Chapter 10.

Knowledge-based competitiveness

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10.1. Introduction

The paper focuses on the importance of structural characteristics for long-term sustainable competitiveness and, based on these characteristics, assesses the position of Visegrad countries (EU-4) within the EU framework.[1, 2] The assessment of the first part is based on the set of structural indicators related to Lisbon strategy (hard data) and on the results of Lisbon review based on the survey undertaken within the Global Competitiveness Report by World Economic Forum (soft data). The second part presents the position of the EU-4 countries within a comprehensive assessment framework of knowledge-based economy as designed by the World Bank (Knowledge Assessment Matrix – KAM). The assessment includes the key indicators of economic performance and institutional quality (as enabling factors) and the knowledge pillars, i.e. innovation performance and human resource quality, and information and communication technology infrastructure. In this case, the position of the EU-4 countries is assessed in comparison to a group of countries with a high level of human development and a more detailed focus includes individual indicators as compared with the best EU performers.

[1] The underlying research has been supported by the Grant Agency and Ministry of Education of the Czech Republic.

[2] To the survey of related theoretical starting points, see e.g. Kaderabkova (2003) and Kaderabkova, Müller (2006), and Kaderabkova *et al.* (2006).

10.2. Assessment of Lisbon Strategy implementation in research and innovation

A set of selected structural indicators has been used to measure the progress in achieving the Lisbon targets.[3] More specifically, the key to knowledge-based competitiveness of the EU members is the strengthening of the position of education and research institutions, improved public-private partnership and more intensive cooperation between science, universities, and industry. The relatively low level of related expenditure (in R&D and other innovation activities) is perceived as an obstacle to knowledge accumulation and long-term growth. An increase in the expenditure alone, however, is not sufficient. The overall business environment for small and medium-size enterprises must be improved, competition strengthened and regulation is to become more efficient. Therefore, besides mere increasing the volume of knowledge inputs, both efficiency of their use as well as the capacity to transform new knowledge into new products and services must be targeted. The role of the business sector is considered as the key one in this respect.

Table 10.1. Research and innovation inputs and outputs (2005)

	CZ	HU	PL	SK	EU-25
Gross domestic expenditure on R&D in % of GDP	1.42	0.94	0.57	0.51	1.85
Percentage of GERD financed by industry	54.1	39.4	30.3	36.6	54.5
Percentage of GERD financed by abroad	4.0	10.7	5.7	6.0	8.5
Patent applications to EPO/million of population**	15.9	18.9	4.2	8.1	136.1
Venture capital investments in % of GDP***	0.007	0.053	0.043	0.002	0.138
High-tech exports as a % of total exports	14.0	22.0	3.0	5.0	17.7
Science and technology grad./1000 of population	7.4	5.1	9.4	9.2	12.6

Note: * year 2004, ** year 2003, ***EU-15.

Source: EUROSTAT (2007).

[3] Structural Indicators are used to underpin the Commission's analysis in the Annual Progress Reports to the European Council (Spring Reports). The Structural Indicators cover the six domains of General Economic Background, Employment, Innovation and Research, Economic Reform, Social Cohesion as well as the Environment. In the Lisbon European Council in March 2000 the European Union set a strategic goal for the next decade

> *of becoming the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion.*

The Council also invited the Commission to draw up an annual synthesis report on the basis of the Structural Indicators, which provide an instrument for an objective assessment of the progress made towards the Lisbon objectives, and support the key messages of the report. In the 2005 Spring Report to the European Council, the Commission presented a new approach to the Lisbon strategy focusing on growth and jobs.

In 2005, EU members invested an average of 1.85% of their GDP in R&D, 54.5% of which were invested by business sector. In both indicators, the EU lags behind the USA (with 2.67% and 62% respectively). This lagging behind is even more significant in the EU-4, with the Czech Republic having relatively the best characteristics with 1.42% of GDP invested in R&D and the share of business sector at least approaching the EU average. The other three Visegrad countries show up much less favourable structural characteristics, especially very low share of businesses in R&D expenditure. The assessment of the R&D intensity of GDP and the role of business sector in national innovation systems must be taken into account when the indicators on high-tech exports are presented in international comparison. The given impressive value of so-called high-tech exports in Hungary (exceeding the EU average and approaching even the USA level of 27%) reflects rather the position in multinational value chain, i.e. with still rather limited internal R&D activities of domestic companies (as is the case of other EU-4 countries). Therefore, the information value of this indicator as to the knowledge-based competitiveness remains rather limited.

The Visegrad countries (with the exception of Hungary) show lower values of R&D financed from abroad than EU-25, which reflects limited external openness of their national innovation systems. All the EU-4 countries significantly fall behind in terms of their international patent activity, i.e. their companies and other innovators do not perceive patent protection is sufficiently profitable to undergo the relatively demanding patent procedures. Neither the specific instruments for financing innovation, the various forms of venture capital, have been much exploited in the Visegrad group, especially in the Czech and Slovak Republics. The under-exploitation of venture capital financing is notable in the so called early stages (when the risk of failure is extremely high). The last indicator approximates the available human resources with specific tertiary qualifications, i.e. in science and technology fields. In this case, the most favourable is the position of Poland and Slovakia (though still lagging behind the EU average exceeding the USA level of 10.2‰). The question is, however, if these resources will be exploited adequately when the R&D intensity of GDP remains low as well as the business sector R&D activities.

