (European Innovation Scoreboard[14] 2002. pp.5.) compared to the previous year.

- Human resource supporting innovation (5 indicators),

[10] Published: European Commission, Enterprise Directorate-General, Innovation Directorate, Communication and Awareness Unit, Luxembourg, p.42

[11] Associate countries: Iceland, Norway, Switzerland

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

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

[14] Published: European Commission, Enterprise Directorate-General, Innovation Directorate, Communication and Awareness Unit, Luxembourg, p.30

- 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 research also, has continued in the coming years; namely to publish separate studies on actual 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, H. – van Cruysen, A. 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.

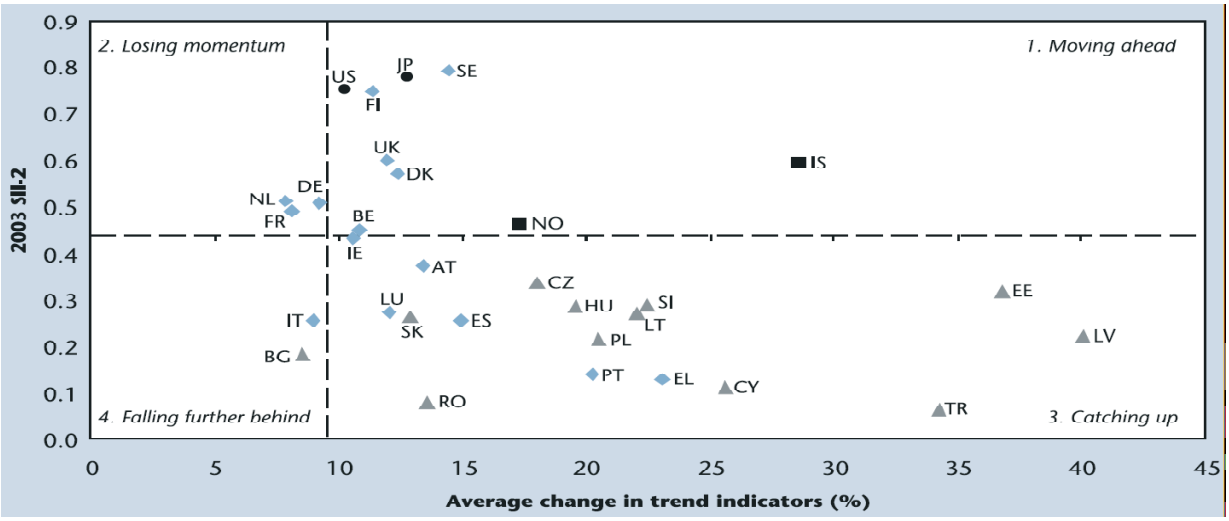
- **SII-1:** The index, made of all 22 indicators is used to calculate the innovation performance of the 15 EU Member States and the associate countries (Iceland, Norway, and Switzerland).

- **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) (Figure 3.).

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 (European Innovation Scoreboard[15] 2003 pp.11) 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.

3. **Figure:** Summary innovation index and its change in 2003



Source: European Innovation Scoreboard, (2003. pp.10.)

EUROPEAN INNOVATION SCOREBOARD, 2004

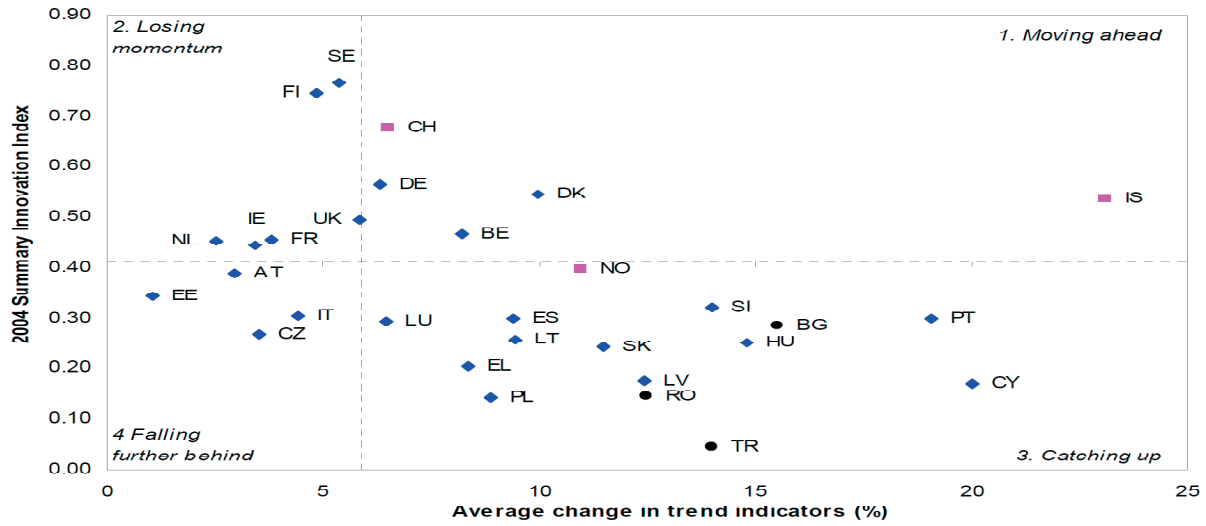
The number of countries (33) did not change that year, however their "definition" did because of the ten new EU Member States. Besides the 25 EU Member

[15] Published: European Commission, Enterprise Directorate-General, Communication and Awareness Unit, Luxembourg, p.37

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 (European Innovation Scoreboard[16] 2004 pp.8) 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).

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



Source: European Innovation Scoreboard, (2004. pp.10.)

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.

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

EUROPEAN INNOVATION SCOREBOARD, 2005

In 2005 based on half a decade of experiences of EIS, and in close cooperation with the Joint Research Centre[17] 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 (European Innovation Scoreboard[18] 200. pp.8.) 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, H. – Van Cruysen, A. 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, M. At. Al. 2005).

Input indicators[19]:

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

Output indicators[20]:

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

[17] 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)

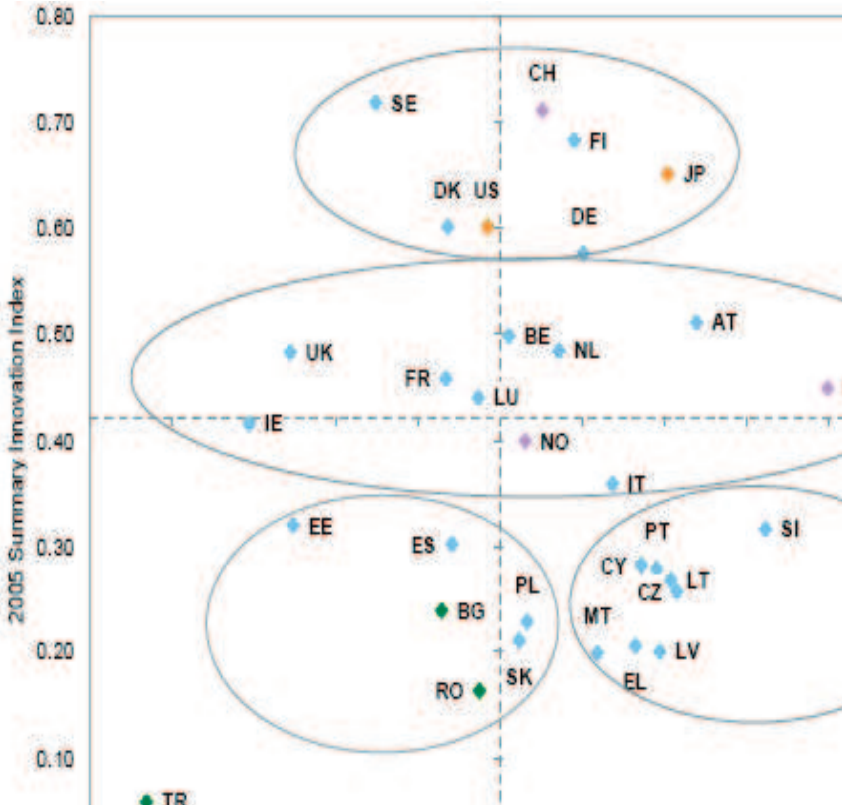
[18] Published: EIS (2005) Comparative Analysis of Innovation Performance, Commission Staff Working Paper, European Commission, Luxembourg, p.46

