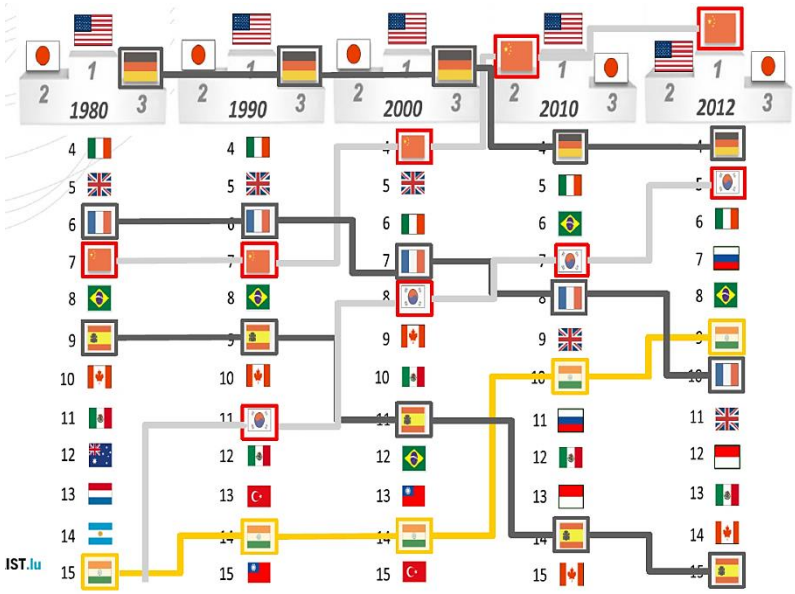
MINISTRY
FOR NATIONAL ECONOMY

How does Hungary fare in technologies compared to its Central European counterparts?

Unless EU member states become capable of finding their own technology specialization profiles, the EU is risking losing out on competitiveness. Even top-performing EU member states have over the past decades kept slipping down on international competitiveness rankings. In order to reverse this trend, the European Commission has identified six technologies which they call "Key Enabling Technologies" (KETs). In light of global indicators, the Central European region may be the axis of future growth: compared to world averages this region in general and Hungary in particular has been developing faster than old EU member states. Hungary is the 7th largest employer within the nano-technology and the nano-microelectronics sectors. For the 2014-2020 programming period the Government has instruments (in the form of calls for application) to assist companies in passing the most critical development phase of an innovative company, called Valley of Death by experts. Innovation productivity data indicate that Hungary has a good chance to become a regional leader in this field, provided domestic innovative enterprises receive proper support and a sound development structure is created, similar to what is likely to have happened in Poland.

One of the key economic challenges the EU is facing now is finding the right direction of specialization. Historic examples namely show that countries/regions that cannot achieve a breakthrough in a specific technology but keep copying others and try to stay competitive in each field eventually risk losing ground and ending up only as mediocre or second-rate. The European Union and within it Hungary are currently facing this paradox: they have to specialize and concurrently boost economic performance. Various studies signal that **Europe is lagging more and more behind in the global innovation race.** The Innovation Union Scoreboard 2015 finds that South-Korea, the USA and Japan have a performance lead of 24 percent, 22 percent and 14 percent, respectively, over the EU28. The other main conclusion of the study is that Europe's largest economies have suffered the steepest ranking losses over the past decades.

Innovation performance ranking by country (2013)



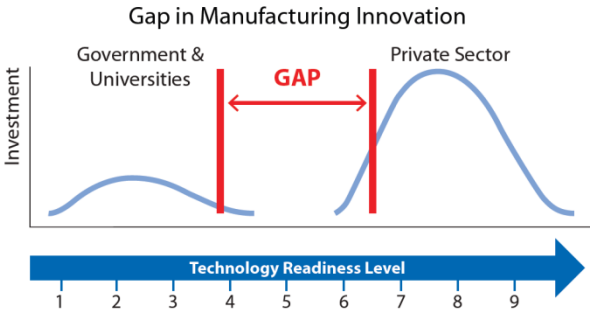
Source: LIST (2014)

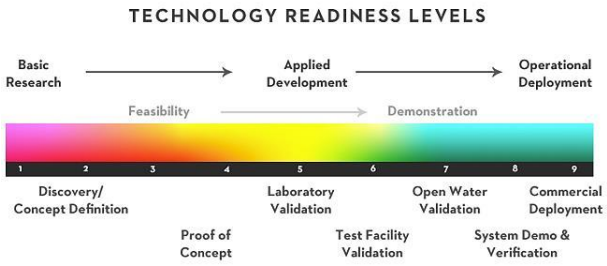
In order to reverse this negative trend, the European Commission identified innovative industries which it termed **"Key Enabling Technologies"** (KETs). In the opinion of the Commission, these technologies – if properly adopted -- may be capable of arresting and even reversing the current inauspicious trend.

