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Quality-based Competitiveness

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Abstract:

The first part asses the position of Visegrad countries (EU-4) in terms of structural indicators and Knowledge Assessment Matrix indexes of innovation performance, human resource quality and information and communication technology infrastructure. The knowledge economy development in the EU-4 country group has been assessed within the comprehensive framework of economic regime efficiency and governance quality. Next part evaluates the qualitative position of the Visegrad countries in terms of pro-innovative nature if their organisational structure. The applied cluster analysis exploits the data of European Working Condition Survey (2005), differentiated according to industry, occupation and country characteristics. The cluster analysis results have been combined with innovation and competitiveness sources. The last chapter evaluates the qualitative aspects of the Czech Republic position in the global economic flows in terms of their knowledge intensity. The stress is being put on structural characteristics of value-added, FDI and R&D and innovation activities indicating the change of competitive advantage towards the increasing role of internal innovation capacity and unique product and processes.

Keywords: competitiveness, competitive advantage, foreign direct investment, innovation performance

JEL: O14, O33, O39

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Introduction

The first chapter of this 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] Firstly, the assessment 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.

The second chapter presents assessment of innovative performance using a theoretical and methodological concept of learning economy applied to the example of EU countries, with a special regard to the group of Visegrad countries (EU-4). Implications of this assessment for quality-based competitiveness (i.e. a competitive advantage based on quality intensive inputs and outputs) are also discussed, and the positions of EU countries are compared in terms of different sources of competitiveness (cost versus knowledge-based advantage) and technology knowledge (internal innovative capacity versus technology transfer). The theoretical and methodological concept of learning economy has so far not been applied to new EU members. The paper starts with the introductory description of the key theoretical and methodological concepts and clarification of the applied terms and methods. The exploited data set is described and major results of the analysis of organisational models presented. The structural aspect includes classification according to industries, occupations and countries. The impact of national differences on organisational models is also discussed. The typology of organisational models is subsequently compared against the typology of innovative activities and sources of competitiveness. The applied methodology is mainly based on the work of Lundvall et al. (2006).

Due to its external openness, Czech economy has been getting more involved in the globalization process that is characterized by an increase in the mobility of production factors, including technology knowledge. Therefore, the last chapter of this paper looks into details of the structural characteristics of quality-based competitive advantage from the perspective of industries, trade flows, foreign direct investment activities and regions. As for industry-related competitive advantage and economic structure, attention is given to performance in terms of technology and knowledge intensities. The industry level is also exploited in the assessment of key characteristics of innovation activities of Czech companies, with a special attention focused on the differences between manufacturing and services (innovation modes, R&D intensity, cost structure and innovation intensity, results, motivation and barriers of innovation activities). In terms

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

of foreign direct investment, attention is especially given to its role in domestic R&D activities (their share in expenditure and employment) and in innovation outputs (in comparison with local companies). At the regional level, focus is aimed at assessing economic performance as both a prerequisite for and result of competitiveness, with a special regard to innovation performance evaluated in terms of R&D activities, technology-intensive value added and the level of foreign direct investment.[2]

1. Knowledge-Based Competitiveness

1.1. 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 1.1. 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).

[2] For the survey of key theoretical starting points related to the knowledge-based competitiveness see e.g. Kaderabkova (2004, 2005, 2006a), Kaderabkova et al. (2006), Rojicek (2006), WEF (2006), UNCTAD (2005, 2006). The comprehensive empirical background has been presented above all in the annual survey publications of OECD (2005, 2005a, 2006, 2006a). Methodology of innovation performance analysis has been included e.g. in the papers of Arundel, Hollanders (2005) underlying the publication of Innovation Scoreboard.

[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 (Table 1.1). 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 USA, 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 1.2. 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 % 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 (Table 1.2). The EU still has a low share of (at least) secondary school graduates (with very significant differences among the individual countries and also 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 1.3).

Table 1.3. Education and life-long learning (2006)

	CZ	HU	PL	SK	EU-25
Total public expendit. 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).

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, 2006a). 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 2006). 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

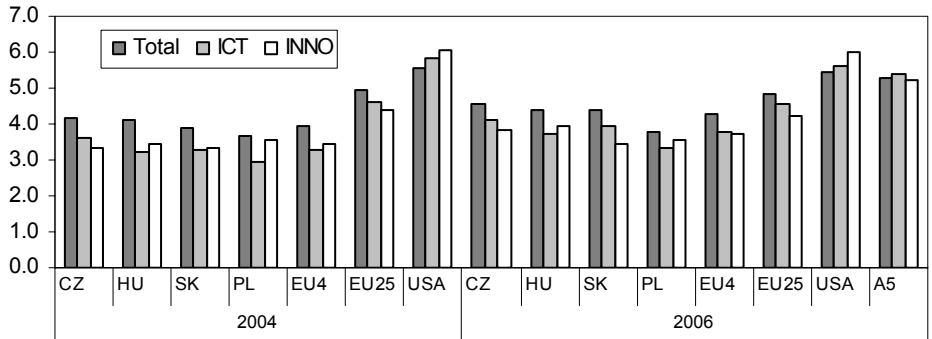
economy in the world": improving the environment for innovation and R&D, developing a stronger information society and, in general, creating an enterprise environment that is more conducive for private sector economic activity.