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

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

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. In 2005 the report illustrates their geographical positions on map (*Figure 6*), from which it is clear that the leading countries are located in the northern-central part of Europe, while the countries losing ground can be found in the southern-eastern areas (European Innovation Scoreboard[21] 2005). A rather obvious fact[22]– which probably does not have to be proved, and which is quite apparent – is that the examination of the national indexes and their geographical illustration by countries can only be slipshod, it would be necessary to zoom at least the regional level so that the developed and undeveloped European areas could be separated (Sitányi L. 2008).

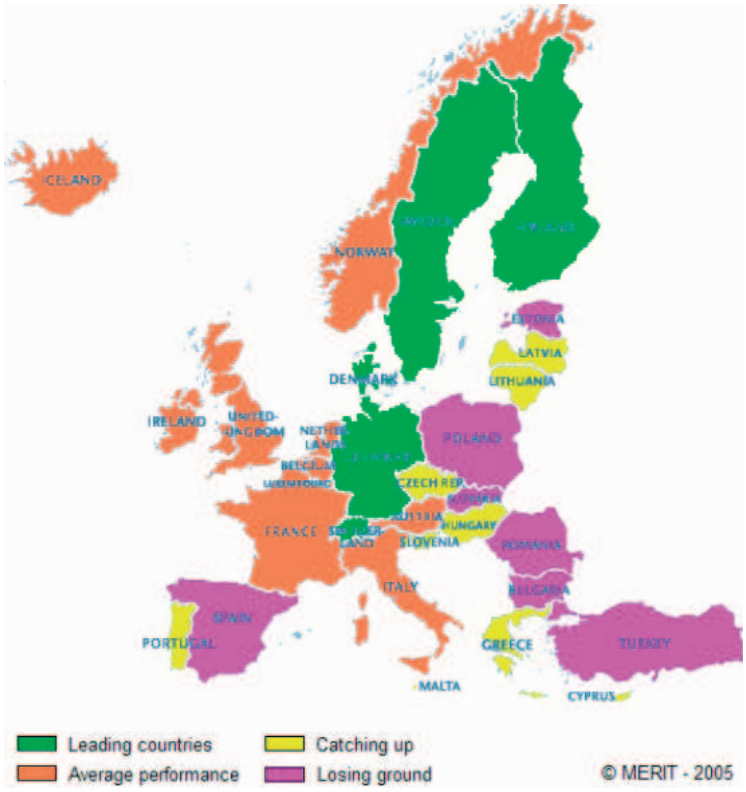
Figure 5: Summary innovation index (SII, Y axis) and its change (%, X axis) in 2005



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

[22] It is enough if we think of the difference for example between the northern part of Italy belonging to the most developed part of Europe (blue banana, EU pentagon) and the undeveloped southern part, which is burdened with economic and social problems.

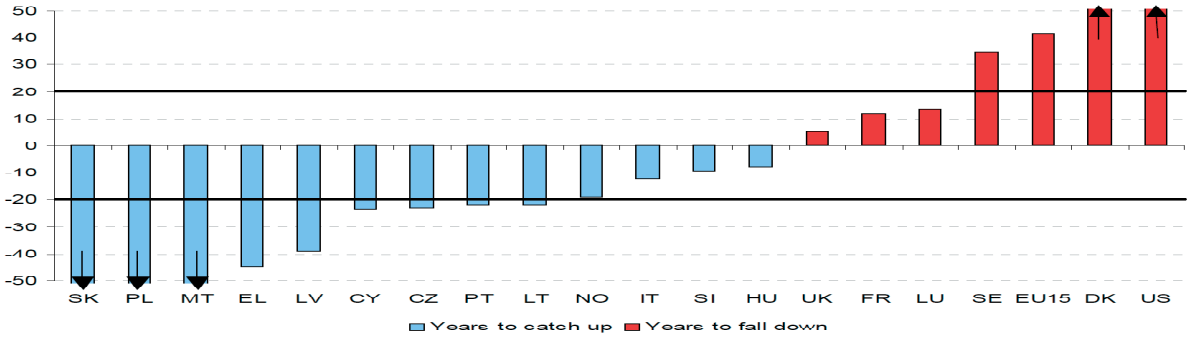
Figure 6: Summary innovation index and groups of countries based on change (%)



Source: European Innovation Scoreboard, 2005

In 2005 a new index number and a graph describing it were introduced. The graph determines the number of years, which are needed for a country to reach the EU-25 average with a simple linear extrapolation. The index number was calculated on the basis of the 2005 performance and growth rate of each country and it clearly shows that based on the 2005 trend-data, and the countries' position and rate of development the convergence of performances could not be expected in the short run. None of the lagging behind countries had any hopes to reach the innovation average of the EU within five years. Slovenia, Hungary (and Italy among the candidate countries) had the chance of it in range of 8-10 years. This type of prediction forecasts 20 years or more in 2005 for the rest of the countries.

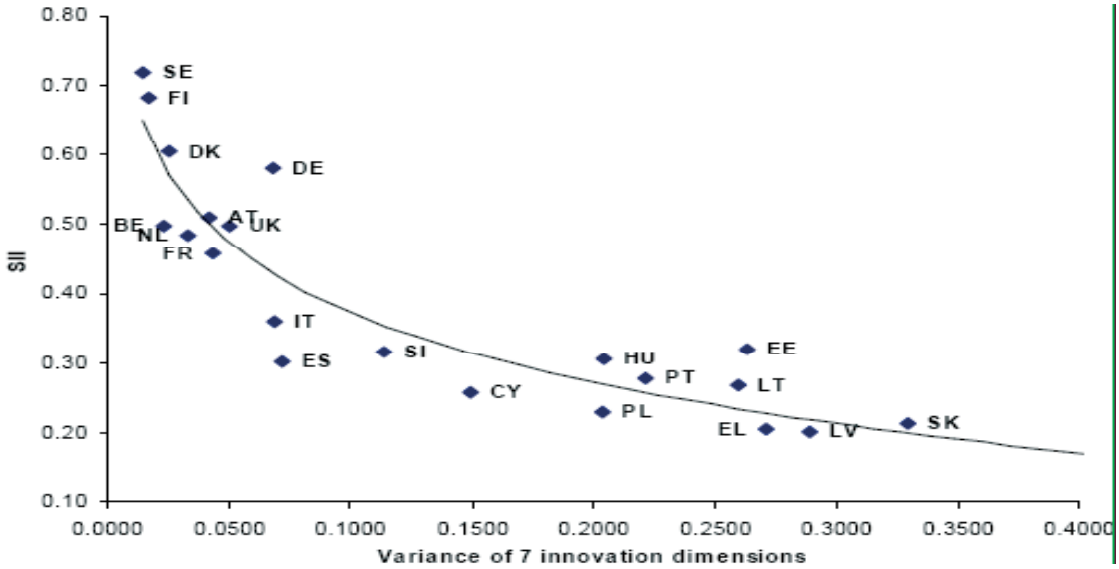
Figure 7: The number of years needed for each country to reach the EU-25 average



Source: European Innovation Scoreboard, 2005

From the aspect of regional development, and generally from the aspect of development policy a very important realization of the year was that negative correlation was found between innovation performance and the variance of certain characteristics. Data in leading countries were uniformly higher, while among less developed countries deviance was bigger between the different innovation indicator groups and dimensions.

