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HUNGARY'S POSITIONS IN BENCHMARKS PREPARED ON THE BASIS OF R+D ACTIVITIES

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Abstract

The aim of the paper is to identify and analyse Hungary's place in the ranking orders prepared on the basis of the R+D activities of countries. As the scoreboards of different supranational institutions point out, the country still performs poorly according to the variables measuring the actual innovative performance of the states, however, the trend indicators show that Hungary has already recognized the importance of research and development, and focuses more on it than in the past.

Keywords: benchmarks, R+D activity, innovative trends.

As a very old paradigm says, all countries should specialize in the production of a given good (or goods), in the manufacturing or offering of which it has a comparative advantage or in the provision of which this advantage can be developed. This specialization – and consequently the focused usage of the scarce resources – could then result in the growth of the production at a global level and in the increase of the welfare of all countries involved in the world trade.

The above idea still holds or even gets more important under the constantly changing conditions of the macro and microenvironment at the beginning of the twenty first century. The reason for it is clear: the (human, information, natural, financial, etc.) resources are getting more and more scarce, and at the same time the customers' needs become more sophisticated[1]. In case all countries try to satisfy all needs at an increasing level by being involved in the economic activities of all industries at the same rate, the usage of the resources and the organization of the production processes get very far from being optimal and effective. However, if countries manage to find the fields in which they are more effective than the other countries – by a reasonable and optimal usage of the scarce resources and by a well designed distribution of the economic activities – the overall welfare of the world's countries and the world economy can be obtained.

The separated specialization of the countries in a given process or economic activity, however, is not enough. A close collaboration and synthesis of the selected

[1] Sophistication should be interpreted in a relative way. What is sophisticated in a not developed country might be a basic need in the developed part of the World.

activities are needed in order to get to an even higher level of the economic development and welfare. This means that after having identified the economic activities in which the countries have comparative advantages, the participants of world trade should have a look at the advantages of other countries or regions and should start collaborating with those who are good at the same activities. Such a collaboration could be implemented both at the level of countries (when two or more countries from different parts of the world decide to collaborate) and also at the regional level (when regions with similar comparative advantage decide to work together)[2].

In order to define the frame of these co-operations it is important to choose some economic variables on the basis of which it is possible to identify the comparative advantages of the countries and to link the similar states to each other. Many researchers today use the R+D (research and development) activities of the countries for measuring and analysing the economic activities of the states. These variables could also serve for comparing and evaluating the economic performance of countries participating in world trade and for finding the groups of countries in which the states are good at the same economic activities – and therefore whose collaboration would lead to economic growth and development. However, the existing measures and ranks do not really help the countries to find those states whose 'economic profile' is similar. The reason for this is threefold.

First, those supranational institutions (the European Commission, the United Nations, the OECD, etc.) which prepare scoreboards in order to rank countries according to their R+D activities, base their comparison on different dimensions of R+D.

Furthermore, these ranks include different countries into their evaluation, which impedes the countries to learn more from the several existing benchmarks. Therefore, if two countries use two different sources for their comparison, they might get two different results – which does not contribute to a world-wide synchronization of the economic activities.

Second, there is a lot of missing data in the ranks prepared by the institutions, what is due partly to the fact that different countries collect the same data in different periods of time. A state might measure the number of registered patents every year, and others might record it every second year. The lack of some information can also be explained by the difficult access to the data in some countries, what makes it impossible to create tables full of information.

Third, most of the institutions describe the actual performance or the trends in the R+D activities of the countries separately, and do not try to classify the states on the basis of the similar patterns in their activities. Those, who intend to cluster the countries, base this grouping only on some economic variables but do not try to integrate all possible dimensions of R+D into their classification effort.

Despite these drawbacks of the scoreboards we can have a basic understanding

[2]Unfortunately, today, in most of the cases countries still focus on their own specialization and do not consider the benefits of a regional or an even more expanded economic co-operation. Although we can observe some efforts that have been made by countries to collaborate with other states, the number of these trials is very low and they stay in a regional context.

of the innovative performance of the countries. In this article the aim is to identify how Hungary performs according to the different dimensions of the research and development activities and to define the fields on which it should focus and where it should collaborate with other countries whose innovative results would show similar patterns. For the analysis the ranks of three supranational firms will be presented, focusing on Hungary's performance.