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. But also 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 require 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 1.1. Lisbon Review – ICT and innovation dimensions

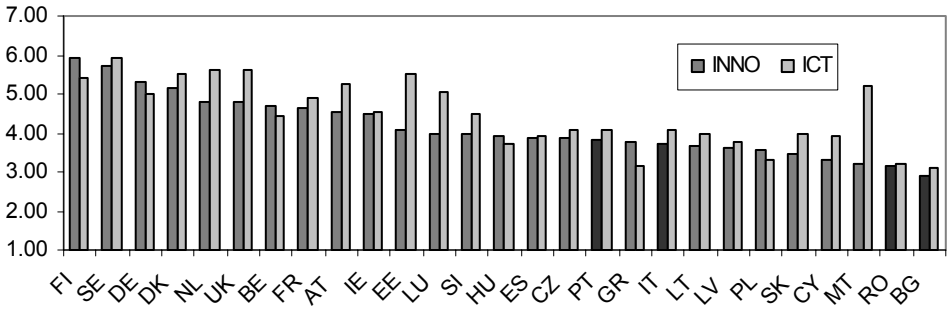


	CZ	HU	SK	PL	EU4	EU25	USA	CZ	HU	SK	PL	EU4	EU25	USA	A5
	2004							2006							
Total	4.16	4.12	3.89	3.68	3.96	4.97	5.55	4.53	4.40	4.38	3.76	4.27	4.84	5.45	5.28
ICT	3.62	3.24	3.29	2.95	3.28	4.61	5.86	4.10	3.74	3.97	3.32	3.78	4.58	5.63	5.41
INNO	3.34	3.47	3.34	3.53	3.42	4.41	6.08	3.85	3.92	3.44	3.57	3.70	4.24	6.01	5.23

Source: WEF (2004, 2006a), modified.

When comparing the total scores of the Visegrad group to the averages of the EU-25, USA and the Asia-5 (Figure 1.1), 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 negligible 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 1.2 puts the EU-4 countries within the ranking of the whole sample of EU-27 countries (i.e. including Bulgaria and Romania).

Figure 1.2. Lisbon Review – ICT and innovation dimensions in EU countries, 2006



Source: WEF (2006a).

1.2. 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 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.

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

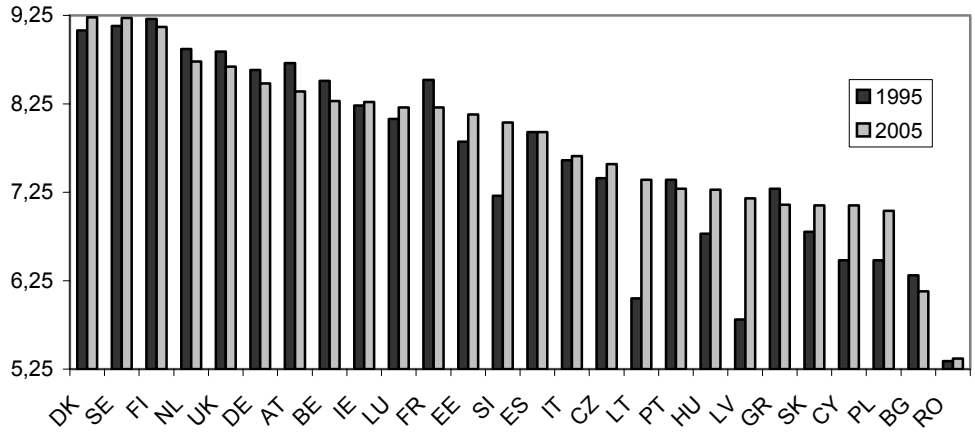
Knowledge economy framework

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 1.3 and Table 1.4). 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 1.3. EU members in terms of knowledge economy index value



Note: Higher value = better result. 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, which, 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 knowledge economy index value 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 1.4 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 1.4. 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

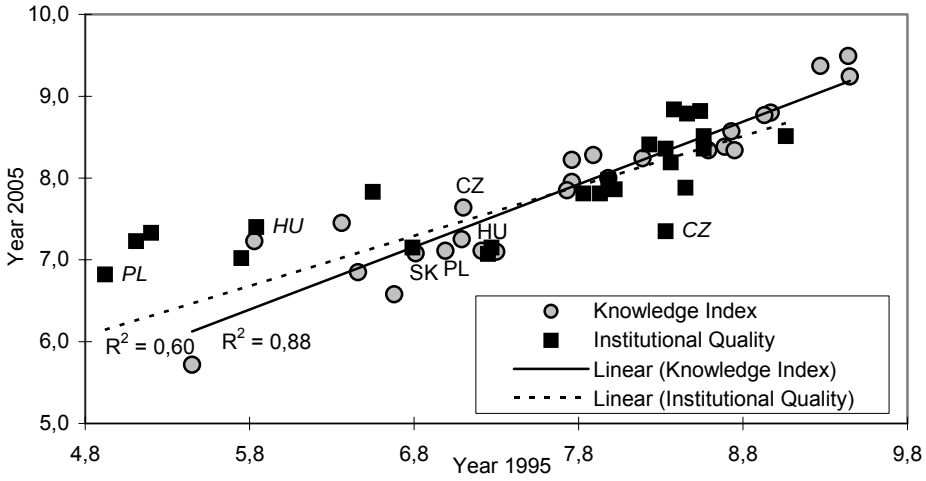
Note: Higher value = better result. New EU members excluding Malta. Source: KAM, World Bank (2006).