Figure 8: Negative correlation between SII value and the variance of 7 innovation dimensions



Source: European Innovation Scoreboard, (2005. pp.30.)

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.

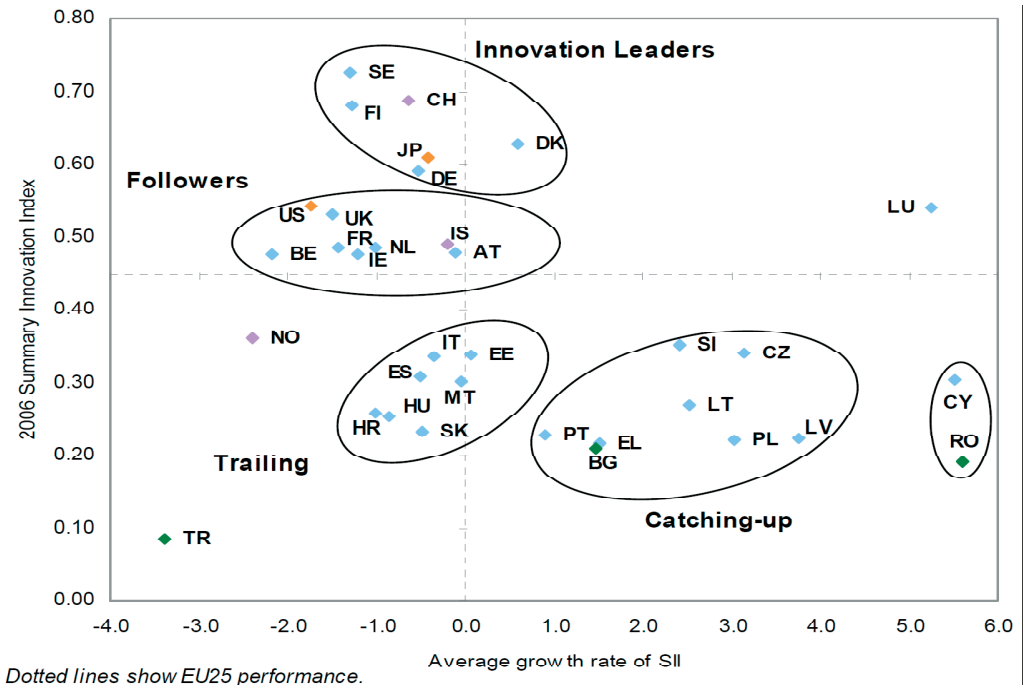
EUROPEAN INNOVATION SCOREBOARD, 2006

As you can see at first glance from Figure 9, 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 any of the groups, therefore they remained separate.

Figure 9: Summary innovation index (SII, Y axis) and its change (%, X axis) in 2006



Source: European Innovation Scoreboard, (2006. pp.9.)

Following the significant modification in the previous year there was only a slight 4% methodological change in 2006 (Arundel, A. – Hollanders H. 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 8 and 9, 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 calculating from these data must be drawn very carefully!

In other respects however, there was a change in the attitudes. While in the 2005 report the number of years necessary for a country to reach the EU-25 average was determined with a simple linear extrapolation, in 2006 it was announced that "innovation is not a linear process" (European Innovation Scoreboard[23], 2006 pp.10.) and no graph illustrating it was published. 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.

A regional innovation scoreboard was published only in 2002 and 2003 for the same 15 member states of EU. It was done again in 2006 with 25 member states and 208 regions. In numbers it meant a 20% growth, however, because of the deficiencies in the regional data of new member states they had to overcome serious methodological obstacles. When calculating the regional innovation scoreboard the previous 13 regional indicators had to be decreased to 7; and these were used to make calculations and draw conclusions.

It was when the European Commission decided to prepare a regional innovation scoreboard biannually, however, the 2008 publication is still to come.

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,

[23] Published: 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, p.46

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 10*).

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. The fact whereas leader countries produce excellent performance in all five dimensions, and the follower group is also above the EU average in almost every dimension did not change. This analysis also confirms the experiences of previous years: *lasting results can be achieved only by developing every single element of the innovation system.* A visible contrast between the two "elites" and the two lagging behind groups is that members of the backward groups do not produce results uniformly in the different dimensions (European Innovation Scoreboard[24], 2007).

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

Figure 10: Summary innovation index (SII, Y axis) and its change (%, X axis) in 2007

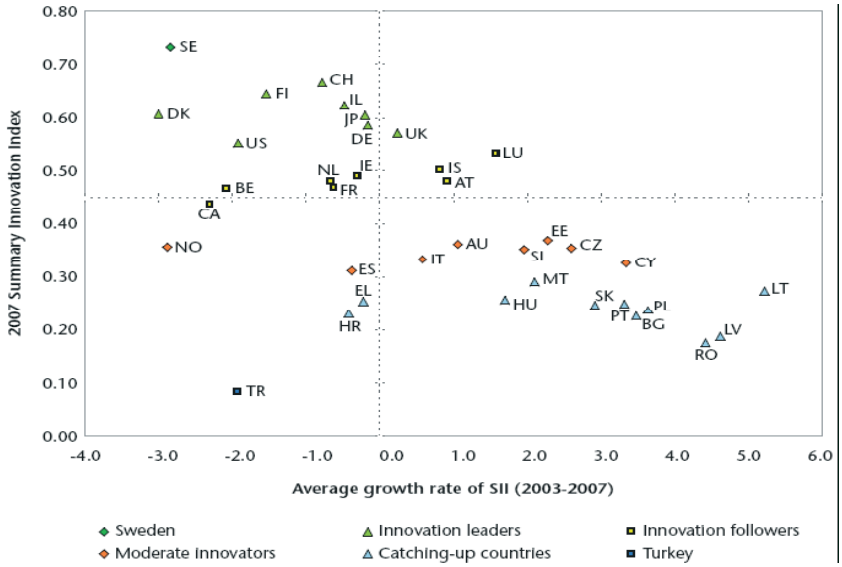
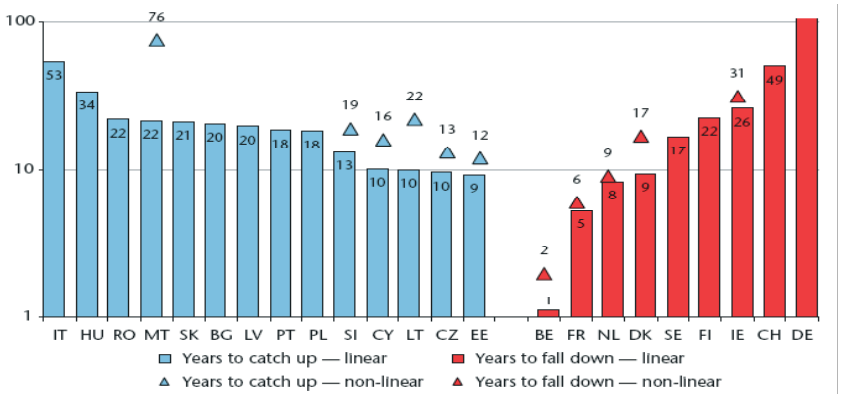