- Photonics
- Nanotechnologies
- (Industrial) bio-technology
- Advanced materials
- Micro- and nano-technology
- Advanced manufacturing systems

Dissemblance is also visible in terms of economic policies: in the United States, the attitude to innovation is direct, business-like: "First acquire new knowledge, be the first to apply it and be the first to introduce it." Although the usual European attitude does not differ from that concerning outcomes but it does differ in terms of approach: **instead of commercialization European R&D policies tend to focus on basic research and industrial innovation, the issue of supporting the phase in-between has only recently come to the foreground.** This period is called the "Valley of Death" by experts (or gap). The EU uses the NASA-developed

Technology Readiness Level scale which is aimed at clear positioning in order to properly customize tendering conditions. This system can best describe the "Valley of Death" phase.





Industrial innovation can obviously help in bridging this gap, but it is also an advantage if enterprises and research centres stay in close physical proximity. This, however, requires support. In the USA, this necessity had been recognized as USD 3.15bn has been added by the Obama administration to the financing of 45 new technology research centres. The rationale behind this measure was that in case these industrial application-focused research centres reach their goals, **high-tech industrial investment projects can be kept within the country**. That is what Europe also needs: **while in 2005 40 percent of the volume of total industrial investment was realized in the EU, this indicator fell to as low as 25 percent within a short period of time, by 2013.** The reason for this may be that planning – especially in industrial and scientific fields -- has been vertically-focused on the EU's level and in the majority of member states; therefore horizontal effects which technologies have exerted could not suitably serve industrial demands. The following statistics are telling: whereas in the USA only 18 percent is being spent on basic research, the respective figure for the EU is above 30 percent.

EU-level problems

1. Development policy schemes are not KET-focused.
2. Capacities are competing with instead of complementing each other.
3. Well-defined specialization is hard to find within member states, especially among the new members.

4. Institutions are not strategy-oriented, especially with regard to transformative technologies.[1]

As in case of technology-focused planning technology funding can be projected relatively independently of industrial sectors and company sizes and as technology funding exerts horizontal spill-over effects, better results can be achieved provided the above aspects are taken into consideration already at the planning stage. One of the advantages stems from the fact that those involved can more easily utilize funding, but there are some drawbacks, too. For example, in contrast to industrial sector-focused planning, in this case there are no precise data on KET technologies. Planning, however, requires explicit statistical categorization of technologies, even by central statistical offices. Currently available data are compiled by various institutions or other non-governmental bodies. In this field, the most reliable data can be found in analyses of the registration of intellectual property rights.

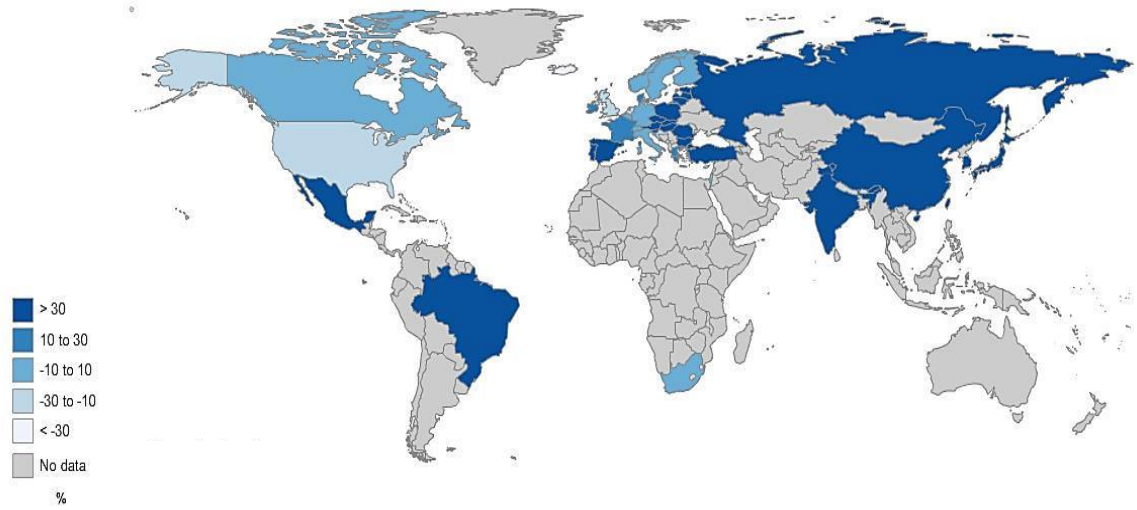
Data compiled by German economic research institution ZEW clearly show that the innovation dynamics of member states that joined the EU in or following 2004 is high and it is nearing the world average. In this aspect, Hungary – with a reading of 47.7 percent -- has almost reached the global average of 60.6 percent[2] with regard to all the six technologies. The average of the EU28 hardly reached 4 percent.