1. The Scoreboards of the European Union [1]

In the Lisbon strategy (elaborated in 2000 by the European Committee) the European Union set the objective of becoming the World's most competitive and most dynamic knowledge-based economy by 2010 [2]. In order to meet this objective the EU deemed important to evaluate the innovative activities and performance of the member states as well as their trend along predetermined dimensions[3]. For the analysis of the actual performance of the states 22 indicators were used[4], which were clustered into four groups (dimensions): 1) the human resources for innovation, 2) the creation of new knowledge, 3) the transmission and application of knowledge, and 4) the innovation finance, outputs and markets. The trends[5] of the R+D activities of the countries have been evaluated on the basis of less indicators: 14 variables were clustered into 3 groups – which are similar to the first, second and fourth groups in the actual performance analysis.

2. Hungary's Performance and its Trend According to the First Dimension: the Human Side of the R+D

The first dimension of the research and development performance and its trend was measured on the basis of five indicators:

- the S&E graduates, as a ‰ of the 20–29 years age class,
- the population with tertiary education as a % of the 25–64 years age class,
- participation in life-long learning as a % of the 25–64 years age class,
- employment in medium-high and high tech manufacturing as a % of total workforce,
- employment in high tech services as a % of total workforce.

[3] First only the European Union Member States were ranked, but in 2002 and in 2003 the associated and candidate countries as well, as the main competitors of the European Union were also included in the analysis. It is important to note that the ranks of these countries are presented in separate scoreboards. Complex, integrated tables were not created by the European Commission.

[4] This number is relevant for the analysis prepared in 2003. In 2002, for example, only 17 indicators were applied to evaluate the countries' performance (European Commission (2003): European Innovation Scoreboard 2002). In 2003 either these indicators were extended, or new indicators were added to the original ones.

[5] The trends were calculated as a percentage change in each indicator between the last year (for which data were available) and the average over the previous three years with a one-year lag.

Table 1[6] indicates where Hungary is positioned on the basis of the human side of its research and development activities – taking both the actual performance and the trend in the performance into consideration.

As it can be seen from the table, Hungary performs poorly according to most of the indicators. Especially bad results can be detected in the case of S&E graduates – both at the actual and the trend level. It shows that in the country the number of students graduating at universities is very low compared to the EU (and USA) average, and that over the years less and less students graduated from universities – compared to the past data there is a reduction by 26.7% in 2003. Also the number of people with tertiary education is very low, however the trend data show that there was a slight increase in 2003 compared to the results in the previous years. As regards the third indicator, the people's participation in life-long learning, Hungary is still ranked 24-th in the order with a low value, but an improving trend can be identified – which trend is better than the EU average. This points to Hungary's dynamic investment and increased interest in a prolonged learning process. The employment in medium-high and high tech manufacturing is considerable in the country not only now but in the previous years as well, when Hungary showed a better performance than the average of the EU countries. The results are not that convincing in the case of the service sector: the employment rate in high-tech service sector falls behind the European Union's average values. It is important to note here that according to the results of a research conducted in 2004 Hungarian firms have more comparative advantages in the service sector than in the manufacturing sector [4]. This contradiction might be the result of one of two things: first, if the companies, having identified the comparative advantage, replaced most of the labour with machines and robots in order to optimize their activities, and second, if they do not focus the usage of their resources on the fields where they have a comparative advantage.

3. Hungary's Performance and its Trends According to the Second Dimension: the Knowledge Creation

The knowledge creation dimension of the research and development is measured by six indicators which are as follows:

- Public R+D expenditures as a % of GDP,
- Business expenditures on R+D as a % of GDP,
- EPO (European Patent Office) high-tech patent applications (per million population),

[6] As in the official reports of the European Union only separated statistics are presented – which show the performance and trend data of the EU Member States in 2003, the associate, the acceding and the candidate countries separated from each other – the direct comparison would be impossible. This is the reason why the author prepared a complex table including all indicators of the dimension and all countries analysed. In this article only the first three and the last three countries are indicated as well as the EU average, the data for the USA (where available) and Hungary's rank in the orders.

- USPTO (US Patent and Trademark Office) high-tech patent applications (per million population),
- EPO patent applications (per million population),
- USPTO patents granted (per million population).

Table 2 presents Hungary's position in the complex order prepared on the basis of the countries' performance in knowledge creation as well as of its trends.