Figure 11: The number of years for countries to reach the average of EU-25



Source: European Innovation Scoreboard, 2007

12. Figure: The relative impact of social, economic and regulatory environment on innovation performance

Table 3 Relative importance of socio-economic and regulatory environment for explaining differences in innovation performance

	SII	Innovation drivers	Knowledge creation	Innovation & entrepre-neurship	Appli-cations	Intellectual property
DEMAND CONDITIONS						
Youth share						
Buyer sophistication		+				
Government procurement	++			+		
Demanding regulatory standards	++					
SOCIAL CAPITAL						
Trust	+++	+++		++		+
Perception of corruption	+++	++		+++		
INSTITUTIONAL FRAMEWORK						
Burden of administration	+	++		++		
Quality of educational system	+			+		
Intellectual property protection	+					
Price stability	++					++
MARKET EFFICIENCY						
Intensity of local competition	++			+	+	
Foreign ownership restrictions	+				++	
Flexibility of wage determination	++	+++				
Financial market sophistication						
TECHNOLOGY FLOWS						
Brain drain						
Firm-level technology absorption	+++			+++	++	+
University-industry research collaboration	+++	++	+	+++	+	
SOCIAL EQUITY						
Social protection expenditure						
Income equality	++		++		+++	
Employment rate		++		+++		
(INNOVATION) GOVERNANCE						
Voice and accountability						
Political stability	+			+		
Government effectiveness	+	+++		+		
Regulatory quality	+	+		+		
Rule of law					+	
Control of corruption	+					

+++: Strong correlation between variation in indicator and innovation performance; ++: Moderate correlation; +: Weak correlation.

Source: European Innovation Scoreboard, (2007. pp.21.)

Perhaps it was the reason why the graph illustrating the "*catching-up years*", the estimated time reaching EU average came back (abandoned in 2006). The graph was completed with non-linear estimations. A sad fact is that in 2005 *Hungary* was (*together with Slovenia*) *in the leader group, in a below-ten-year position*, and in 2007 it is next to the last. According to the 2007 linear estimation only Estonia, the Czech Republic, Lithuania and Cyprus are below ten years. Characteristically

the non-linear values are much higher than these, since this model presumes the decrease of the countries' growth rate over time (*Figure 11.*)

2007 was the year when the impact of social, economic and regulatory environment on innovation performance was examined for the first time, and there was an attempt to find the factors, which help understand they differ so much in the case of countries and country groups. The analysis establishes that two categories are in close relationship with the summary innovation performance: *social capital* and *technology flow* (*Figure 12*).

These two categories also have effect on the level of firms' innovation performance, which consists of six indicators[25]. The results supports that development policy should be based on growing confidence level and developing co-operation, which can be achieved by supporting innovation networks and innovation co-operations.

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[26]. 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 another five were newly involved (Hollanders, H.–van Cruysen, A. 2008).

[25] Firm indicators: SMEs innovating in-house, SMEs cooperating in innovation, Innovation expenditures, Early stage venture capital, ICT expenditures, share of SMEs using organizational innovation

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

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 (Annex 1 /Table 6):

1) Enablers, that 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 has undergone several changes over time, mainly in 2003 and 2005 (Figure 1) and only 13 indicators were used across all Scoreboards (Annex 1 / Table 5).

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 – 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, A. at 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 13) and only three countries changed their groups[27]. The gap between the most innovator and the least innovator groups is similarly visible to that in 2007 (European Innovation Scoreboard[28], 2008 pp.9).

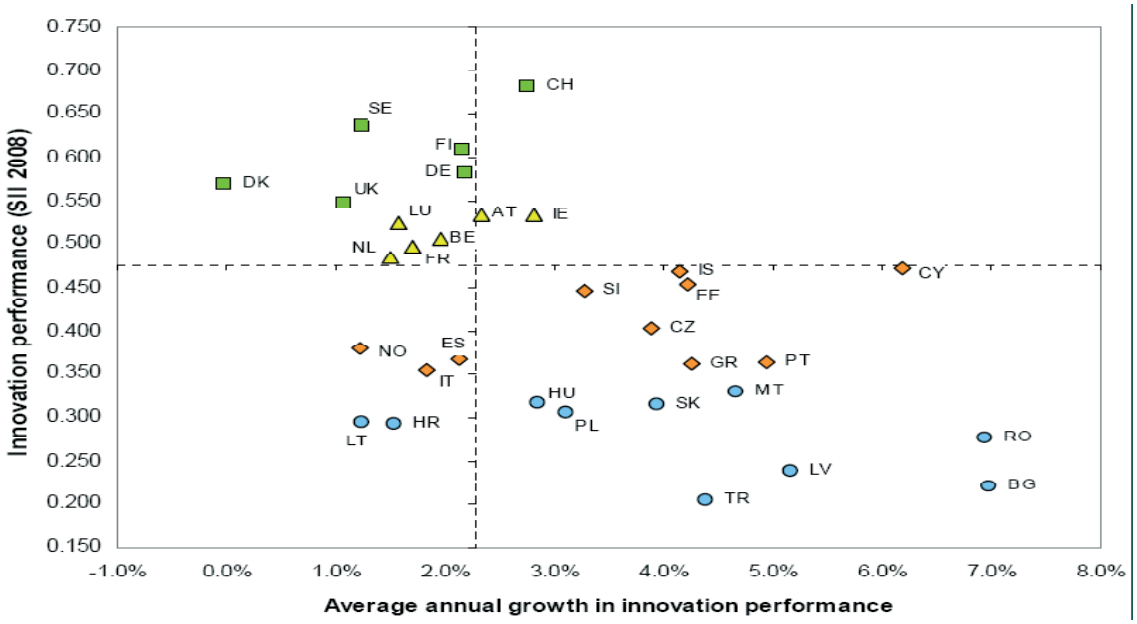
[27] Leaders (1) remain the same, Iceland fell into the group 'moderate innovators'(2) from 'followers'(3) while Portugal and Greece stepped into the group 'moderate innovators' (3) from catching up countries(4).

[28] Published by EIS (2008) Comparative Analysis of Innovation Performance. Maastricht Economic Research Institute on Innovation and Technology (UNU-MERIT), Luxembourg, p.58

It is similarly seen in 2008 that had been reported in 2005 *(Figure 8)* already, that is, the pattern of innovation performance is more balanced in developed countries. The difference between the two more and less developed groups is even more visible across the new indicator and measure system from this aspect, when the overall variance across the seven dimensions is considered:

- the heterogeneity is rather small within the groups *'innovation leaders'* and *'followers'* (0,14%);
- while this figure is higher in case of *'moderate innovators'* and *'catching-up countries'* (0,65% and 0,63%).