[1] "The U.S. and Asian research and Innovation efforts are often more strategically oriented. Science and Technology development in Asia and the United States are more focused on transformative and pervasive technologies […].

In comparison, the EU is less focused on strategic areas and tends to scatter its efforts on a wider range of scientific fields and technologies, with the risk of dominating none".

[2] The indicator is the quotient gained from patent applications submitted in the periods 2007-2012 and 2001-2006. China has the largest figure (44 percent), while Iceland the lowest (-61 percent). Deviation: 96.6.

Medium-term patenting dynamics of 6 KETs



Source: ZEW – KET Observatory (2016)

Competition is naturally even fiercer within individual regions. The below chart compares Hungary's achievement in various technologies with that of our regional peers. Calculations are based on the quotient of averages in the periods 2007-2012 and 2001-2006.

KETs dynamics in 2001-2006 and 2007-2012 (2013)

	Czech Republic	Poland	Slovakia	Romania	Hungary	World
Photonics	302,4	68,5	912,5	6,9	260,9	**126,1**
Nanotechnology	85,6	245,5	1 708,3	432,7	244,1	**142,5**
(Industrial) Bio-technology	50,3	150,5	-27,45	124,4	-4,69	**75,7**
Advanced materials	24,2	231,6	52,3	62,7	26,7	**58,1**
Micro- and nano-electronics	360,3	19,7	-20,73	32,1	152,3	**27,8**
Advanced manufacturing systems	45,9	215,9	327,8	104,8	20,2	**28,1**
Nr of registered patents (by EPO)	187	305	163	234	148	**105**[3]

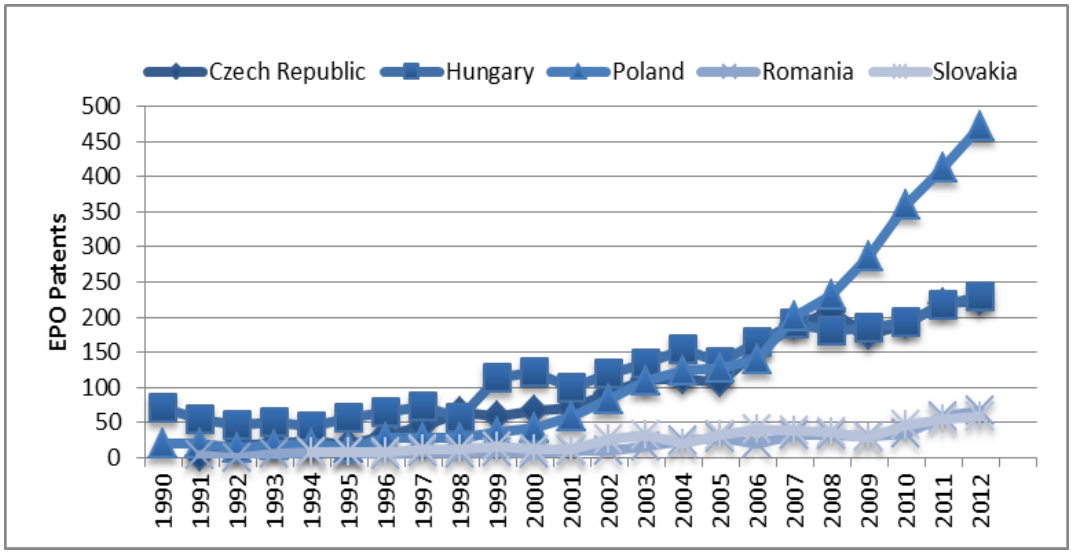
Source: ZEW, KET Observatory and Eurostat (2013)

[3] Only EU28 data

Thus, the Central European region's development data have beaten the global averages over the past 12 years in the field of almost every key technology. **The Hungarian indicators for nano-technology, photonics and micro-nanotechnology were above the respective world averages**. This achievement is not surprising, given the fact that **Hungary is the 7th largest employer within the nano-technology and micro-nanotechnology sectors.** The third field where Hungary has been successful is **photonics**. This area may gain additional impetus as the Szeged-based ELI_ALPS (Attosecond Light Pulse Source) project, the building and operating of a large-scale high-power laser research facility, has recently gained massive funding. The main objective of ELI is the establishment of a unique attosecond facility which provides ultrashort light pulses with high repetition rate for international developers and end-users. Government grants from EU resources total EUR 111 million for the project in 2014-2020.