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 1.4). 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 1.4. The relation between the knowledge and institutional quality indexes in 1995 and 2005



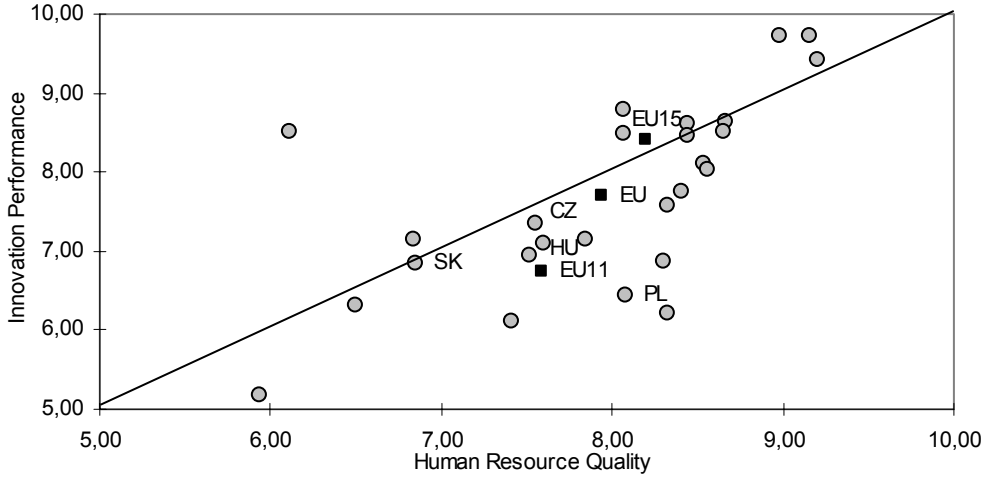
Source: Own calculations based on KAM data, World Bank (2006).

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 1.5). 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.

Figure 1.5. Innovation performance and human resource quality, 2005



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

1.3. Pillars of knowledge-based competitiveness

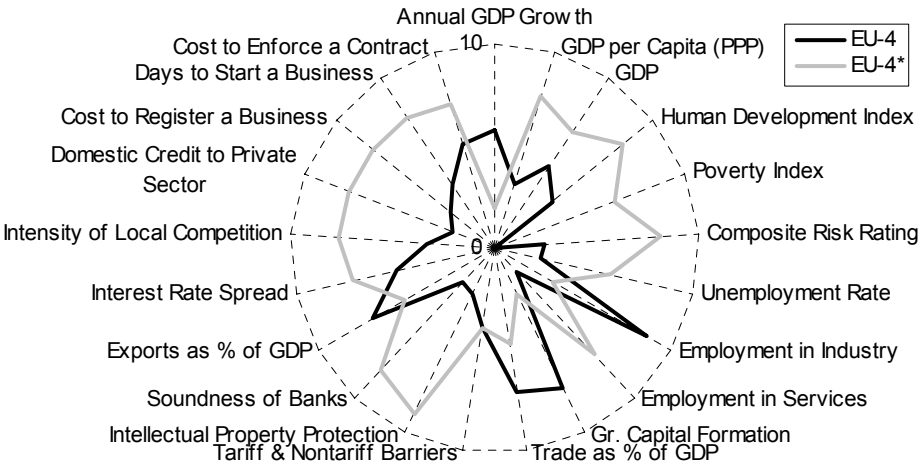
A more detailed assessment of the individual indicators of quality-based competitiveness according to the KAM methodology enables a more accurate identification of strengths and weaknesses of Visegrad country group (as compared to the top performers). At first, the indicators of economic performance 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.

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.

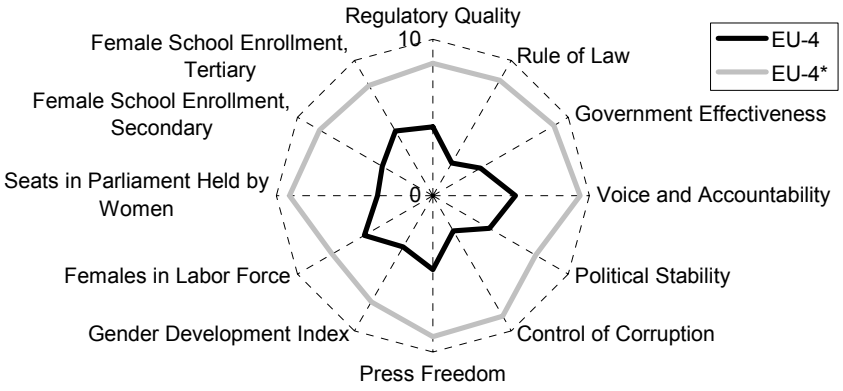
Figure 1.6. Indicators of economic performance and efficiency



Source: KAM, World Bank (2006).

The assessment of the Visegrad country group in terms of economic performance, efficiency, governance quality and the equality of opportunities is shown in Figures 1.6 and 1.7. 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).