The effective use of **information and communication technologies** is of a great importance for economic productivity. However, the shares of ICT industries in the European economy still lag behind the USA as well as ICT intensity of GDP and R&D intensity of ICT value added. On the other hand, some ICT related indicators in Europe do show rather positive trends, such as school and household Internet connection or access to broadband Internet. Favourable trends are also apparent in the e-commerce, with Internet purchases gaining an increasingly more important share in business sales (in Hungary almost reaching the EU-25 average). E-government expands as well, however,

this service has been predominantly (and still to a limited extent) used by companies rather than individuals. In comparison to the USA (4.0%), the EU-25 shows a significantly lower share of IT expenditures as percentage of GDP, but, on the contrary, has higher telecommunication expenditures (2.7% in the USA). This is also the case of Visegrad countries (and in general, of most of the new EU members which largely build up a completely new ICT infrastructure). The number of households with Internet connection in EU-4 is still small, compared to the old EU members or the U.S., but is growing. Rather strong is the lagging behind of the EU-4 in a more sophisticated technology as broadband penetration, especially in Poland and Slovakia. As far as e-government services are concerned, Slovakia scores high values for both individual as well as business users; on the other hand, Hungary lags behind significantly.

Table 10.2. ICT expenditure and intensity (2006)

	CZ	HU	PL	SK	EU-25
Expenditure for IT in % of GDP*	2.9	2.4	2.2	2.3	3.0
Expenditure for tel. tech. in % of GDP*	3.7	5.7	5.0	4.4	3.4
Percent. of househ. with Internet access at home	29	32	36	27	51
Percentage of total sales from E-commerce	3.1	3.6	1.6**	0.0	4.0
Broadband penetration rate (in %)	8.4	7.5	3.9	4.0	14.8
E-government usage by individuals (in %)	17	17	6	32	24
E-government usage by enterprises (in %)	76	45	61	77	64

Note: * year 2005, ** year 2003.
Source: EUROSTAT (2007).

As to the public **expenditure on education** (in percentage of GDP), the EU-25 average is still lagging behind the USA (5.43%) with a generally lower share of private investment in education in Europe. However, of EU-4, Hungary and Poland spend relatively higher share of their GDP on education than EU-25, while the Czechs and Slovaks spend less. The EU still has a low share of (at least) secondary school graduates (with very significant differences among the individual countries and between the two sexes), and, at the same time, relatively a large share of so-called early school leavers. These two groups have strong inclination to difficult adjustment to the developments in the labour market (low flexibility). Most of Visegrad countries, however, show up rather favourable scores in these indicators, (including low gender inequality). The only exception is the rather high share of early school leavers in Hungary (still under the EU-25 average). Extremely low remains the participation in life-long learning in the EU-4 country group, reaching mostly less than half the EU-25 average.

Table 10.3. Education and life-long learning (2006)

	CR	HU	PL	SK	EU25
Total public expenditures on education in % of GDP**	4.51	5.85	5.62	4.34	5.20
Percentage of the population aged 20-24 with at least upper secondary education*	91.2	83.4	91.1	91.8	77.5
- females*	91.1	84.9	93.3	92.6	80.3
- males*	91.3	81.9	88.9	91.0	74.7
Early school leavers as a % of population aged 18-24	5.5	12.4	5.6	6.4	15.1
Participation in life-long learning in % of adult popul.	5.6	3.8	4.7	4.3	10.1

Note: *year 2005, **year 2003.
Source: EUROSTAT (2007).

10.2.1. Assessment of the Lisbon Strategy implementation according to the WEF

The Lisbon Review study assesses the implementation of the goals set by the Lisbon Strategy. It has been published biennially since 2002 by the World Economic Forum (WEF 2002, 2004, 2006). Due to methodology changes, however, only the last two editions of WEF Lisbon Review are considered as comparable. Unlike other studies concerning this topic, the WEF review is primarily based on expert opinion survey that is carried out among the CEOs and top executives in the countries subject to review (within the Global Competitiveness Report, see WEF, 2006a). The assessment in WEF Lisbon Review indicates that EU attention should be focused on three areas in order to get closer to the notorious goal of becoming "the most competitive and dynamic knowledge-based economy in the world": improving the environment for innovation and R&D, developing a stronger information society and, in general, creating an enterprise environment that is more conducive for private sector economic activity.

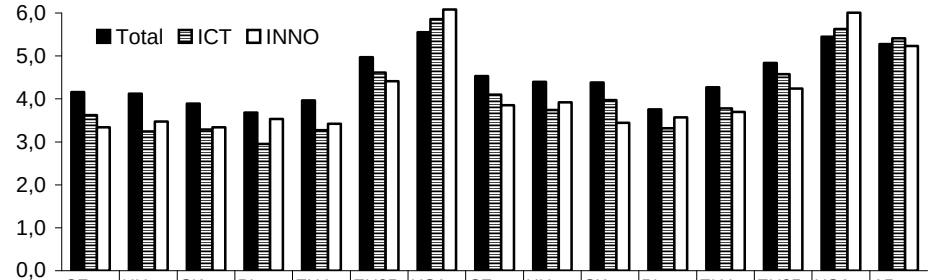
The results are shown on a scale ranging from 1 to 7 (the higher the score, the better the result), created by a combination of hard data and the aforementioned survey results on the quality characteristics. Attention is given to both the total score as well as the assessment of the individual dimensions (topics), sometimes further divided. Besides the EU-25 members, the 2006 Review also covers the two candidate countries, including the current new members Bulgaria and Romania, plus the USA and the average of an East Asian country group (Japan, Hong-Kong, Korean Republic, Singapore, and Taiwan) perceived as ever stronger competitors to the EU.

The first Lisbon priority dimension includes developing a European area for **innovation, research, and development**. According to WEF, innovation is critical, especially for those countries that have moved very close to the technology frontier, as is the case of most EU countries. In addition, the catch-up countries, which are inevitably losing their cost-based competitiveness, must increase

their innovation capacity. Innovativeness as well as making the maximum use of existing technologies requires the creation of necessary infrastructure and framework conditions: sufficient business investment in research and development, high quality scientific research institutions, collaboration in research between universities and industry, protection of intellectual property and innovation stimulation through government procurement.

The dimension of **information society** measures the extent to which an economy has managed the ICT for sharing knowledge and enhancing the productivity. According to WEF, countries with companies that aggressively integrate these new technologies into their production processes, such as the USA, have seen higher productivity improvements. In order to create a true information society, all stakeholders in the economy (individuals, businesses, and governments) must use these tools efficiently. This concept is captured by variables such as the prioritization of ICT by the government, ICT penetration rates (Internet, PCs), Internet usage by business, and the extent to which students have Internet access in schools.