As the table shows Hungary performs poorly according to the performance indicators and lags behind the European Union 15 Member States, but it is ranked among the first countries in the order – with above the EU average scores – on the basis of the trend indicators. This result is somehow surprising as it is known that in the region people and firms place considerable emphasis on the research and innovative activities. The reason for the paradox lies *first* in the Hungarian habits and principles related to patents: the outcome of the research and development activities will be the property of the institution where the development processes had taken place. This means that these pieces of new know how, technology, product cannot be registered in the Patent Offices, therefore they will not be presented in the statistics of the country. Contrary, in the Western European countries, in the USA or in Japan, in case when people invented some new products, technologies, processes, etc. they made them registered at the Patent Offices as soon as they could for the purpose of protection. *Second*, the paradox might be explained by the fact that only in certain industries do firms and people get involved in innovative processes, and in other sectors the firms feel no need for the R+D activities. This latter behaviour is due to the lack of financial help, bad or elusive market position, and no information about the conditions of the market – these firms struggle for survival and try to protect their actual position and market share.

The trend results from the other side, however, shows that Hungary – after having recognized the changed characteristics of the world market and global economy – makes an effort to invest more and more in the research and development and to apply for protection for the invented knowledge and products. This effort is more visible in the European market than in the USA: at the European Patent Offices a continuously growing number of Hungarian patents are registered while in the USA, despite the increase in the number of registered Hungarian patents, the growth lags behind the EU average.

4. Hungary's Performance and its Trend According to the Third Dimension: the Transmission and Application of Knowledge

Hungary's performance cannot be evaluated along the third dimension as related data are missing. Not only in the analysis in 2003 the data cannot be found but also in the evaluation made in 2002 no information can be found about how Hungary is involved in knowledge transmission and application. Furthermore, for the trend analysis the European Commission doesn't apply the indicators[7] which belong to

[7] The indicators are as follows:

the third group, but focuses exclusively on the indicators of the first, second and fourth groups.

5. Hungary's Performance and its Trends According to the Fourth Dimension: the Innovation Finance, Output and Markets

Eight indicators measure the countries' performance according to the fourth dimension:

- Share of high-tech venture capital (VC) investment, (Ind. 1.)
- Share of early-stage venture capital in GDP, (Ind. 2.)
- Sales of 'new to market' products as a % of all turnover in manufacturing and a % of all turnover in services,
- Sales of 'new to the firm but not new to the market' products as a % of all turnover in manufacturing and a % of all turnover in services,
- Internet access/use, (Ind. 3.)
- Information and Communication Technology (ICT) expenditures, (Ind. 4.)
- Share of manufacturing value added in high tech sectors, (Ind. 5.)
- Volatility-rates of the small and medium size enterprises (SMEs).

As regards the trend of the performance, out of the above indicators only three are used for its measure: the share of early-stage VC, the ICT expenditures, and the share of manufacturing value-added in high tech sectors.

As Hungary's data are only available for the first, second, fifth, sixth and seventh indicators in the performance analysis, and for the ICT expenditures and value added in high-tech manufacturing in the trend evaluation, the complex table (*Table 3*) is prepared for these variables.

Table 3 shows a slightly similar picture to the previous one: Hungary performs very poorly in most of the current activities, but has an above the EU average value according to the two trend indicators and is ranked among the five first countries. The two performance indicators, on the basis of which Hungary was scored higher than the EU average, are the ICT expenditures, and the share of manufacturing value-added in the high tech sectors. This shows – *on the one hand* – that Hungary has recognized the importance of the development of the information and communication technology in the economic growth and in its more beneficial participation in world trade that would lead to a better and stable position among the competitors. Therefore, the country invests considerable amount of money in the development,

- SMEs' innovation in house as a % of manufacturing SMEs and a % of services SMEs,
- SMEs involved in innovation co-operation as a % of manufacturing SMEs and a % of services SMEs,
- Innovation expenditures as a % of all turnover in manufacturing and a % of all turnover in services.

which exceeds even the average investments of the EU and also the invested money in the USA. As there is no available data on the trend of Hungary's ICT expenditures, it is not possible to evaluate whether Hungary has also realized that an only investment in ICT is not sufficient: a continuous development is needed in order to keep up with the recent technologies and to maintain the attained position in the market. Last year's data are, however, promising: in 2002 the investment of Hungary in ICT was 32.2% more than the reference value[8]. *On the other hand*, the table shows that Hungary's manufacturing value added in the high tech sectors is higher, and that it is growing more significantly than the EU average. It is however warning that even with the above value in the current activities the country is positioned only in the 14th place. This implies that other countries – including two states that have just joined the EU (Malta at 6th and Latvia at 7th place) – have a much bigger share of value added in the high tech sectors – which is definitely needed in the permanently developing technological environment.

