FACTORS OF INNOVATION RELATED TO HIGHER EDUCATION

Gabriella Keczer
University of Szeged, Faculty of Engineering

ABSTRACT

The European Union evaluates the member states' innovation potential and performance by the European Innovation Scorecard. According to this, in 2005 Hungary was the 18th out of the 33, among the countries catching up, but by 2006 we dropped to the 23th rank, among the countries that are trailing behind the rest. In my paper I examine our innovation potential and performance on the basis of those factors that are related to higher education. Then I give some suggestions in order to improve our position.

INTRODUCTION

In creating a knowledge-based economy we should produce such "settlement" that is obviously necessary not only for us, but also for others, and can be done locally. But in our present set of values innovation and creativity are still strange entities. (Gál J, 2006) In what follows, I will present Hungary's innovation potential and performance on the basis of an analysis of international and Hungarian statistical data, mainly focusing on factors directly related to higher education. I will consider the conditions required by universities for fulfilling their role in developing a knowledge-based economy.

1. HUNGARY'S INNOVATION POTENTIAL AND PERFORMANCE

The European Innovation Scorecard (EIS) takes 5 dimensions of innovation into consideration, 3 from the input and 2 from the output side.

A. Input dimensions:

1. Innovation drivers: human resources as the structural condition of innovation potential
-- science and engineering graduates (per 1000 inhabitants aged 20-29)
-- number of persons with a higher education diploma (per 100 inhabitants aged 25-65)
-- broadband internet access (number of broadband lines per 100 inhabitants)
-- number of participants in life-long learning (per 100 inhabitants aged 25-65)
-- youth education attainment level (proportion of population aged 20-24 having completed at least secondary education)

2. Knowledge creation: investments in research and development (R&D) activities as a condition for a successful knowledge-based society
-- state R&D expenditures (measured as a percentage of the GDP)
-- business R&D expenditures (measured as a percentage of the GDP)
-- medium-high-tech and high-tech R&D (measured as a percentage of manufacturing R&D expenditures)
-- innovative enterprises receiving public funding (measured as a percentage of all enterprises)

-- university R&D expenditures financed by businesses (measured as a percentage of total university R&D expenditures)

3. Innovation and entrepreneurship: innovation-related activities of the enterprises
-- innovative small and medium size enterprises (SME) (measured as a percentage of all SMEs)
-- innovative SMEs cooperating with one another (measured as a percentage of all SMEs)
-- innovation expenditures (measured as a percentage of the total turnover)
-- early-stage venture capital (measured as a percentage of the GDP)
-- ICT expenditures (measured as a percentage of the GDP)
-- SMEs implementing non-technological change (measured as a percentage of all SMEs)

B. Output dimensions:

4. Application: the performance expressed in terms of labour force and business activities and their added value in innovative sectors
-- employment in high-tech services (measured as a percentage of the total work force)
-- exports of high-tech products (measured as a percentage of the total exports)
-- sales of products newly introduced to market (measured as a percentage of the total turnover)
-- sales of products introduced recently by the company (measured as a percentage of the total turnover)
-- employment in medium-high and high-tech production (measured as a percentage of the total work force)

5. Intellectual property: successful achievements related to know-how
-- new European Patent Office (EPO) patents (per million inhabitants)
-- new United States Patent and Trademark Office (USPTO) patents (per million inhabitants)
-- new triadic (European, USA, Japan) patents (per million inhabitants)
-- new community trademarks (per million inhabitants)
-- new community designs (per million inhabitants)

According to the EIS, Hungary has the following performance indicators:

Based on the Summary Innovation Index (SII), in 2005 Hungary ranked 18th out of the 33 European countries scoring 0.3. This performance ranked us among those catching up. Sweden (above 0.7), Switzerland, Finland, Denmark and Germany (scoring 0.6 or above) are the EU's innovation leaders. The EU-25 average for 2005 is 0.42. Of the new member states, Estonia and Slovenia have the highest scores (above 0.3), outdoing Hungary. The trailing country is Turkey (below 0.1). Unfortunately, our indices had worsened by 2006, pushing us back in the rank to 23. We were preceded by Spain, Cyprus, Lithuania, the Czech Republic, and also Malta. (It should be noted that this set-back was mostly due to a deterioration in indices associated with small and medium-sized enterprises, rather than higher education.) This puts us to the group of those trailing behind the rest.

2. THE ROLE OF HIGHER EDUCATION IN THE PROVISION OF INNOVATION POTENTIAL AND INNOVATION PERFORMANCE

Of the above innovation factors, those directly related to higher education are the following:

- recently graduated science and engineering students
- those with a higher education diploma
- those participating in life-long learning
- patents

As regards the above factors, Hungary scored as follows:

1. recently graduated science and engineering students: 2005: 4.8; 2006: 5.1
The EU25 average in 2005 was 12.2. The highest rate was noted in Ireland (24.2), with Lithuania having the highest score of the new members states (16.3), this index being the one in which Hungary lags behind all the other countries. As far as this aspect is concerned, unfortunately, Hungary will follow a negative trend also in the longer run because the number of science and engineering students will remain at a low level, regardless of the dramatic increase in the number of students enrolled in higher education over the past 15 years. As a result, the proportions are expected to keep worsening, rather than improve.