Figure 10.1. Lisbon Review – ICT and innovation dimensions



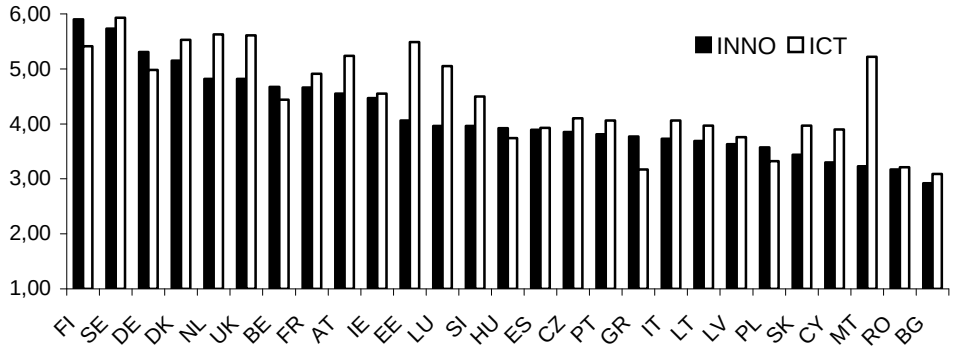
	CZ	HU	SK	PL	EU4	EU25	USA	CZ	HU	SK	PL	EU4	EU25	USA	A5
	2004							2006							
Total	4,16	4,12	3,89	3,68	3,96	4,97	5,55	4,53	4,40	4,38	3,76	4,27	4,84	5,45	5,28
ICT	3,62	3,24	3,29	2,95	3,28	4,61	5,86	4,10	3,74	3,97	3,32	3,78	4,58	5,63	5,41
INNO	3,34	3,47	3,34	3,53	3,42	4,41	6,08	3,85	3,92	3,44	3,57	3,70	4,24	6,01	5,23

Source: WEF (2004, 2006), modified.

When comparing the total scores of the Visegrad group to the averages of the EU-25, USA and the Asia-5 (figure 10.1), the lagging behind of the EU-4 is quite apparent despite some improvements since 2004. The most favourable is the position of the Czech Republic, followed by Hungary, Slovakia and, with a larger distance, by Poland. The ranking is slightly different in the R&D and innovation dimension, with the leading position of Hungary. When the development in time is evaluated, the improvement in innovation dimension has been the strongest in the Czech Republic and Hungary, on the contrary, rather negli-

gible in Slovakia and Poland. In case of the ICT dimension, the leading position is taken by the Czech Republic followed by Slovakia. The improvements in ICT dimension have been mostly much stronger than in innovation and R&D. Figure 10.2 puts the EU-4 countries within the ranking of the whole sample of EU-27 countries (i.e. including Bulgaria and Romania).

Figure 10.2. Lisbon Review – ICT and innovation dimensions in EU countries, 2006



Source: WEF (2006).

10.3. Knowledge-based competitive advantage

A more detailed evaluation of the structure of knowledge-based competitiveness in terms of its individual components has been undertaken for the two country groups – the Visegrad EU-4 and the four best performers within the European Union, EU-4* (Denmark, Finland, Sweden and the Netherlands). The set of indicators **Knowledge Assessment Matrix** (KAM), enlisted in the World Bank Database (2006), is used, enabling international comparison of sources and results of knowledge-based competitive advantage according to a structured group of indicators in four different pillars. The driving force behind quality-based competitiveness is innovation performance, the key impetus of the demand for knowledge inputs. Their supply is influenced especially by education and training, i.e. by improving the quality of human resources. Innovation companies require high-quality human resources and are motivated to invest in their development. The combination of innovation performance and high-skill human resources is the key condition for developing knowledge-based competitiveness. The quality of IT and telecommunication infrastructure and governance and business environment are the enabling characteristics.[4] The analysis evaluates the position of the Visegrad group within the set of countries with a high level of

[4] For more details on the method used in construction of KAM database, see Chen, Dahlman (2005).

human development as classified by the World Bank. The group of top EU performers is used for comparative purposes as an example of a successful transition to or development of knowledge economy.

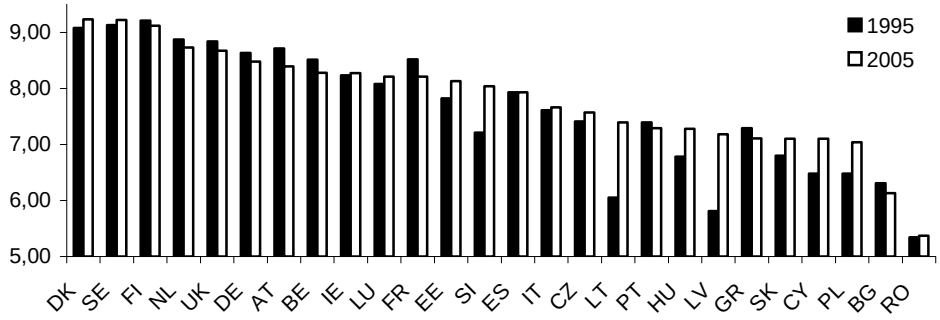
10.3.1. Knowledge economy framework

The speed of creation and diffusion of knowledge has increased significantly due to the development of information and communication technologies, including their improved accessibility (see e.g. OECD 2005, 2005a, 2006, 2006a; EC 2005, 2006; Hollanders, Arundel, 2005; Gelauff, Lejour, 2006). The faster creation and diffusion of knowledge also support faster proliferation of efficient production processes, thus positively affecting competitiveness and interconnection of the global economic processes. The combination of **revolution in knowledge and globalization** brings about important opportunities for supporting economic and social development but, at the same time, risks of further falling behind for those are not able to adjust sufficiently. Besides an increased competition, its nature changes, as well. Production costs of undifferentiated products are pushed down quickly; therefore the sources of additional value added require the exploitation of various forms of product differentiation, such as innovation design, effective marketing processes, efficient distribution, renowned brands.