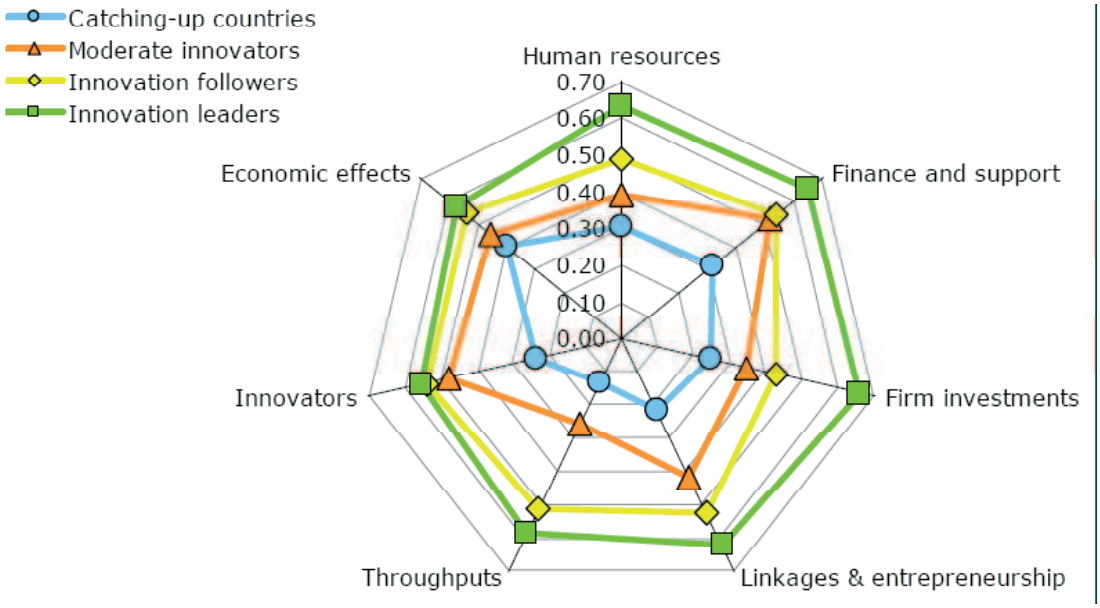
Figure 13: Summary Innovation Index (SII) and its average annual growth (%) in 2008



Source: European Innovation Scoreboard, (2008)

Figure 14 shows the significant differences found between the development levels across the dimensions. In addition, this difference is still visible when the average figures of the country groups were considered; although the use of averages may have had a balancing effect.

Figure 14: Innovation performance in country groups by 7 dimensions in 2008



Source: European Innovation Scoreboard, (2008)

Hungary's performance is very low in three out of the seven dimensions:

- Hungary is the one before the last country from the aspect of the output value of innovation (Innovators),
- Only three countries follow us in Finance and support (investment in innovation),
- And in Human resource the country stands at the 28th place followed by only four countries in the rank order. (European Innovation Scoreboard, 2008 pp.16.)

In addition, considering the CTI, the country's growth performance is also the worst in Human resource: it overtakes only two countries on the 30th place (European Innovation Scoreboard, 2008 pp.16.).

GENERAL CRITICS ON THE EIS REPORTS 2001-2007

Apart from the undoubted positives 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. These can be illustrated, for instance, with two Hungarian examples:

- Hungary was the first in 2005 in Europe from the aspect of the average annual growth rate of SII;
- While in the next year it was lower than the EU average;

or:

- While the linear estimation for reaching the EU average was 8 years in 2005;
- In 2007 it was 34 years.

As because it is not likely that the overall innovation system of a certain country changes at such speed in such a short time, we assume rightly that the calculation methods need further refinement.

EIS researchers were criticised by experts of other countries as well. 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 out of consideration the differences of economic structures of the increasing number of involved countries;
- The five innovation dimensions been introduced in 2005 (Sajeva, M. at al.) do not cover several aspects of innovation processes29.

Hariolf Grupp (2006), Adriana van Cruysen és Hugo Hollanders (2008), and Christian Rammer (2005) mention further interesting aspects in their works; out of them, the following are the most important:

- The use of a single composite indicator and of the growth rate of it 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;

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

- 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[30], which runs the risk of comparing the innovation performance across countries fairly;
- Higher value of the indicator not necessarily reflects a better innovation performance[31]. It is a relating question whether what is the optimal value for given indicator, which results in the best innovation performance. In addition, these optimal values may also differ across countries. (Rammer 2005)

SUMMARY

The group of analysed countries

The geographic area analysed from the aspect of innovation is primarily Hungary, therefore, those countries ant 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 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 Middle Europe, in the 'moving border zone' of the modern history of Europe (Pándi L. 1995)
- They have experienced a socialist planned economy of four decades;
- In the nineties, they tried to catch up to 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;

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

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

- These countries joined to the EU in 2004[32], their society and economy has become open and they needed to harmonise their legal system with acquis communautaire.

Concluding from the above mentioned, it is advisable to analyse six countries: Bulgaria, Croatia, Hungary, Romania, Slovakia and Slovenia. 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 changes 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 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 misbelieves, evaluate 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 year33, these recalculated SII figures vary from those published in earlier EIS reports. In his analysis, the author presuming that the system of data

[32] 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.

[33] 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, pp.8 and pp.58)

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).

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
SI	0.321	0.323	0.388	0.393	0.412	0.429	0.446
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: Own construction based on EIS 2006, 2007, 2008; Annex D

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

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

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

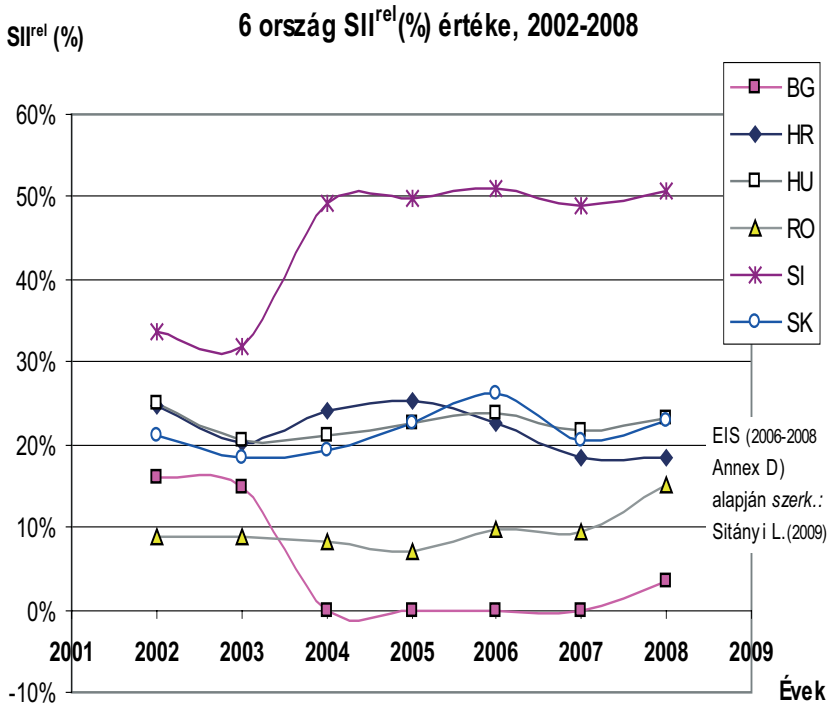
where SII_{min} is the minimum, SII_{max} is the maximum SII figure and SII_i is the figure for "i' country.