Figure 1.7. Indicators of governance and equality of opportunities



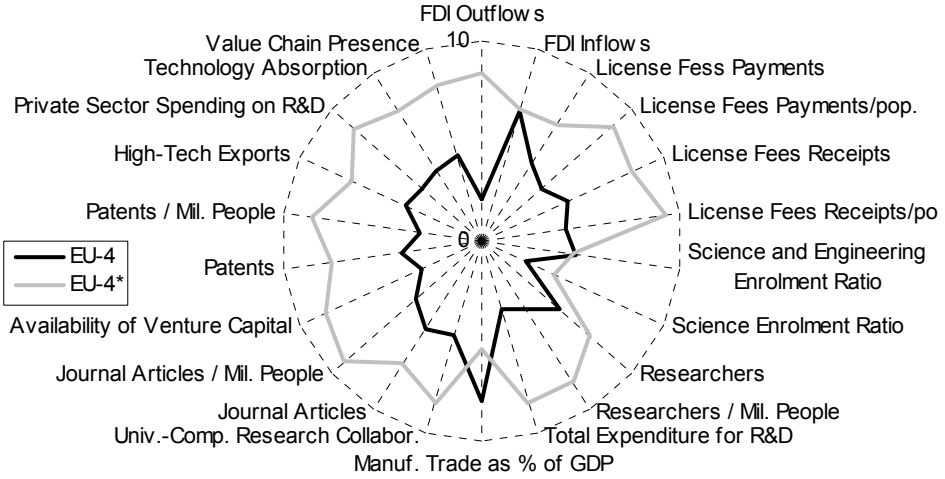
Source: KAM, World Bank (2006).

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. 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.

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.

Figure 1.8. Innovation performance indicators



Source: KAM, World Bank (2006).

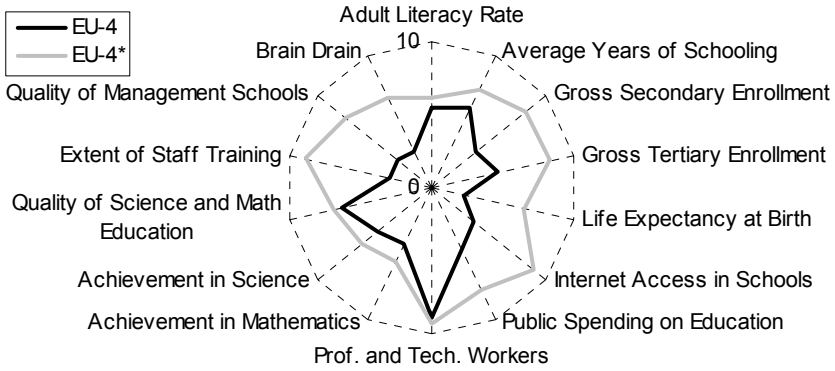
In terms of the **innovation system** (see Figure 1.8), the Visegrad countries lag behind in the production of technology knowledge (patents and licenses) that reflects an overall low level of the knowledge base development. External openness, reflected especially in trade flows and the inflow of foreign investment (as a possible source of technology transfer), is assessed positively, whereas the levels of international technology flows are not so favourable. Cooperation 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.

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.

Figure 1.9. Indicators of human resource quality



Source: KAM, World Bank (2006).

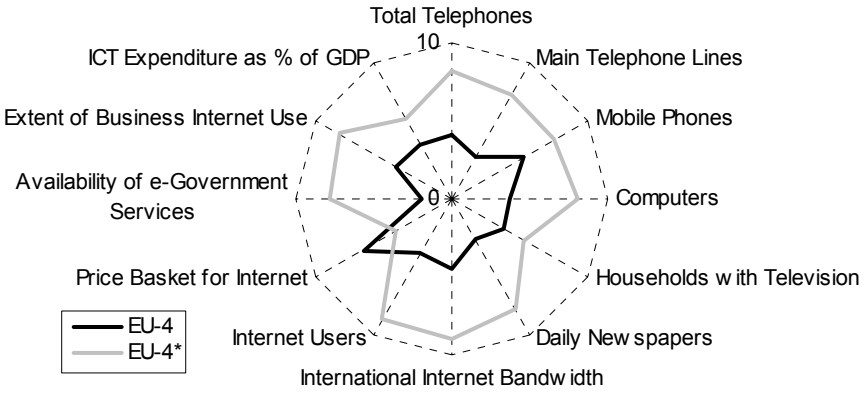
When compared internationally, the Visegrad countries **quality of human resources** (see Figure 1.9) is favourably assessed in the fields of science and mathematics as it has been proven by international testing of students. Also the relative representation of professional and technical workers and 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). 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.

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.

Figure 1.10. ICT infrastructure indicators



Source: KAM, World Bank (2006).

As far as the infrastructure of **information and communication technologies** (see Figure 1.10) 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. 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.

2. Innovative Performance in a Learning Economy

2.1. Theoretical and methodological starting points

Distinguishing between price/cost-based and quality-based sources of competitive advantage to some extent reflects both the achieved economic level of a country and conditions for its further improvement.[5] Competitiveness of more advanced countries tends to be based more on quality uniqueness reflecting their more developed domestic knowledge base and hence allowing for higher incomes for production inputs.[6] On the other hand, cost-based competitiveness prevails in less advanced countries, as it is supported by low wages and undervalued currencies. A transition to a quality-based competitive advantage in the less developed countries (which have exhausted their cost-based

[5] For a more detailed overview of the key theoretical approaches and concepts related to the sources of quality-based competitiveness and long-term performance see for example Kaderabkova (2003), Kaderabkova, Müller (2005), Müller, Srholec (2006). Specifically for the role of innovation based competitiveness see e.g. Fagerberg et al. (2005).