The scoreboards prepared on the basis of the data gained from the statistics of the European Commission give the following picture of the country.

Hungary still does not perform well on the basis of the current indicators, but tries hard to invest in and focus more on the development of the elements of R+D defined by the EU – which results in the country's good position in the ranks according to the trend indicators. There is one significant exception from this generalized perception: along the human dimension of the research and development activities trend of Hungary is disappointing. There is even an indicator according to which Hungary's performance is much worse than in the previous years, and also some of the other indicators show poor records.

As regards the actual performance, Hungary has a value above the EU average according to only three indicators: the country's employment in medium high and high tech manufacturing, the ICT expenditures, as well as the share of manufacturing value added in high tech sectors. These results point out that the country has already recognized the importance of the high tech sector's development – from the human, the financial and from the creation of value added aspects at the same time – and has started to focus more on this area. However, the country's very bad results according to the other indicators demonstrate that Hungary is still at the very beginning of the restructuring of the economy and in the rethinking of the development strategy. Furthermore, the country's position among the last countries in some of the orders raise doubts about whether Hungary has an integrated view on how to implement the modifications in the strategy. As the current results show, the country selected probably some of the fields of the research and development and started to develop them – without looking at the interdependencies of the several aspects of R+D, and at the consequences of the non-balanced development of the fields.

[8] As all trends are calculated as a percentage between the last year for which data are available and the average over the preceeding three years with a one-year lag, the score in 2002 is not related to the previous year's data but to the calculated reference value. (European Commission: European Innovation Scoreboard, 2002)

6. Scoreboards of the United Nations

a) United Nations Industrial Development Organization [5]

In an attempt to interpret the results of the scoreboard of countries prepared according to the states' competitive industrial performance[9], the United Nations ranked the states on the basis of the drivers of the industrial performance as well. However, in their report, the experts state that it is not possible to benchmark all countries involved in the analysis according to all factors that might have an effect on the states' performance. Instead, they selected five indicators, that – under the new competitive conditions of the market which lead the (very much or less) developed countries to focus more on innovativeness, as well as on technological development when trying to differentiate themselves from the competitors – might be responsible the most for the competitive advantages. These indicators are as follows:

- Skills index, (Ind. 1.)
- R+D spending per capita by productive enterprises, (Ind. 2.)
- Foreign direct investment per capita, (Ind. 3.)
- Royalties per capita, (Ind. 4.)
- Infrastructure index. (Ind. 5.)

The complex table (*Table 4*) contains Hungary's position[10] according to the five indicators in the same format as was used in the evaluation of the EU data. The difference is that in the reports of the United Nations only rankings are published, therefore the table can only represent the relative positions. Furthermore, as having no reference data for the EU average value, in this table Hungary's neighbours in the order are presented instead.

As it can be seen in *Table 4* Hungary is ranked around the middle of all orders. The worst position can be detected in the ranks created according to the skilled manpower in the country. What is more warning, is the deteriorating relative position of Hungary on the basis of this indicator: while in 1985 the state was ranked 45th, in the order representing the data of 1998 Hungary could only obtain the 48th position. The results might be explained by three things. *First*, due to the demographic downturn in the country, there are less and less students each year who graduate from colleges or from universities. Although the same percentage of people might graduate, their total number may decrease. *Second*, it is possible that the already low share of people who graduate in the population further dropped during the 13 years. The latter explanation would be supported by the results of the trend analysis of the EU data (*Table 1*) – which showed that the share of the S&E graduates[11] decreased considerably, and the share of the population with tertiary

[9] In this scoreboard Hungary is ranked at the 34th place in 1985 while in 1998 it gained the 27th position in an order of 87 countries. Although there was a significant improvement in the ranking, the calculated competitive industrial performance is still very low.

[10] The research was implemented only twice: in 1985 and in 1998.

[11] as a % of the 20–29 years age class

education[12] increased only minimally during the recent years. *Third*, as only relative positions are demonstrated in the ranks, it is only possible to say, that compared to the other states, position of Hungary was worse in 1998, than in 1985.