Table 2: Relative SII (SIIrel) for the six involved countries between 2002 and 2008

Range	0.665	0.724	0.440	0.441	0.459	0.456	0.477
SIIrel	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%
SI	33.80%	31.80%	49.08%	49.73%	51.00%	48.96%	50.60%
SK	20.99%	18.46%	19.35%	22.48%	26.17%	20.54%	22.86%

Source: Own calculation based on Table 4

Figure 15: Relative innovation performance ($SIIr^{el}$) of the involved six countries between 2002 and 2008



Source: Own calculation based on Table 5

The innovation path of the analysed countries is pictured by the graph of the annual relative SII data *(Figure 15)*. Figure 15 shows that the innovation performances of the analysed countries are varying in the lower quartile of the European SII level. Except for Slovenia, where the SII figure reaches double of the previous ones, and since 2004 it has levelled around 50%.

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.

The 'relative change of trend indicator' of the analysed countries is pictured by the graph of the annual relative CTI *(CTI^{rel})* data *(Figure 16),* which show greater variation than SII paths.

Table 3: Innovation trend indicators in the involved six countries (CTIrel) between 2003 and 2008

CTI	2003	2004	2005,00	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%

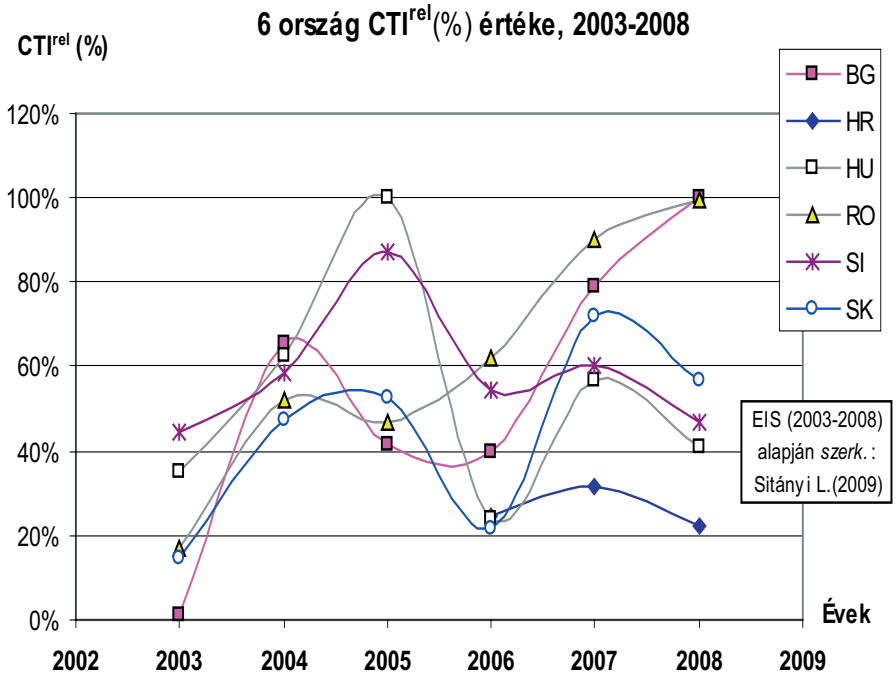
Source: Own calculation based on EIS 2003-2008

Table 4: Relative change of innovation trend indicators of six countries (CTIrel) between 2003 and 2008

Range	0,318	0,221	8,631	3,064	8,235	0,070
CTIrel	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: Own calculation based on Table 6

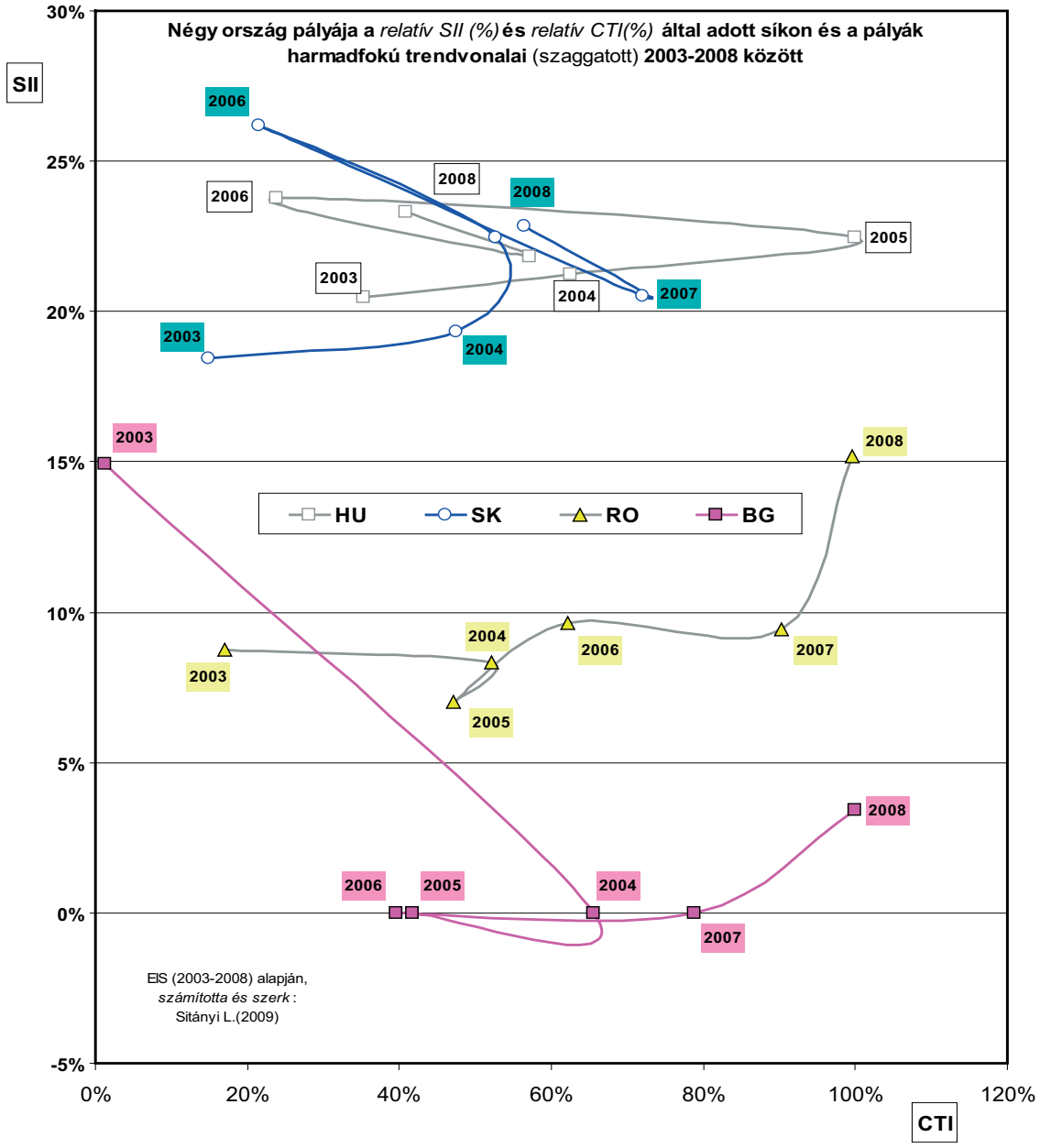
Figure 16: Relative change of innovation trend indicators of six countries (CTIrel) between 2003 and 2008



Source: own construction based on Table 7.

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 plane (Figure 17).

Figure 17: Innovation paths and third order trend lines of four countries in the relative SII (SIIrel) – CTI (CTIrel) plane between 2003 and 2008



Source: own construction based on Table 5 and Table 7

CONCLUSIONS

Comparative development paths of innovation

As it can be seen in case of Hungary and Slovakia in Figure 15 and especially in Figure 16, these curves show wavering performance without any obvious directions. After a relatively better starting position there can be not seen any development even in comparison to Bulgaria and Romania that lack far behind the EU average.