[6] Quality is an additional (tangible or intangible) feature of a product that increases consumer, investor and producer willingness to pay for it. Higher quality allows achieving higher market value without reducing or loosing the existing market share. Products competing with their quality (as opposed to price-based competition) are characterised by lower price sensitivity and higher income sensitivity (elasticity), vertical differentiation, higher profit margins and a limited number of competitors. Maintaining competitiveness in these market structures is conditional on continuous quality improvement through process and product innovation (Aiginger 2005).

competitiveness) is a condition for long-term sustainable growth performance. Improving economic levels and increasing price levels associated with currency appreciation inevitably lead to the loss of the cost-based competitiveness which must be replaced with competitive advantage requiring improvement in technology knowledge and internal innovation capacity.

Quality-based competitiveness has played a key role in long-term economic development and explained much of its cross-country differences and their changes in time. The importance of innovativeness for sustainable long-term growth performance and competitiveness has been studied widely and explored in terms of alternative analytical methods and (ever expanding) data sources.[7] The subject has also attracted attention of the practical economic policy, in particular when striving for an effective support to the transition to a knowledge economy or improving growth performance and competitiveness (see for example recommendations of the Lisbon Strategy with multitude of related documents and proclamations).

In the discussion on the adequacy of data sources for a qualified analysis of innovative performance, potentially leading to valuable policy implications, a shift of emphasis can be observed from measurement of traditional innovative input (research and development activities) to identification of innovative output and its impact on competitiveness, covering the widest possible range of innovative activities (including non-technical innovation and innovation in services). At the same time, the stress is being put on a wider context of conditions for and results of innovative activities in the comprehensive concept of quality-based competitiveness (institutional characteristics of the environment, linkages and networking, quality of human resources and the educational system specifically in supporting lifelong learning, globalisation of economic activities and positions of countries in the multinational value chain of FDI activities). This knowledge progress requires new theoretical, methodological and analytical concepts and methods, including new data sources capable of providing information about what we need to know (rather than what we are able to measure) to make the related policy support effective.

Models of work organisation and organisation of innovative activities

In the assessment of innovative performance of EU members the paper identifies alternative learning styles/organisational models presented in particular by Lundvall (discretionary learning, lean production learning, taylorism, traditional organisation). These are combined with different types of innovative activities as identified in Arundel's background papers for European Innovation Scoreboard (they differentiate between strategic innovators, intermittent innovators, modifiers, adopters reflecting especially the role of internal R&D).

Innovative activities are influenced by a wide range of factors. Qualification and skills acquired in the workplace, i.e. as a part of lifelong learning, play an important role besides the traditional inputs of research and development activities and tertiary educational attainment of workforce. Moreover, a higher quality of work organisation and working environment has a positive impact on innovation, as they promote learning and efficient exploitation of skills. With innovations ever more interpreted as an interactive process including a wide range of agents, their openness and the intensity of their linkages and

[7] See especially Community Innovation Survey, patent statistics of EPO and USPTO, internationally comparable data of OECD/EUROSTAT on inputs and outputs of research and development activities.

interactions play an important role as well. Therefore the indicators used to evaluate innovativeness must also analyze the combination of traditional inputs, and the capacity of the environment to support development of knowledge and skills of workers.

Lundvall et al. (2006) presented the application of this approach to the EU-15 countries exploiting 2000 data; the current paper uses the same methodology with the 2005 data for EU-15 compared to EU-4 country groups. The relationship between innovation and work organisation is evaluated in terms with micro-data from two surveys – the European Study on Working Conditions (ESWC) undertaken by the European Foundation for the Improvement of Living and Working Conditions (in 2000 and 2005) and the Community Innovation Survey (CIS). The data on working conditions are used to define types of organisational practices and policies, while the data on innovation are used to identify the typology of innovators. The relationship between the two data sets shows correlation rather than causality when aggregated at the national level. Nevertheless, it confirms the importance of work organisation in supporting learning and problem solving for the type of innovative activities (and therefore innovative performance) carried out by enterprises.

2.2. Measuring forms of work organisation

Lundvall et al. base the selection of variables for the analysis on two groups of sources focused on the relationship between forms of work organisation and the ways of learning and innovating in companies. The approach of high performance work system focuses on the diffusion of Japanese organisational techniques, based on increased involvement of workers in problem solving and operational decision-making, in the USA and Europe (Ramsay et. al. 2000; Truss 2001). They specifically point to the model of the so-called lean (flexible) production which originated from transforming companies with strong hierarchical structures based on taylorist task specialisation and clear division of conception and executive work.