The position of Hungary declined also on the basis of the second indicator – the R+D spending per capita by productive enterprises –: it stepped back by 10 places during the analysed 13 years. The relevant EU data, however, contradicts these results: As *Table 2* showed, although actual position of Hungary was still lagging behind the EU average, compared to previous years' data an increase by 36.1% could be detected in the business expenditures on R+D. The reason for the discrepancy might be twofold. First, the analysis of the United Nations was implemented earlier: the latest data are available from 1998, while the EU has performed the data collection even in 2002. During the related 4 years considerable changes might happen in the business entities' cost structure, including an increase in their spending on R+D – although the results of the already referred research [4] points out that still a lot of profit oriented firms are reluctant to invest in R+D activities. Second, in the EU research there were much more countries involved: along most of the dimensions (indicators) the positions of 87 states were identified. Due to the fact that in the table only relative ranks are represented – without absolute numbers, we can only conclude that Hungary's position was better in 1985 than in 1998 compared to the other countries.

According to the third and fourth indicators, as having no data from 1985, a direct comparison is impossible between Hungary's performance in 1985 and in 1998. However, a static evaluation can be done about the per capita foreign direct investment and royalties in the country in 1998. As the table shows Hungary is ranked in the first third of the order according to both of the indicators. The reasons for the good position are threefold. *First*, the Hungarian government offered substantial incentives to the foreign investors in the country. *Second*, the low salary of the relatively well-trained and skilled labour was also considered as of strategic importance by the foreigners in their market selection. *Third*, an investment in Hungary geographically meant a 'bridge' towards the other, more promising countries in the East. All the above facts explain why Hungary was a target for foreigners in their foreign direct investments and why the country is positioned among the first twenty five states in the order. The country's position along the fifth dimension is unchanged – however, due to the increase in the number of states involved in the research in 1998 compared to that in 1985, Hungary's rank should be considered better in 1998. Although, without absolute values no conclusion can be drawn about the deterioration or the improvement of the infrastructure of the country, hopefully the maintained position – where Hungary is ranked in the first half of the ranking order – refers to the latter case.

[12] as a % of the 25-64 years age class

b) United Nations Commission on Science and Technology for Development [3]

The United Nations Commission on Science and Technology for Development at its V. session in Geneva in 2001 set the objective of measuring the technological development of countries for its inter-sessional period of 2001–2003. The task was carried out in three panels. In the first one the indicators which would be applied in the identification of the technology development levels across countries – with special focus on the information and communication technologies – were selected. Furthermore, in the first panel the countries involved in the analysis were clustered along the chosen indicators, and input was provided for the second and third panels in terms of policy analysis to facilitate the movements of states between the clusters.

For the preparing of the scoreboards, the UN used three indicators to measure the *technology development of countries*:

- R+D expenditures, as a % of GNI (in order to measure innovation),
- The number of technical personnel in R+D and tertiary enrolment, as a % of the population (in order to measure the human capital),
- High-tech exports, as a % of total exports (in order to measure the export structure).

On the basis of these indicators a complex value was calculated for the technological development of each country and a scoreboard of 88 states was created. The position of Hungary in this rank is presented in *Table 5*[13]:

As *Table 5* shows Hungary is positioned in the first half of the order towards the middle, between Bolivia and Chile on the basis of the complex index. In case the country's rank according to the three components of the index is evaluated separately, the picture is different. The worse is the relative position of Hungary in the case of the human capital, which is followed closely by the R+D spending. On the basis of both of the indicators the country is in the second half of the order, though very close to the middle position. These bad results are supported by the EU and UN IDO scoreboards, where the actual performance of the country according to both the human and the R+D expenditure sides of the development were very poor (and on the basis of some of the trends they even show a deteriorating performance over the years). In the contrary, according to the high-tech exports of the countries, Hungary gained a position in the first quarter of the order. The results demonstrate that the 34th rank of the country in the overall order is due to its good position on the basis of the third indicator.

The UN, besides preparing the scoreboards of the states, clustered the countries according to their performance on the basis of the complex index. In this classification Hungary got into the cluster 'keeping up', together with the Latin American countries. There are two more clusters: the cluster 'getting ahead' where

[13]The ranks refer to the complex index of technological development. The values for the R+D spending, the human capital as well as for the high-tech exports are presented only for comparison purposes.

we find the OECD countries as well as some South-East Asian Tigers, and the group "catching up" to where the other states belong.