This can be seen well when the figures[34] of the four countries are illustrated in the relative SII-CTI plane *(Figure 17)*. 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 development paths of Romania and Bulgaria, where a well defined development starting from 2005 can be seen – although from a much lower level.

Thus, it can be stated on the basis of data of six years between 2003 and 2008 and the graphs of these data (Figures 15, 16 and 17) that it is an illusion to think that either Slovakia or Hungary "proceeded in their development in the last few years' that was read in the Action Programme for Research-development and Innovation 2009-2010-es (Innovative Hungary Programme 2009 pp.7).

The following deals with the conclusions and recommendations on the basis of the facts published in the EIS reports.

Definition of directions of innovation development

From the aspect of the regional development policy or more importantly of the development policies it was a significant recognition of several EIS reports (2005, 2007, 2008) that negative correlation exists between innovation performance and the variance of certain parameters *(Figure 8 and 14)*. The figures of the leader countries represent a high level uniformly; higher variation of various innovation indicators was typical for less developed countries.

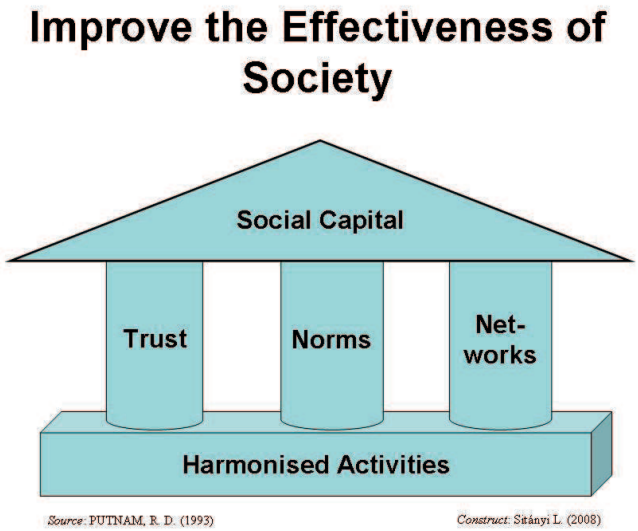
The conclusion seems to be obvious that *parallel development of several dimensions is necessary; it is not possible to achieve high level of innovation performance*

[34] Two countries are left out of the comparison: Slovenia, because it has an SII level double of the maximum SII figures of the four countries; and Croatia, because its CTI index has been available since only year 2006.

sustainable in the long term if efforts are made on the development of some of the dimensions while others are neglected. From the aspect of defining the development directions, this means that – assuming given budget –the development policy should focus on the improvement of less developed areas instead of further fostering the strengths (which is unfortunately not easy but necessary). Such type of development policy may contribute to the establishment of an innovation environment, where development, invested money and efforts made can achieve their objectives and provide high quality and high added value products in a way that it ensures the final objective of all developments, that is, the improvement of well-being of local population.

Innovation catch-up years

The estimated years to catch-up the EU average were calculated in the EIS Reports 2005 and 2007, which was supported by non-linear calculations in 2007. As it was seen on graphs *(7 and 11)* on the estimated catching-up years, only Estonia, the Czech Republic, Lithuania and Cyprus have less than 10 years according to linear model. Slovenia is at the fifth position with 13 years. Hungary, *one of the leaders in 2005 with 10 years*, would only reach the EU average in 34 years(!) according to the calculations in 2007. With this figure, Hungary is at the one before the last position in the EU country rank order. Typically, the nonlinear figures are higher, longer catching-up periods, because this model assumes a degressive country growth rate over time.



Linkage of social capital and trust to innovation performance

According to Fukuyama, F. (1995) economic life inseparable from culture: such "irrational' values that are in relation with morals, community, family or religion. Therefore, major task of modern society is to preserve or establish high level of social trust or social capital, because the lack of this is a barrier of economic growth at an extent at least as the shortage of physical capital. According to Robert D. Putnam (1993): "social capital derives from the characteristics of social organisations such as trust, norms and networks, which may contribute to the efficiency of society by promoting the coordination of actions'.

EIS researchers investigated the impacts of the social, economic and legal environment in 2007 in order to find out hose factors that influence the innovation performance. This EIS Report found also that two categories are in close relation with innovation performance*: social capital and technological flow*. It was also found that these categories are determinant to the *entrepreneur innovation performance*, as well. The result above proved that development policy should be built on the improvement of social trust and cooperations, which can be achieved by supporting innovation networks and cooperations. In the same year Esser (2007 pp.21.) demonstrated that the *summary innovation index was mostly related to the following*:

- Control of corruption;
- Efficiency of government;
- Legal regulation.

Balanced development of innovation in Hungary

Hungary's performance is very low in three out of the seven dimensions in 2008: innovators, finance and support and human resource. This later is especially sad because the leader countries are strong in this dimension, and its maybe not necessary to prove its long-term negative effect: entering the knowledge-based society of the future without knowledge seems not to be a good perspective.

In addition, considering the CTI, the country's growth performance is also the worst in Human resource: it overtakes only two countries on the 30th place (European Innovation Scoreboard, 2008 pp.16).

Recommendations

On the basis of European experiences, four major areas for intervention of the government can be envisaged:

Area 1: Fostering the "industry-higher education' cooperations, networking between real sphere and academic sphere

According to the study of the European Commission (2003) it is necessary to prioritise the cooperations between industry and higher education or industry and research institutes in the use of R&D funds, because this is the most effective way of supporting according to their survey. In the course of financial planning R&D sector needs to be considered as the major 'supplier of knowledge' for the national economy.

Area 2: Efficient government models for the effective use of centralised funds and for the adaptation of the principle 'value for money'

It is not the size of the state that determines the competitiveness of the economy. The extent of the economic participation of the government and income reallocation and the size of welfare payments i.e. bigger size of the state by themselves do not refer to unsuccessful economy. The Scandinavian model that operates with significant income-reallocation is an excellent example for the efficient and fair social system. The government model is effective if the government is able to use centralised funds efficiently and to adopt the principle 'value for money'.

Area 3: Operation of transparent systems in order for effectiveness

- Continuous operation of the National Innovation System (NIS), which forms the framework of the definition and implementation of government policies.
- Improvement of efficiency of government models
  - Cutting back on the official corruption, improvement of confidence index;
  - Fostering transparency via the implementation of electronic information services of the e-government and local

Area 4: Appropriate legal background, control, impact-analysis

Innovation and competitiveness should be taken into consideration when shaping or modifying the regulators and legal background; especially the following ones according to Borsi B. (2004):

- Protection of intellectual property;
- Finance of project-based research and development (R&D);
- Transparent use of money for the previous;
- Substantive impact-analysis and accounting of R&D projects

It is an advantage of the listed measures that they do not require significant infrastructural investments and can be implemented at relatively low costs.