	1990/1991	2001/2002	2002/2003	2003/2004	2004/2005
total number of students	102,387	313,238	341,187	366,947	378,466
science students	1,647	5,405	5,917	6,338	6,774
engineering students	20,223	29,443	50,590	50,368	49,945

Source: own compilation and calculation on the basis of KSH data

2. those with a higher education diploma: 2005: 16.7; 2006: 17.1
The EU25 average in 2005 was 21.9. The highest rate was noted in Finland (34.2). Hungary appears to lag behind Latvia, Lithuania, Slovenia, and Estonia of the new member states. The highest rate was recorded in Estonia (31.4).

3. those participating in life-long learning: 2005: 4.6; 2006: 4.2
The related ratio among the EU25 in 2005 was 9.9. The highest proportion of the age group taking part in such education is in Sweden (35.8). Of all the new members, only Slovakia is not behind Hungary, where a ratio similar to ours is noted. The highest rate is noted in Slovenia (17.9).

4. patents:
Patents submitted to the EPO: 2005: 18.3; 2006: 18.9
The EU-25 average in 2005 was: 133.6, the highest rate was noted in Switzerland (460.1). Of the new EU members, Slovenia ranks higher than Hungary (32.8).
Patents submitted to the USPTO: 2005: 4.9; 2006: 5.3

The EU-25 average in 2005 was 59.9, again, the highest rate was noted in Switzerland (188.3), and, also, Slovenia ranks higher than Hungary (8.4).
Triadic patents: 2005: 3.3; 2006: 1.9
The EU-25 average in 2005 was 22.3, with Switzerland being the leader again (110.8), and Slovenia ranking higher than Hungary (4.0).

A low number of patents does not indicate low performance of Hungarian researchers or research sites, rather, it points to the fact that research rarely progresses to the state that is most important in terms of innovation. I have compared ratios between the number of patents in several countries against the number of scientific papers, and the result attained appears to underlie the above statement.

	PAPER	PATENT	PAPER/PATENT
HUN	220	19	11.6
EU25	450	137	3.3
US	720	168	4.3
SWE	1180	285	4.1
SWITZ	1160	426	2.7
FIN	1000	306	3.3
GER	550	319	1.8
JAP	450	219	2.0
SPA	400	31	13.0
CZECH	225	16	14.0
SK	180	8	22.5
PORT	210	7	30.0
POL	170	4	42.5

Source: own compilation and calculation on the basis of 2003 OECD data

3. CONCLUSIONS

The above data indicates considerable lag of Hungary in a number of factors that are directly related to higher education. In order to achieve a higher rate of university contribution to the innovation output of the country and the region concerned, the following aspects merit consideration.

1. A governmental policy based on specifying the number of admissible students almost exclusively on the requirements of potential students and thus letting the number of, say, media graduates multiply by a magnitude while allowing the number of some science and engineering majors shrink is wrong also from the point of view of innovation. Numbers of students in state-financed education should be determined on the basis of the country's long-term interests and the expected labour market demand. In addition to maintaining a better proportion in this respect, the government and the institutions of higher education are required to do their best in order to steer students in public education towards science and engineering studies.

2. An obstacle to dissemination of innovative knowledge in Hungary is related to a lack of tradition to be involved in life-long learning. Such dissemination should play a crucial role in improving this situation and higher education should assume a key role in adult training, as universities represent the best natural resource for disseminating research-based and

up-to-date knowledge. To this end, universities are required to face the professional, pedagogical, and technical challenges posed by non-conventional study groups, non-traditional educational technologies, and advanced forms of training. Apparently, adult training at the university will only contribute to increasing innovation potential if students acquire a knowledge that is readily implemented in practice.

3. The decreasing (and ever lowering) number of patents is one of the clear symptoms of the fact that the results of research performed at Hungarian universities fail to reach the phase of practical implementation. Therefore, simultaneous utilization of various means is necessary for the knowledge and expertise developed at the university to directly penetrate the economy, that is, to strengthen what is called knowledge transfer. To this end, it is necessary to strengthen the relationship between the economy and the universities, which appears possible first of all at the regional level.

4. At present, universities typically cooperate on interregional, international levels, and tend to get integrated into their own region to a lesser extent. Also, they have their results implemented in practice earlier by way of mediation through international networks, compared to regional level utilization (Gál Z, 2005). Management of innovation, utilization of research output, and provision for the flow of knowledge require a separate organizational unit to be established within the university (office of innovation, technological transfer centre, a kind of clearing house), as well as involvement of universities (incubator, scientific parks, regional offices for development). It is important to streamline the main research orientations of the university that represent world class performance of the institution with the structure of the local economy, as that is indispensable for the transfer of knowledge and technology (Bajmóczy, 2005).

SOURCES

1. Bajmóczy Z. (2005): „Vállalkozó egyetem" vállalkozásfejlesztési szemszögből. In: Buzás N.: Tudásmenedzsment és tudásalapú gazdaságfejlesztés. JATEPress, Szeged.
2. Gál J. (2006): Gondolatok a nemzetközi vándorlás és a tudásáramlás logisztikai értelmezéséről. Agrár- és Vidékfejlesztési Szemle, 2006/1. p. 75-79.
3. Gál Z. (2005): Az egyetemek szerepe a regionális innovációs hálózatokban. In: Buzás N.: Tudásmenedzsment és tudásalapú gazdaságfejlesztés. JATEPress, Szeged.
4. Statistical databases of the KSH (Hungarian Central Statistical Agency).
5. Statistical databases of the OECD.
6. Statistical databases of the Eurostat.