Competitiveness, thus, depends on the productive contribution to the **global value chain** and on creating unique new chains based on innovation and services with high value added. Sustainable economic growth in such a world economy requires successful strategies based on constant use and creation of knowledge. At the lower development levels (usually related to lower level of research and technology capacities), the competitive strategy usually involves the use of existing knowledge and the adaptation of foreign technology to local needs, thus increasing domestic productivity. At the higher development levels (usually related to higher level of research and technology capacities), knowledge strategies strongly depend on domestic innovation effort that enables a shift toward products and services with higher value added, thus making the high wage level sustainable.

The initial comparison of the EU country positions in terms of **knowledge economy index (KE)** includes the development in time since 1995 (see figure 10.3 and table 10.4). The index takes into account the quality of environment supporting effective use of knowledge. Its value approximates the development level of knowledge economy (or the level of transition toward knowledge economy). The index is calculated as the average of normalized values of indicators included in all the four knowledge economy pillars.

Figure 10.3. EU members in terms of knowledge economy index value



Note: Higher value = better result. Highest score – 10.0; lowest – 0.0.
Source: KAM, World Bank 2006.

The Scandinavian countries have constantly held the leading position within the EU (as well as when compared globally). Out of the old EU members, who, on average, still keep their significant lead over the new members, only Denmark, Sweden, and Italy have improved their position since 1995. In all other countries, the index value has decreased, sometimes even significantly, as was the case of Austria and France. As opposed to that, the position of new members has improved (with the exception of Bulgaria), leading to continuous knowledge catch-up. Out of the new members, the position of Estonia and Slovenia is the best, with the latter making significant progress compared to the initial year. As to the EU-4 countries, the Czech Republic still occupies a position below the EU average and it was surpassed by Slovenia during the period reviewed. Even though the value of the knowledge economy index has increased in the CR, the total ranking has deteriorated a bit (one has to run faster just to stay in the same place). The positions of the other three Visegrad countries improved rather markedly (especially those of Poland and Hungary).

Table 10.4 shows the values of **individual indexes of knowledge economy**, i.e. the knowledge index and the indexes of individual pillars. The knowledge index measures the capacity to create, adopt, and diffuse knowledge. It is an indicator of the overall potential of knowledge development in the given country. The index is based on the average of normalized values of key variables of three pillars of knowledge economy – the quality of human resources, innovation system and information and communication technologies. New EU members score better in the knowledge index as opposed to the knowledge economy index (mostly due to the lower level of institutional quality) and, within that index, the quality of human resources reaches the best values (assessed as the adult literacy rate and the secondary and tertiary educational attainment). On the other hand, new members show the worst results in the innovation system development that

is assessed in terms of technology and science performance and the number of R&D employees. In the information and communication technology pillar (assessed in terms of the use of telephones, computers and Internet), the new members still lag behind the old members (though to a lesser extent than in innovation performance).

Table 10.4. Knowledge-based competitiveness and its components

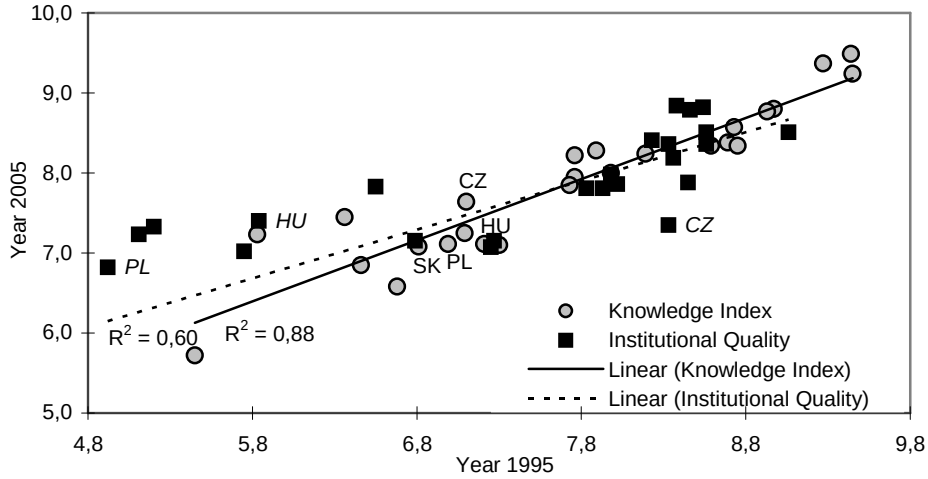
Ranking		Change		Knowledge Economy		Knowledge Index		Economic Regime		Innovation System		Human Resources		ICT	
1995	2005			1995	2005	1995	2005	1995	2005	1995	2005	1995	2005	1995	2005
5	1	4	DK	9.08	9.23	9.27	9.37	8.54	8.82	9.25	9.42	9.01	9.20	9.53	9.48
2	2	0	SE	9.13	9.22	9.44	9.49	8.23	8.41	9.66	9.72	9.01	8.98	9.63	9.77
1	3	-2	FI	9.21	9.12	9.45	9.24	8.46	8.79	9.56	9.71	9.15	9.16	9.66	8.84
9	8	1	NL	8.87	8.73	8.97	8.80	8.56	8.51	8.67	8.63	9.12	8.67	9.14	9.08
			EU-4*	9.07	9.08	9.28	9.23	8.45	8.63	9.29	9.37	9.07	9.00	9.49	9.29
27	28	-1	CZ	7.41	7.57	7.10	7.64	8.33	7.35	6.62	7.34	7.20	7.55	7.49	8.04
32	31	1	HU	6.78	7.28	7.09	7.25	5.84	7.40	6.84	7.10	7.35	7.60	7.07	7.04
31	34	-3	SK	6.80	7.10	6.81	7.08	6.79	7.15	6.66	6.84	6.81	6.85	6.95	7.56
35	37	-2	PL	6.48	7.04	6.99	7.11	4.92	6.82	6.49	6.44	7.99	8.08	6.51	6.80
			EU-4	6.87	7.25	7.00	7.27	6.47	7.18	6.65	6.93	7.34	7.52	7.00	7.36
Old members			EU1	8.40	8.32	8.47	8.37	8.21	8.17	8.31	8.40	8.46	8.20	8.62	8.52
New members			EU2	6.59	7.12	6.77	7.22	6.06	6.83	6.35	6.73	7.09	7.59	6.85	7.34
EU-25			EU	7.64	7.81	7.75	7.88	7.30	7.60	7.48	7.69	7.88	7.94	7.87	8.02