As the special focus of UN research was the measuring of *the information and communication technology level*, the experts used another set of indicators for its separate evaluation:

- In order to measure the connectivity aspect:
  Internet hosts, number of PCs, telephone mainlines, mobile phones
- In order to measure the access aspect:
  Number of Internet users, literacy, GDP per capita, cost of a local call
- In order to measure the usage aspect:
  Average incoming/outgoing telecom traffic
- In order to measure the policy aspect:
  The presence of an Internet exchange, competition in the local loop, domestic long distance and ISP market.

One complex index (ICT Diffusion Index) was formed out of the four dimensions and each of the countries involved in the research obtained a value on the basis of this index. The scoreboard of the UN is developed according to these values, however, the values the states obtained according to the first, second and fourth indicators are also indicated. *Table 6* shows the position of Hungary in this benchmark.

As it is shown in *Table 6*, according to the diffusion index, Hungary is positioned in the first half of the rank, closer to the border which separates the first quarter from the second – between the Bahamas, and Qatar. In case the country's rank is evaluated on the basis of the selected three components of the index, only according to one indicator is Hungary in a (slightly) better position than according to the complex index. This variable is the connection dimension which shows that the ICT infrastructure of the country (the number of PCs, telephone mainlines, mobile phones, Internet hosts) is relatively good. The position is much worse in the case of the two other indicators. On the basis of the access the country is ranked at 68th place, which shows first, the human side of the development (for example the number of Internet users, or the literacy) where the records of Hungary are very poor (also supported by the EU and UN results) and second, the economic conditions of the market (for example the GDP per capita) that should be improved. According to the policy aspect of ICT Hungary is ranked at the 60th place what shows an intermediate position – together with the other 17 countries whose score was exactly the same as the one of Hungary.

As was the case in the previous analysis, the UN not only ranked the countries according to their calculated ICT Diffusion Index but also clustered the states on the basis of their scores. Hungary got again into the group 'keeping up' together with the Latin American countries. Other clusters exist as well: the group 'catching up' where African and South Asian countries can be found, and the cluster 'getting ahead' where the members are the OECD and the Scandinavian states as well as the South-East Asian Tigers.

Table 1. Hungary's performance and its trend according to the human side of the R+D

rank	Indicators									
	Ind. 1. Actual	Ind. 1. Trend	Ind. 2. Actual	Ind. 2. Trend	Ind. 3. Actual	Ind. 3. Trend	Ind. 4. Actual	Ind. 4. Trend	Ind. 5. Actual	Ind. 5. Trend
1.	Ireland	Malta	Latvia	Cyprus	Denmark	Cyprus	Germany	Lithuania	Sweden	Austria
2.	France	Estonia	USA	Austria	UK	Romania	Slovenia	Slovakia	Denmark	Cyprus
3.	UK	Switz.	Norway	Ireland	Finland	Slovenia	Czech R.	Luxemb.	Finland	Germany
Last-2	Cyprus	Germany	Romania	Estonia	Bulgaria	Italy	Lithuania	Sweden	Latvia	Slovakia
Last-1	Malta	Cyprus	Portugal	Slovenia	Greece	Austria	Turkey	Estonia	Romania	Luxemb.
Last	Luxemb.	Hungary	Turkey	Sweden	Romania	Estonia	Cyprus	Latvia	Portugal	Latvia
EU aver.	11.3	9.1	21.5	3.3	8.4	0.6	7.41	–3,7	3.57	11.5
USA	10.2	–3.3	37.2	6.1	–	–	–	–	–	–
HU	3.7	–26.7	14.1	2	3.3	6.5	8.5	2.1	3.06	7.4
Rank	27 (out of 30)	28 (out of 28)	24 (out of 31)	23 (out of 28)	24 (out of 29)	8 (out of 20)	4 (out of 30)	7 (out of 27)	14 (out of 28)	15 (out of 27)