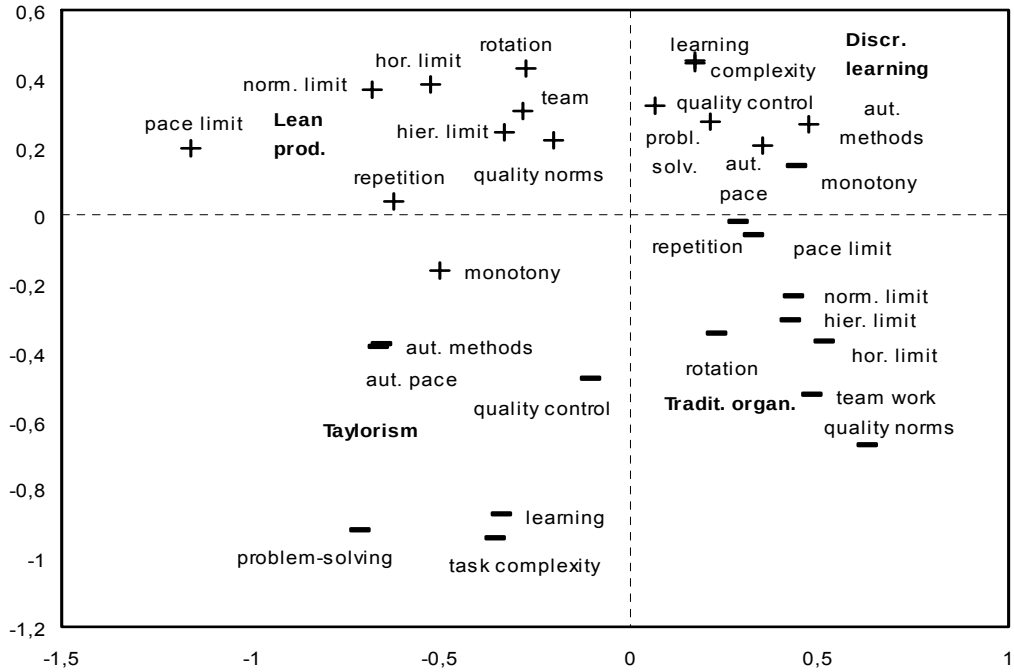
The approach of organisational design strives towards the development of more comprehensive taxonomies. Mintzberg (1983) distinguishes between bureaucratic and organic organisations. Bureaucratic organisations are typical for their limited capacity for adjustment and innovation. Jobs and tasks in machine bureaucracies are standardised in terms of formal work descriptions and rules established by the management. The organisation is therefore highly centralised and provides a limited space for discretion in decision making regarding methods or pace of work. On the other hand, the level of centralisation in professional bureaucracy is low and behaviour is regulated and modified through the acquired standardised qualifications and skills and internalisation of professional norms and standards of conduct. Although the autonomy of workers is high, operating procedures are very stable and routine. An organic organisation is typical for its high ability to adjust. A traditional form is based on direct supervision by an individual (typically the entrepreneur). Adhocracies are based on mutual adjustment where workers coordinate their work through informal communication. The autonomy of work is low in the former and high in the latter case.

Two ideal forms of organisation that support various learning and innovative styles – operating adhocracy and J-form are presented in the synthesis and extension of both approaches (Lam 2005). Adhocracy relies on the individual expertise and uses a project structure to its dissemination to creative project teams that implement innovation projects (usually on behalf of their clients). Adhocracy allows a high level of autonomy in work and

thus discovering new knowledge, which in turn supports the capacity for radical innovation. The J-form is a rather bureaucratic, although pro-innovation form of organisation. Knowledge penetrates the collective organisation through formal team structures and job rotation. Stable professional careers within the internal labour market provide incentives for involvement in the continuous product and process improvement, i.e. for incremental innovations.

Selected EWCS questions are used to construct 15 binary variables (see Table 2.1) based on the anticipated relationship between work organisation and the innovative type and capacity of companies. The variables (1-4) involve the use of work practices identified in the literature on high performance. The variables (5-6) reflect the involvement of workers in learning and problem solving, which is a typical characteristic of adhocracy and the J-form. The variable (7) identifies the complexity of tasks and relates to operating adhocracy. The variables (8-9) include discretion in determining work methods or work pace typical for adhocracy. The variables (10-13) identify various forms of constraints to workers: hierarchical constraints (direct management and control carried out by immediate superiors) and automatic constraints (determining the pace of a production line or the pace of equipment operation) represent taylorist work organisation, while norm-based constraints (quantitative production standards) are intrinsic to taylorism, as well as the Japanese form of organisation. Horizontal constraints show whether work is carried out collectively rather than individually. The last two variables (14-15) are typical for taylorist work organisation.

Figure 2.1. Clusters of organization modes in terms of factor analysis (EU-4)



Note: +/- = Presence/absence of the characteristic. Source: Own calculations based on ESWC database.

Workers are divided into individual clusters based on a factor analysis (the multiple correspondence analysis – MCA), which identifies relationships between the 15 variables listed above (for the EU-4 group see the graphic presentation of the results of the analysis shown in Figure 2.1).[8]

[8] The use of the MCA method is especially suitable as category variables are being analysed. The method measures the overall variation of the data matrix using the chi-squared statistics and interprets (analyses) the variation according to factors (elements). The chi-squared statistics are commonly used to determine

Table 2.1 presents distribution of workers in the EU-4 and EU-15 country groups according to the forms of organisation and the variables used. The first organisation cluster with **discretionary decision making** includes 41 % of workers in the EU-15, but mere 35 % in the EU-4 (however, the share increased rather significantly in Visegrad countries as compared with 26 % in 2000; in EU-15 the increase reached only 2 p.p.). Besides a significant autonomy, this cluster is characterised by a high level of learning and problem solving. Comparison of the structure of cluster characteristics between the groups of the EU-15 and the EU-4 members reveals particularly lower importance of team work and job rotation and learning in the EU-4; the role of problem solving is similar in both country groups. On the other hand, the importance of task monotony is stronger.

The second, **lean production** cluster includes 31 % of workers in the EU-15 and 26 % in the EU-4 (the share slightly increased in the first group and decreased in the other). It is characterised by frequent job rotation, high importance of team or collective work and increased significance of quality norms. Compared to the EU-15, quality control and problem solving play a less important role in the EU-4, as well as autonomy in working methods. On the other hand, hierarchical limits are stronger. The third, **taylorist production** cluster includes 14 % of workers in the EU-18 and 24 % in the EU-4 (with a slight increase in both country groups). The characteristics of this cluster are in many aspects opposite to those of the organisation with discretionary decision making, i.e. the importance of learning, problem solving and task complexity is lower, while various constraints and working standards play a more important role and tasks are monotonous and repetitive. Taylorism in EU-4 features more limits, norms and controls than in EU-15. At the same time, problem solving and learning new things are is given less space.