Note: Higher value = better result. New EU members excluding Malta.
Source: KAM, World Bank (2006).

In comparison to 1995, the knowledge economy index of the Visegrad countries has improved, particularly in Poland; however, its lagging behind still remains the largest within the EU-4. As to the knowledge index, the Czech Republic recorded the most favourable development, particularly owing to a significant improvement of the innovation system, as well as the other pillars of knowledge economy. The Czech Republic, however, heavily worsened the quality of its economic regime (the most of all the included EU countries) which, on the contrary, has markedly improved in Hungary and Poland. On the other hand, the Czech Republic performed rather well in upgrading the ICT infrastructure, similarly to Slovakia. As to the human resources quality, the opposite positions are occupied by Slovakia and Poland (the worst and best values respectively). Despite the overall progress, the Visegrad countries still lag in all the included criteria behind the old EU members. In comparison with the best performers of EU-4*, the Visegrad group mostly loses in innovation performance, with only moderate improvement in the last decade.

The **analysis of relations** between values of individual indexes and their development in time shows a very strong dependency between the initial values of the knowledge index and the institutional quality index and their resulting values at the end of the assessed period (see figure 10.4). It is apparent from the comparison that a more significant change in quality characteristics of economic development requires rather powerful and effective measures in order to receive more visible results, or, that in the long run, the previous period strongly influences the subsequent developments (path dependency). Moreover, a strong correlation between the initial level of institutional quality and the resulting value of knowledge index is apparent, with this fact pointing at the importance of a wider economic environment for quality-based competitiveness.

Figure 10.4. The relation between the knowledge and institutional quality indexes in 1995 and 2005

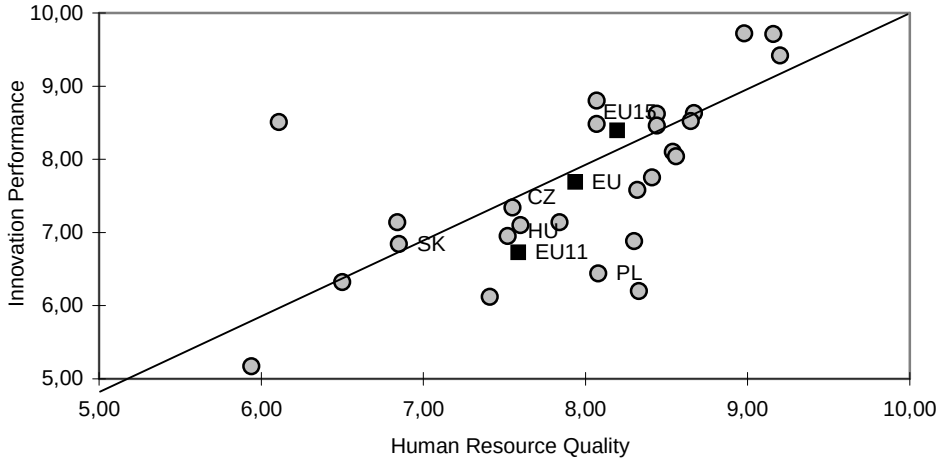


Source: Own calculations based on KAM data, World Bank (2006).

In 2005, the position of Visegrad countries, in terms of knowledge index slightly improved in comparison to the expected value as indicated by the regression line. Much more diverse, however, were the developments as to the institutional quality. The resulting value was significantly worse than expected in the Czech Republic, where the worsening of the institutional quality brought a very negative effect on the knowledge index development. On the contrary, in Poland and Hungary, the institutional quality has improved much more markedly than anticipated; in Slovakia the development approximately matched the regression line.

It is also necessary to mention the specifics of the relation between **innovation performance and the quality of human resources**. Within the EU, it is strongly differentiated, reflecting the development level of knowledge economy (see figure 10.5).

Figure 10.5. Innovation performance and human resource quality, 2005



Note: EU15, EU11 – the averages for old and new members respectively.
Source: KAM, World Bank (2006).

The old members tend to show a higher innovation performance as opposed to the quality of human resources, with the opposite being true for the new members. This discrepancy hints that an increase in the availability of skilled workforce is a necessary, yet not the sufficient precondition for the growth of quality-based competitiveness. Whether the high-skilled workforce is fully exploited depends especially on the level of innovation intensity of economic activities. The relatively better results of the new members in the quality of human resources as opposed to innovation performance also reflect the different nature of the indicators used. Whereas internationally approved data of patent statistics are used for evaluating outputs of innovation activities (as published by European or US patent offices), thus securing an adequate quality level of included outputs, there is no such authority present at the international level in case of human resources, with the national educational statistics being the only data available in this respect. In the Visegrad countries, the both values are either identical (Slovakia) or very close to each other (CR and Hungary), with the exception of Poland, where the quality of human resource markedly exceeds innovation performance.

10.4. Pillars of knowledge-based competitiveness

A more detailed assessment of the individual indicators of quality-based competitiveness according to the KAM methodology enables a more accurate identification of strengths and weaknesses of Visegrad country group (as compared to the top performers). At first, the indicators of economic performance and governance quality are presented, followed by the indicators of the knowledge indexes, i.e. the innovation performance, human resource quality and information and communication technology.