Table 2. Hungary's performance and its trends according to the knowledge creation

rank	Indicators											
	Ind. 1. Actual	Ind. 1. Trend	Ind. 2. Actual	Ind. 2. Trend	Ind. 3. Actual	Ind. 3. Trend	Ind. 4. Actual	Ind. 4. Trend	Ind. 5. Actual	Ind. 5. Trend	Ind. 6. Actual	Ind. 6. Trend
1.	Finland	Roman.	Sweden	Latvia	Sweden	Slovenia	USA	Spain	Finland	Norway	USA	Estonia
2.	Sweden	Hungary	Finland	Turkey	Finland	Norway	Japan	Sweden	Sweden	Estonia	Japan	Malta
3.	Holland	Greece	Japan	Lithuan.	Switz.	Cyprus	Switz.	Norway	Holland	Slovenia	Sweden	Turkey
Last-2	Cyprus	Switz.	Lithuan.	Poland	Bulgaria	Italy	Bulgaria	Japan	Turkey	Greece	Poland	Poland
Last-1	Roman.	Lithuan.	Bulgaria	Slovakia	Turkey	Latvia	Roman.	Switz.	Poland	Roman.	Portugal	Lithuan.
Last	Luxem.	Slovakia	Cyprus	Roman.	Roman.	Malta	Turkey	Holland	Roman.	Bulgaria	Turkey	Slovakia
EU aver.	0.69	2	1.3	4.8	161.1	63.6	80.1	43.9	31.6	25.3	12.4	28
USA	0.76	13.4	2.04	2.7	169.8	76.6	322.5	41.9	57	30.9	91.9	13.3
HU	0.57	36.5	0.38	36.1	19	226	7.3	n.d.	4.3	47.9	0.3	26.2
Rank	16 (out of 31)	2 (out of 28)	21 (out of 31)	7 (out of 29)	19 (out of 32)	5 (out of 31)	19 (out of 31)	n.d.	17 (out of 31)	10 (out of 32)	23 (out of 28)	17 (out of 32)

Table 3. Hungary's performance and its trends according to the innovation finance, output and markets

rank	Indicators									
	Ind. 1. Actual	Ind. 1. Trend	Ind. 2. Actual	Ind. 2. Trend	Ind. 3. Actual	Ind. 3. Trend	Ind. 4. Actual	Ind. 4. Trend	Ind. 5. Actual	Ind. 5. Trend
1.	Italy		USA		Sweden	Poland	Switzerl.		Ireland	Turkey
2.	France		Sweden		Denmark	Slovakia	Sweden		Finland	Bulgaria
3.	Norway		Finland		Japan	Romania	Estonia		USA	Finland
Last-2	Greece		Slovakia		Latvia	Turkey	Malta		Portugal	Malta
Last-1	Poland		Portugal		Hungary	Ireland	Bulgaria		Bulgaria	Spain
Last	Hungary		Romania		Lithuania	Norway	Turkey		Luxemb.	Sweden
EU aver.	45.4		0.037		37.7	15.5	7		10.1	12
USA	–		0.218		0.73	4.9	8.2		23	7
HU	1.6		0.015		0	32.2	8.9		14.9	18.3
Rank	17 (out of 17)		17 (out of 21)		26 (out of 27)	5 (out of 28)	6 (out of 31)		14 (out of 25)	4 (out of 23)

Table 4. Hungary's position in the scoreboard of the United Nations Industrial Development Organization

rank	Indicators									
	Ind. 1. 1985	Ind. 1. 1998	Ind. 2. 1985	Ind. 2. 1998	Ind. 3. 1985	Ind. 3. 1998	Ind. 4. 1985	Ind. 4. 1998	Ind. 5. 1985	Ind. 5. 1998
1.	Rep. of Korea	Rep. of Korea	Germany	Switz.	Singapore	Singapore	Singapore	Ireland	USA	USA
2.	Canada	USA	Switz.	Japan	New Zealand	Belgium	Hong Kong	Singapore	Canada	Canada
3.	Sweden	Canada	Japan	Sweden	Switz.	Sweden	Netherl.	Netherl.	Sweden	Singapore
Last-2	Russian Fed.	Mozam-bique	Uganda	Uganda	Algeria	Bangla-desh	Uganda	Venezuela	Central African R.	Madagas-car
Last-1	Slovenia	Malawi	Zambia	Zambia	Jamaica	Malawi	Venezuela	Yemen	Ethiopia	Uganda
Last	Yemen	U.R. of Tanzania	Zimbabwe	Zimbabwe	Bahrain	Ethiopia	Zambia	Zambia	Nepal	Central African R.
Neighbour from top	El Salvador	Ecuador	Singapore	South Africa	n.d.	Finland	n.d.	Portugal	Rep. of Korea	Portugal
Neighbour from bottom	South Africa	South Africa	Ireland	Argentina	n.d.	Malaysia	n.d.	Italy	South Africa	Mauritius
USA Rank	2	5	4	4	9	16	25	22	1	1
HU Rank	45	48	20	30	n.d.	18	n.d.	25	30	30
No. of countr.	87	87	84	87	80	87	82	87	83	87