ANNEX 1 /TABLE 5

		2000 (pilot)	2001	2002	2003	2004	2005	2006	2007	Source of Data
I.	**Innovation drivers (EIS 2005)**									
1	S&E and SSH graduates	Share of post secondary graduates	Population aged 20-29	→	→	→	→	→	→	Eurostat/ OECD
2	Share of working-age [Population with tertiary education (% of 25-64 years age class) 2002]	→	→	→	→	→	→	→	→	Eurostat / Labour Force Survay
3	Broadband penetration rate	→	→	→	→	→	→	→	→	
4	Participation in life-long learning	→	→	→	→	→	→	→	→	Eurostat / Labour Force Survay
5	Youth education attainment level	→	→	→	→	→	→	→	→	Eurostat
II.	**Knowledge creation (EIS 2005)**									
6	Public R&D expenditures (% of GDP)	GOVERD only	GOVERD + HERD	GERD – BERD	→	→	→	GOVERD + HERD	→	Eurostat / R&D statistics, OECD
7	Business R&D expenditures (% of GDP)	BERD	→	→	→	→	→	→	→	Eurostat / R&D statistics, OECD
8	Share of medium-high and high-tech R&D in manufacturing	→	→	→	→	→	→	→	→	Eurostat OECD
9	Share of enterprises that receive public funding for innovation	→	→	→	→	→	→	→	→	Eurostat CIS4
10	Share of university R&D funded by private sector	→	→	→	→	→	→	→	→	
III.	**Innovation and entrepreneurship (EIS 2005)**									
11	Share of SMEs innovating in-house	Manufacturing sector	→	→	+ Services sector	Total business sector	→	→	→	Eurostat CIS4
12	Share of SMEs co-operating in innovation	Manufacturing sector	→	→	+ Services sector	Total business sector	→	→	→	Eurostat CIS4
13	Innovation expenditures (% of turnover) (CIS)	Manufacturing sector	→	→	+ Services sector	Total business sector	→	→	→	Eurostat CIS4
14	Venture capital (% of GDP)	Early stage and expansion stage	→	→	Early stage only	→	→	→	→	Eurostat
15	ICT expenditures (% of GDP)	→	→	→	→	→	→	→	→	Eurostat
15	Share of SMEs using organisational innovations	→	→	→	→	Using non-technological change	→	Using organisational innovation	→	Eurostat (CIS4)
17	High-tech venture capital	→	Share of GDP	→	→	Share of venture capital	→	→	→	
18	Internet use	Users per 100 population	Share of households	→	Composite indicator for households and firms	→	→	→	→	Eurostat OECD
19	Capitalisation of new markets (% of GDP)	→	→	→	→	→	→	→	→	
20	Volatility rates of SMEs	→	→	→	→	→	→	→	→	

INPUT INDICATORS

ANNEX 1 / TABLE 5

Source: EUROPEAN INNOVATION SCOREBOARDS (2001-2009); *Construct*: **Sitányi L.**

ANNEX 1 / TABLE 5

		2000 (pilot)	2001	2002	2003	2004	2005	2006	2007	Source of Data
IV.	**Applications (EIS 2005)**									
21	Share of high-tech services employment (% of total workforce)	→	→	→	→	→	→	→	→	Eurostat / Labour Force Survay
22	Share of high-tech exports	→	→	→	→	→	→	→	→	Eurostat
23	New-to-market products (% of turnover) (CIS)	Manufacturing sector	→	→	+ Services sector	Total business sector	→	→	→	Eurostat
24	New-to-firm products (% of turnover) (CIS)	→	→	→	Manufacturing + Services sector	Total business sector	→	→	→	Eurostat
25	Share of medium-high and high-techmanufacturing employment (% of total workforce)	→	→	→	→	→	→	→	→	Eurostat / Labour Force Survay
26	Share of high-tech manufacturing value added	Percent change	Share of value added	→	→	→	→	→	→	OECD
V.	**Intellectual property (EIS 2005)**									
27	EPO patents per million population	→	→	→	→	→	→	→	→	Eurostat OECD
28	USPTO patents per million population	→	→	→	→	→	→	→	→	Eurostat OECD
29	Triad patents per million population	→	→	→	→	→	→	→	→	Eurostat OECD
30	Community trademarks per million pulation	→	→	→	→	→	→	→	→	OHIM Eurostat
31	Community designs per million population	→	→	→	→	→	→	→	→	OHIM Eurostat
32	High-tech EPO patents per million population	→	→	→	→	→	→	→	→	
33	High-tech USPTO patents per million population	→	→	→	→	→	→	→	→	

OUTPUT INDICATORS

Source: EUROPEAN INNOVATION SCOREBOARDS (2001-2009); *Construct*: **Sitányi L.**

ANNEX 1 / TABLE 5

ANNEX 1 / TABLE 6

Table 6: EIS Innovation indicators between 2008 and 2010, changes compared to 2007

TABLE 2: INDICATORS FOR THE EIS 2008-2010

		Cf. to EIS 2007	Data source
ENABLERS			
	Human resources		
1.1.1	S&E and SSH graduates per 1000 population aged 20-29 (first stage of tertiary education)	Revised	Eurostat
1.1.2	S&E and SSH doctorate graduates per 1000 population aged 25-34 (second stage of tertiary education)	Revised	Eurostat
1.1.3	Population with tertiary education per 100 population aged 25-64	Same	Eurostat
1.1.4	Participation in life-long learning per 100 population aged 25-64	Same	Eurostat
1.1.5	Youth education attainment level	Same	Eurostat
	Finance and support		
1.2.1	Public R&D expenditures (% of GDP)	Same	Eurostat
1.2.2	Venture capital (% of GDP)	Revised	EVCA/ Eurostat
1.2.3	Private credit (relative to GDP)	New	IMF
1.2.4	Broadband access by firms (% of firms)	Revised	Eurostat
FIRM ACTIVITIES			
	Firm investments		
2.1.1	Business R&D expenditures (% of GDP)	Same	Eurostat
2.1.2	IT expenditures (% of GDP)	Revised	EITO/Eurostat
2.1.3	Non-R&D innovation expenditures (% of turnover)	Revised	Eurostat (CIS)
	Linkages & entrepreneurship		
2.2.1	SMEs innovating in-house (% of SMEs)	Same	Eurostat (CIS)
2.2.2	Innovative SMEs collaborating with others (% of SMEs)	Same	Eurostat (CIS)
2.2.3	Firm renewal (SMEs entries + exits) (% of SMEs)	New	Eurostat
2.2.4	Public-private co-publications per million population	New	Thomson/ ISI
	Throughputs		
2.3.1	EPO patents per million population	Same	Eurostat
2.3.2	Community trademarks per million population	Same	OHIM
2.3.3	Community designs per million population	Same	OHIM
2.3.4	Technology Balance of Payments flows (% of GDP)	New	World Bank
OUTPUTS			
	Innovators		
3.1.1	Technological (product/service/process) innovators (% of SMEs)	New	Eurostat (CIS)
3.1.2	Non-technological (marketing/organisational) innovators (% of SMEs)	Revised	Eurostat (CIS)
3.1.3	Resource efficiency innovators Unweighted average of the following 2 indicators:		
3.1.3a	○ Reduced labour costs (% of firms)	New	Eurostat (CIS)
3.1.3b	○ Reduced use of materials and energy (% of firms)	New	Eurostat (CIS)
	Economic effects		
3.2.1	Employment in medium-high & high-tech manufacturing (% of workforce)	Same	Eurostat
3.2.2	Employment in knowledge-intensive services (% of workforce)	Revised	Eurostat
3.2.3	Medium and high-tech exports (% of total exports)	Revised	Eurostat
3.2.4	Knowledge-intensive services exports (% of total services exports)	New	Eurostat
3.2.5	New-to-market sales (% of turnover)	Same	Eurostat (CIS)
3.2.6	New-to-firm sales (% of turnover)	Same	Eurostat (CIS)

Source: **Hollanders, H. – van Cruysen, A. (2008)**

ANNEX 2

Country abbreviations:

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

ANNEX 3

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