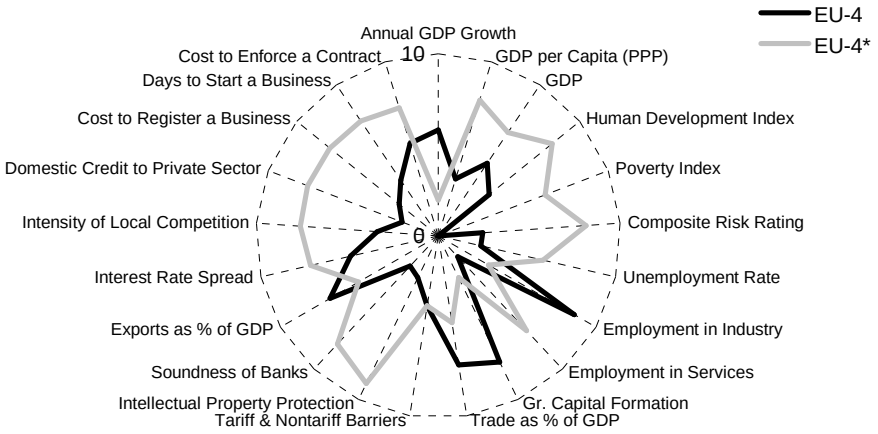
10.4.1. Economic performance and institutional quality

The indicators of economic performance are supplemented with characteristics of the efficiency of economic regime. Its basic prerequisite is the presence of incentives supporting an efficient use and creation of knowledge, i.e. the effective and transparent economic and regulatory policies. An efficient **economic regime** shows up minimum price distortions – it is open to trade and competition, thus stimulating entrepreneurship. Government spending and deficits are kept at an acceptable level, with stable and low inflation. Domestic prices are not regulated; exchange rate is stable and reflects the real value of the currency. The financial system allocates resources to potentially profitable investment opportunities. Supportive **institutional framework** includes effective, accountable and incorruptible public administration and legal system that supports and enforces the basic principles of business relations, protects ownership and intellectual property rights.

The assessment of the Visegrad country group in terms of economic performance, efficiency, governance quality and the equality of opportunities is shown in figures 10.6 and 10.7. As far as the **economic performance** is concerned, the EU-4 countries show a relatively high employment rate in industry as opposed to services, i.e. the maintenance of the traditional competitive advantage. A high annual growth rate, projecting in a rising economic level, is a favourable effect. The rating of political risks is less favourable as is the unemployment rate. In an **efficient economic regime,** the high level of external openness is clearly positive and supports competitive pressures on the domestic market. On the contrary, the characteristics of business environment and the quality of the banking sector are assessed rather negatively, (including the low level of intellectual property protection).

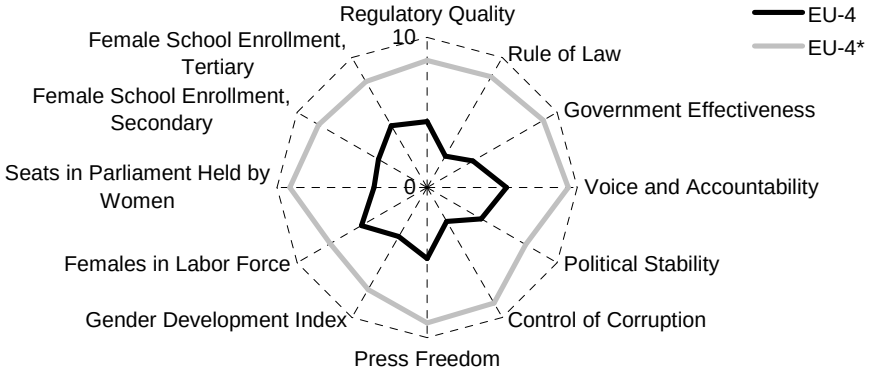
As it has been already mentioned, the weakness of the Visegrad countries includes the **low governance quality**. This lagging behind is especially strong in comparison to the top EU performers.

Figure 10.6. Indicators of economic performance and efficiency



Note: EU-4, EU-4* as in table 10.4.
Source: KAM, World Bank (2006).

Figure 10.7. Indicators of governance and equality of opportunities



Note: EU-4, EU-4* as in table 10.4.
Source: KAM, World Bank (2006).

From the long-term perspective, the corruption control has been assessed as the worst, reflecting low institutional quality, with only slightly better rule of law and public administration performance indicators. In order to change this situation in a significant way, comprehensive and fundamental changes will be necessary, with the change also being required for ensuring an appropriate level of efficiency and effectiveness of supporting economic and political measures for

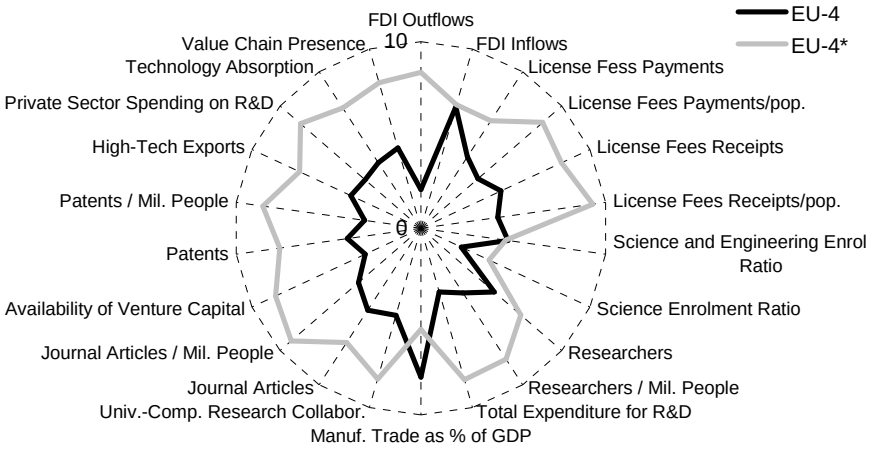
the transition to knowledge-based economy. In **gender equality of opportunities**, the lagging behind of the Visegrad countries is clearly apparent as well. Only the indicator of female participation in the labour market, together with some components of the human resource development index, show slightly better results.