Table 2.1. Clusters of organization modes in EU-4 and EU-15 (in % of labour force)

		Discr. learn.		Lean prod.		Taylorism		Tradit. org.	
		EU15	EU4	EU15	EU4	EU15	EU4	EU15	EU4
1	Team work	61,4	51,5	89,2	87,2	61,1	66,9	34,5	34,6
2	Job rotation	43,8	34,9	78,6	73,0	42,4	38,9	28,0	26,0
3	Quality norms	69,7	71,4	90,0	91,2	88,9	94,0	16,0	18,2
4	Quality control	83,7	72,7	87,7	72,2	63,0	50,5	19,0	19,4
5	Problem solving	94,8	94,1	93,1	89,7	61,3	49,5	49,0	54,0
6	Learning new things	93,5	86,2	93,7	91,1	41,4	32,4	35,9	25,7
7	Complexity of tasks	77,4	87,9	85,4	87,0	23,1	32,8	16,6	34,3
8	Auton. in work. methods	87,1	79,7	74,3	60,4	18,8	15,6	45,6	48,7
9	Auton. in pace of work	84,2	85,5	73,0	70,9	27,4	32,2	55,8	55,8
10	Horizontal limit of pace	27,6	26,3	82,1	85,5	54,0	60,0	24,6	19,7
11	Hierarchical limit of pace	13,6	37,2	53,2	77,2	55,2	66,9	25,2	35,8
12	Norm limit of pace	30,7	20,0	73,3	67,4	53,7	52,3	15,4	7,5
13	Automative limit of pace	3,7	4,5	30,1	35,7	36,9	40,8	6,7	6,3
14	Monotonous tasks	19,8	24,5	52,5	55,3	70,3	72,1	32,5	42,7
15	Repetitive tasks	22,2	12,4	58,8	45,5	57,0	46,2	23,6	15,2
	Total	41,3	35,2	31,0	25,6	17,5	24,1	10,1	15,0

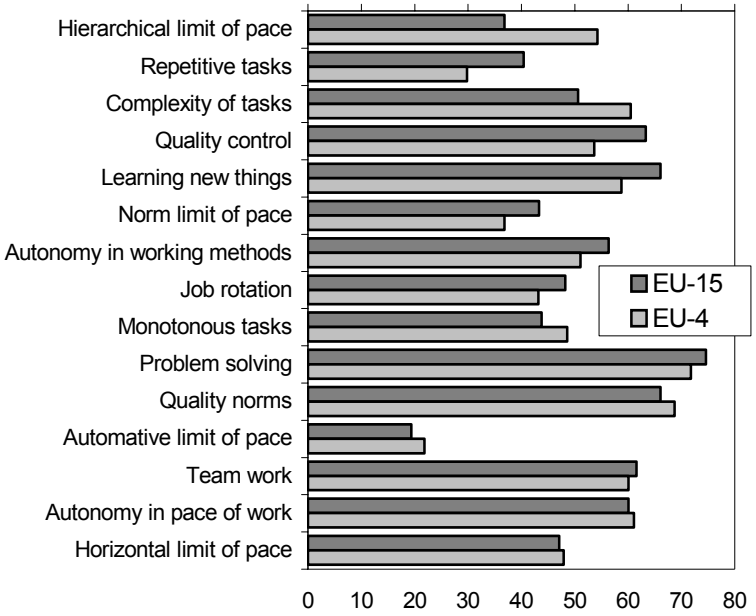
Source: Own calculations based on ESWC data (2005).

the row-column independence. The significance of factors is described by their benefit for clarifying the overall inertia. Inertia is defined as a ratio of the chi-squared statistics of the data matrix and the number of observations.

The share of workers in the **traditional organisation** cluster is for one third higher in EU-4 (15 % as compared to 10 % in EU-15). This organisational form is mainly characterised by informal and non-codified constraints with a low level of learning (in the EU-4 less so than in the EU-15, see Table 2.1). The complexity of tasks and problem solving are more important in the EU-4, on the other hand, learning new things is more limited and tasks are more monotonous (yet less repetitive) than in EU-15.

The largest differences in individual variables between the EU-15 and the EU-4 (see Figure 2.2) in favour of the former can be observed in responsibility for quality control, problem solving and learning new things (but also repetitiveness of tasks). On the other hand, relatively more employees in the EU-4 report hierarchical constraints, complexity of tasks and setting quality norms. The highest, on average, is the share of workers reporting problem solving in both country groups, followed by setting quality norms. More diverse are the shares of workers learning new things in E-15 and EU-4.

Figure 2.2. Indicators of organization modes in EU-4 and EU-15 (averages, in % of labour force)



Source: Own calculations based on ESWC data (2005).

2.3. Structural aspects of work organisation

Structural aspects of alternative forms of work organisation are described according to industries (Table 2.2) and occupations (Table 2.3) for the EU-15 and the EU-4, and at the level of individual EU countries (Table 2.4).