Table 5. The position of Hungary in the scoreboard of the United Nations Commission on Science and Technology for Development.
a) Technology development

Ranks	Indicators				
	Technological Development		R+D expenditures	Human capital	High tech exports
1.	USA	0.7091	0.6995	0.9214	0.5063
2.	Republic of Korea	0.6894	0.7500	0.7711	0.5471
3.	Finland	0.6584	0.7394	0.8440	0.3918
Last-2	Ecuador	0.0170	0.0053	0.0349	0.0107
Last-1	Tanzania	0.0132		0.0068	0.0195
Last	Pakistan	0.0125		0.0203	0.0048
Neighbour from top	Bolivia	0.2727	0.1330	0.1441	0.5411
Neighbour from bottom	Chile	0.2698	0.1809	0.3588	n.d.
Hungary	34^{th} rank (of 88cies)	0.2720	39^{th} rank (of 75cies) 0.2656	46^{th} rank (of 85cies) 0.1809	17^{th} rank (of 79cies) 0.3696

Table 6. The position of Hungary in the scoreboard of the United Nations Commission on Science and Technology for Development, b) Information and communication technology level

Rank		Indicators			
	ICT Diffusion Index		Connection	Access	Policy
1.	USA	0.8040	0.8155	0.7925	1
2.	Norway	0.7938	0.7203	0.8672	1
3.	Iceland	0.7852	0.6566	0.9138	1
Last-2	Angola	0.0063	0.0028	0.0097	0.7500
Last-1	Cambodia	0.0035	0.0048	0.0022	0
Last	Eritrea	0.0031	0.0031	0.0031	0.6667
Neighbour from top	The Bahamas	0.3266	0.1856	0.4676	0.8750
Neighbour from bottom	Qatar	0.3193	0.1895	0.4491	0.1667
Hungary	46th rank (out of 159)	0.3232	45th rank (out of 159) 0.1788	68th rank (out of 159) 0.4676	60th[14] rank (out of 159) 0.5

[14]In the order 18 countries can be found with the same value. In the individually created order the athor placed Hungary is at first among the states with the same value.

After the evaluation of the position of Hungary in the ranking order it is important to state, that although the tables of the United Nations include a large number of indicators and countries into the analysis, the results of the researches are questionable and do not make a direct comparison possible. The reason for it is that the scores of the states according to the various indicators were calculated on a very different basis. As an example, some of the variables are explained as a percentage of the GDP, however, the value of the GDP in the different countries varies significantly. Therefore, the obtained scores have different meanings in the case of the countries, what makes it impossible to compare them and to interpret the states' rank in the scoreboard properly.

7. Conclusion

The scoreboards of the different supranational institutions vary what is due to the different indicators they use to the different range of countries involved in the research, and to the different time period when the data collection was implemented. However, when trying to draw conclusions about Hungary's performance of research and development, common results can be found in the benchmarks of the institutions. One of them is the country's very low performance and negative trend in the human side of the research and development. All scoreboards demonstrate that the country has a lot to do in the increase of the skilled labour and of the participation of people in higher education. There is one exception from this generalized view: the employment in medium-high and high-tech manufacturing and services is either acceptable or increasing. Another important result is that the R+D expenditures of the country are still very low, however, according to the EU results there are more and more spending in the country in the field of development. Although the UN ranks show different results: within 13 years the rank of the country decreased by 10 places – a reliable conclusion cannot be drawn from these data as absolute numbers were not available. Finally, what is clear from the benchmarks is that although Hungary's scores on the basis of most of the current indicators are very low, the trends are promising: the country invests more and more in its improvement according to most of the variables. However, it is worrisome, that the state develops and improves only certain aspects, but leaves the other deteriorate. In order to get to a balanced development the country should possess a clear view of its actual position and its already realized improvements on the basis of as many indicators as possible. Only after a comprehensive improvement of the performance should Hungary select those fields where the country's competitive advantages might be developed.

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