10.4.2. Innovation performance

An efficient innovation system is the key prerequisite for technology progress. It includes a network of institutions, policies, and procedures that affect the methods of acquiring, diffusing, and exploiting knowledge. Universities, public and private research institutions, non-profit organization and the government sector are all considered innovation institutions. The majority of technology knowledge is currently created in developed countries – more than 70% of patents and scientific and technical publications. The differences between developed and less developed countries in the production of technology knowledge per capita are even more pronounced than the differences in the economic level. Nevertheless, the technology catch-up presents an opportunity for adoption of external technology knowledge, provided sufficient development of domestic innovation capacities (absorption capacity) is ensured.

In terms of the **innovation system** (see figure 10.8), the Visegrad countries lag behind in the production of technology knowledge (patents and licenses) that reflects an overall low level of the knowledge base development.

Figure 10.8. Innovation performance indicators



Note: EU-4, EU-4* as in table 10.4.
Source: KAM, World Bank (2006).

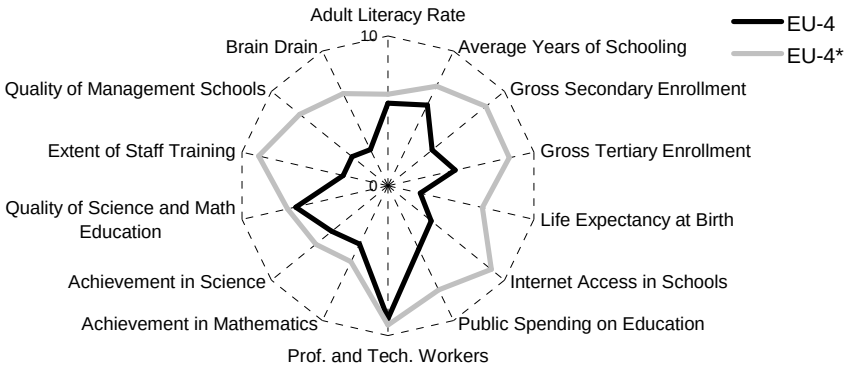
External openness, reflected especially in trade flows and the inflow of foreign investment (as a possible source of technology transfer), is assessed positively, whereas the levels of international technology flows are not so favourable. Co-operation between businesses and universities is assessed relatively positively even though its scope still remains limited when compared to academic institutions. The relative number of researchers, low numbers of students in science and technology fields, and the low availability of venture capital are considered significant weaknesses.

10.4.3. Quality of human resources

Educated and skilled population is key to effective creation, diffusion and exploitation of knowledge. The primary education increases the capacity for learning and for application of information. Technical vocational training and higher education is necessary for innovation activity and for adopting and adapting external knowledge. More educated population is usually also more technically sophisticated, which creates domestic demand for advanced products and therefore expands their range supply.

When compared internationally, the Visegrad countries **quality of human resources** (see figure 10.9) is favourably assessed in the fields of science and mathematics as it has been proven by international testing of students. Also the relative representation of professional and technical workers and the length of education are perceived positively. Other indicators lag behind more significantly. The worst situation is in the public spending on education and the relative number of students (gross enrolment).

Figure 10.9. Indicators of human resource quality



Note: EU-4, EU-4* as in table 10.4.
Source: KAM, World Bank (2006).

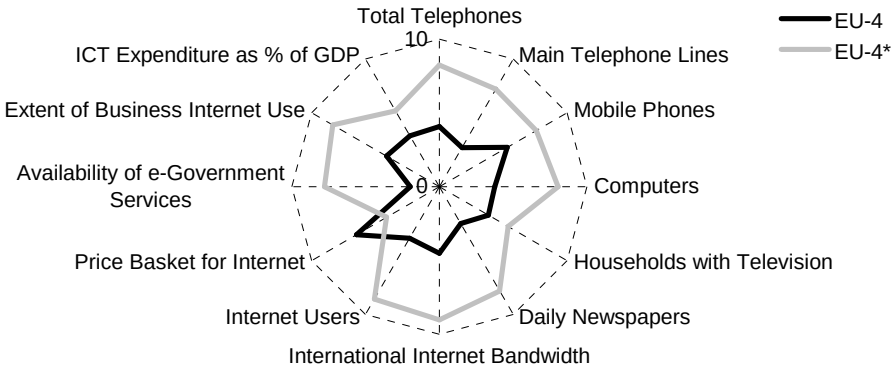
Other characteristics of the educational system are also rather problematic, especially internet availability at schools, quality of management schools and the average extent of training in businesses.

10.4.4. Information and communication technologies

The infrastructure of information and communication technologies affects the availability, reliability, and effectiveness of computers, telephones, TVs, and various networks that are used for their interconnection. According to the World Bank definition, information and communication technologies include hardware, software, networks, and media for collecting, storing, processing, transmitting and presenting information in a form of voice, data, text and pictures. Thanks to relatively low user costs and the ability to overcome large distances, information and communication technologies have caused a revolution in the transfer of information and knowledge in the global economy. Pro-growth effect is visible in the production of ICT as well as their use by other industries. Their greatest contribution can be seen in the decreasing the costs and insecurity of economic transactions which supports the improvement of output and productivity. The global interconnection of markets and economic agents brings about additional positive increase in the efficiency.

As far as the infrastructure of **information and communication technologies** (see figure 10.10) is concerned, the position of the Visegrad countries has been rather variable based on individual indicators. The mobile telephone penetration and ICT expenditures as percentage of GDP are at a high level.

Figure 10.10. ICT infrastructure indicators



Note: EU-4, EU-4* as in table 10.4.
Source: KAM, World Bank (2006).