Although dynamics is remarkable in Central European countries, it is necessary to see the driving forces behind this trend. There are no available data for various key technologies, but accumulated data compiled by the European Patent Office provide proper estimates of the innovation performance of these countries. The below chart shows the combined number of patent applications per year. These figures also reveal large differences within the Central European region.

Number of patent applications per calendar year (2013)



Source: Eurostat, European Patent Office (EPO) (2015)

The main difference regarding the Central European "competition" lies in **productivity.** From this aspect, Hungary tops the regional ranking in terms of population- and expenditure-based comparisons. This, however, has mainly been the result of foreign-owned enterprises. In order to address this discrepancy, the Government aims to boost the SME innovation by EUR 645 million. Under a funding scheme, enterprises receive a special subsidy for patenting intellectual property rights in the field of industry. The Government supports laboratory and test facility product validation, which takes part in the "gap" phase, by another scheme: EUR 64 million is being earmarked until 2017 for funding companies' prototype developments and a so-called innovation voucher will help enterprises utilize research facilities for their activities. In order to help assist the hardest phase of the gap, marked number 5 on Readiness Level scale, the combined value of avaialable funding is estimated to be EUR 55 million.

R&D data from the CEE region (2012)

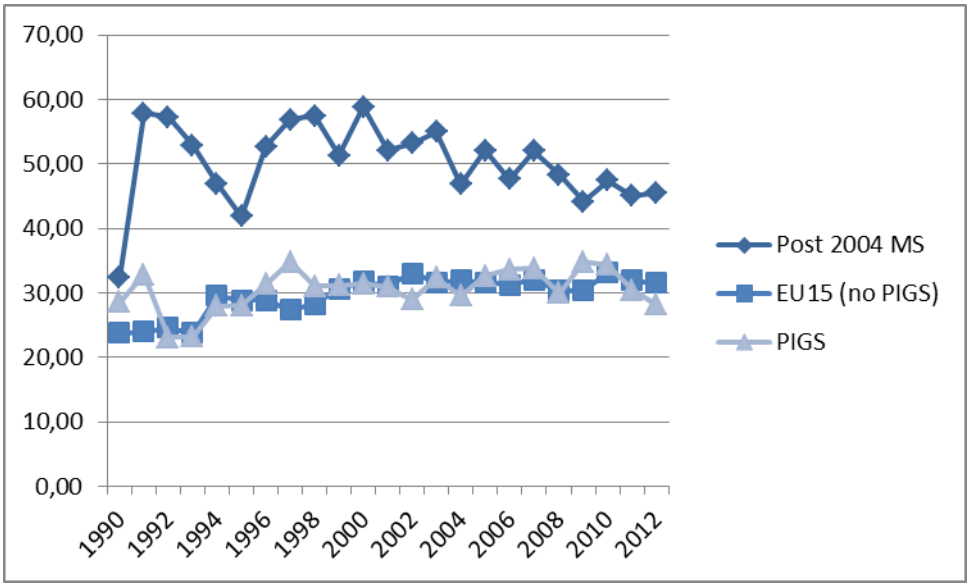
	Czech Republic	Poland	Slovakia	Romania	Hungary
Nr of patents per EUR 1bn of gross R&D expenditure (GERD) (2012)	77,79	137,52	101,19	103,99	182,96
Nr of patents per EUR 1bn of business enterprise R&D expenditure (BERD) (2012)	145,12	369,54	244,73	266,86	278,79
Nr of patents per 1 million inhabitants at the European Patent Office	21,31	12,24	10,96	3,33	23,16
Share of foreign-owned patents within total (2012) (%)	50,69	31,3	79,41	57,69	64,8
Share of German-owned patents within foreign-owned patents (2012) (%)	36	20	48	40	27

Source: Eurostat (2016)

Accordingly, **maintaining the upward trend in patent statistics, channelling more and more of funding to technologies with comparative advantages** as well as **increasing the number of Hungarian-owned patents** constitute the largest stumbling blocks that the Central European region must try to overcome. As far as foreign-owned patents are concerned, the EU average (36.1 percent) is well below the average of the Central European region (56 percent). The share of foreign-owned patents within the total volume at member states with advanced high-tech sectors, such as Sweden, Germany and France, is usually below 25 percent. As within the EU28, the share of patents that originate from a non-EU country is only 10 percent one can

conclude that **cross-border investments in each other's technologies has been usual among EU member states**.

Share of foreign-owned patents within total (2012)



Source: Eurostat – EPO (2016)