The situation is not so favourable when it comes to Internet characteristics, especially Internet capacity, its costs, and use in households, companies, and public administration. Lagging behind is especially substantial in the availability of e-government, i.e. in terms of internal interconnection of the public administration, as well as in the e-service range supplied to the public.

10.5. Conclusions

Based on the **structural indicators** of the Lisbon process, the initial position of the Visegrad group is assessed as showing the following problems, challenges and opportunities. The long-term sustainability of higher growth rates or their further increase still remain the key issue. Low productivity per one hour worked remains one of the key indicators of lagging behind in the EU-4. The main source of its increase is especially an improvement in the intensity of economic activities in terms of quality-intensive processes.

As far as the research and development is concerned, the Visegrad countries lag behind the EU-25 average in the most of structural indicators, both in terms of inputs and outputs, i.e. R&D expenditures, the share of the business sector in these expenditures, availability of venture capital, patent applications and percentage of high-tech exports. Another problematic area is the low intensity of R&D cooperation between the business sector and universities and the low (relative) number of science and technology graduates. In terms of information and communication technologies, the EU-4 group shows rather high telecommunication expenditures. The Internet use rate in households and the technological level of Internet connection still remain low. On the contrary, the importance of e-commerce as percentage of corporate sales and the use of e-government by the business sector have been favourable. In education, the Visegrad countries, expenditures as percentage of GDP still lag behind in private and/or public sectors (with the difference between the Czech and Slovak Republics in comparison with Poland and Hungary), accompanied by the notoriously low share of population with tertiary education. As opposed to that, the indicator of population with at least secondary education and the indicator of early school leavers remain favourable.

When simulating the fulfillment of the Lisbon goals in the long run, the Visegrad countries may expect important impacts on their performance characteristics (the growth of product, productivity, export and employment), especially in the areas where the indicators in the initial period were assessed as lagging behind the targeted Lisbon goals. This would mostly apply to increasing R&D expenditures, percentage of population with tertiary education and decreasing the administrative burden.

Based on the World Bank indicators of **knowledge-based competitive advantage**, the international position of the Visegrad countries indicates lingering gaps between the old and new EU members. At the same time, the group of the less developed countries significantly lags behind the group of more developed members. These persisting national differences require appropriate actions, tools and measures in a form of supporting policies so as to reflect the acquired level of competitive advantage in individual countries (country groups). The countries with a less-developed level of competitive advantage need to be differentiated and assistance should be targeted based on the source and extent of the key weaknesses. If these are more or less exceptional and include only specific individual aspects, assistance should always be specifically targeted at their remedy. If the overall quality of competitive advantage is low, the attention should be focused on supporting system measures of the widest possible scope.

In terms of framework characteristic of knowledge economy, the Visegrad countries have so far shown an under-average position, lagging behind the new EU members of Estonia and Slovenia. The low governance quality in the most indicators assessed, especially in the corruption control, has been a lasting obstacle to competitiveness of the Visegrad countries (despite some modest improvements except the case of the Czech Republic). The quality of institutions plays an important role in developing knowledge activities requiring medium to long-term decisions (and connected to a higher level of risks).

As far as the individual indicators of the knowledge index are concerned, innovation performance shows low knowledge production and innovation performance but the high degree of openness to investment flows creates the potential for adopting external technology knowledge to local needs. The low supply of specific high qualifications and skills is critical, with a relatively low numbers of researchers and science and technology graduates. Therefore, a more pronounced system support to the creation and application high qualifications seems vital. The information and communication infrastructure in the Visegrad countries is developed especially in terms of the number of telephones. However, the availability, or use, of more advanced technologies and applications, including their commercial use, should be improved.

References

1. EC (2005), *European Innovation Scoreboard*, Brussels: European Commission.
2. EC (2006), *Time to Move up a Gear: Annual Progress Report on Growth and Jobs*, Brussels: European Commission.
3. EUROSTAT (2007), *Databases – Structural Indicators, Science and Technology*, Luxembourg: Eurostat (1 March).
4. Gelauff, G., Lejour, A. (2006), *Five Lisbon Highlights – The Economic Impact of Reaching These Targets*, CPB Netherlands Bureau for Economic Policy Analysis, "CPB Document" No. 104, Hague.
5. Hollanders, H., Arundel, A. (2005), *European Sector Innovation Scoreboards., TrendChart*, Brussels: European Commission.
6. Chen, D., Dahlman, C. (2005), *The Knowledge Economy, the KAM Methodology and World Bank Operations*, "Working Paper" No. 37256, World Bank Institute.
7. Kaderabkova, A. (2003), *Economic Growth and Structural Changes*, Prague: Oeconomica.
8. Kaderabkova A. *et al.* (2005, 2006), *Competitiveness Yearbook of the Czech Republic – Analysis*, Prague: Linde Publ.
9. Kaderabkova, A. (2006), *The Czech Republic in Globalized and Knowledge-Based Economy*, Centre for Economic Studies, Prague, "Working Paper" No. 11.
10. Kaderabkova, A., Müller, K. (2005), *National Innovation Systems – Inputs and Infrastructure*, Centre for Economic Studies, Prague, "Working Paper" No. 12.
11. OECD (2005), *Communications Outlook*, Paris: OECD.
12. OECD (2005a), *Science, Technology and Industry Scoreboard 2005*, Paris: OECD.
13. OECD (2006), *Information Technology Outlook 2006*, Paris: OECD.
14. OECD (2006a), *Science, Technology and Industry Outlook 2006*, Paris: OECD.
15. World Bank (2006), *Knowledge Assessment Matrix*, www.worldbank.org/kam.
16. WEF (2006a), *Global Competitiveness Report 2006-2007*, London: Palgrave-Macmillan.
17. WEF (2002, 2004, 2006), *The Lisbon Review 2006 – Measuring Europe's Progress in Reform*, Geneva: World Economic Forum.