The **industry classification** in the EU-15 group shows the highest share of organisation with discretionary decision making in network industries and financial, business and public services. The share of employees in this form of organisation is the highest in financial intermediaries in the EU-4 group (even higher than in EU-15). Manufacturing reports a significantly lower share of discretionary decision making (the lowest of all industries), a slightly lower share of lean production and higher importance of taylorist organisation (which is significantly higher even in the construction and in some of knowledge-intensive services) in EU-4 as compared to the EU-15.

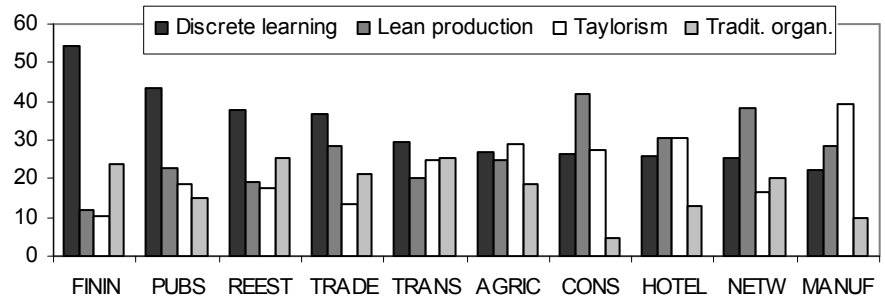
Table 2.2. Organization modes in industries in EU-4 and EU-15 (in % of industry labour)

	Discr. learn.		Lean prod.		Taylorism		Tradit. org.	
	EU15	EU4	EU15	EU4	EU15	EU4	EU15	EU4
Agriculture, fishering	25,3	27,1	34,1	25,0	26,4	29,2	14,3	18,8
Mining, manufacturing	31,2	22,5	33,9	28,3	27,4	39,3	7,5	9,9
Network industries	46,7	25,5	38,7	38,2	11,7	16,4	2,9	20,0
Construction	27,4	26,2	39,8	41,7	22,7	27,4	10,1	4,8
Trade and repairs	35,3	36,7	24,6	28,5	22,9	13,5	17,1	21,3
Hotels and restaurants	17,9	26,1	34,0	30,4	31,7	30,4	16,4	13,0
Transport, comunications	30,6	29,5	31,6	20,1	23,7	24,8	14,1	25,5
Financial intermediaries	47,1	54,2	34,5	11,9	11,3	10,2	7,2	23,7
Real estate	47,9	38,0	30,6	19,0	12,0	17,7	9,6	25,3
Public services	47,0	43,3	30,3	22,8	12,7	18,7	9,9	15,2

Source: Own calculations based on ESWC data (2005).

When compared with the starting period of 2000, in the EU-4, the most significant is the increase of discrete learning organization form in financial intermediaries (at the expense of lean production form), followed by construction and manufacturing (however their qualitative structure remaining much lower in comparison with the EU-15). The structure of other industries remains rather stable.

Figure 2.3. Organization modes in industries in EU-4 (in % of industry labour)



Source: Own calculations from ESWC (2000).

In the case of **occupation groups** (classified according to occupational categories – ISCO-88) the EU-4 countries approach the EU-15 group in the share of discretion in decision making in professions with the highest qualitative intensity (i.e. managers, engineers and professionals, and technicians), similarly as in the case of the lean production organisational form. Only exceptionally more significant structural differences are visible between both country groups (as in the occupation category of skilled agricultural workers).

The category of engineers and professionals reports the highest share of discretionary decision making in both groups of countries and is followed by managers and technicians (this group on the whole represents the so-called high-skill white-collar workers). The least skilled occupations (unskilled blue-collar workers) in the EU-4 report a lower share of lean production and a higher portion of the traditional organisation compared to the EU-15, which may weaken the adjustment capacity.

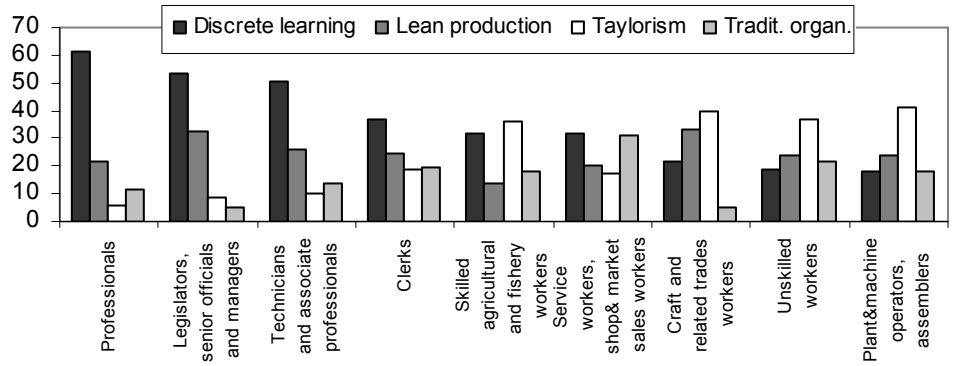
Table 2.3. Organization modes in professions in EU-4 and EU-15 (in % of labour)

	Discr. learn.		Lean prod.		Taylorism		Tradit. org.	
	EU15	EU4	EU15	EU4	EU15	EU4	EU15	EU4
Legislators, senior officials and managers	53,9	53,5	37,1	32,5	4,9	8,8	4,1	5,3
Professionals	58,6	61,4	29,6	21,3	5,8	5,8	6,0	11,5
Technicians and associate professionals	51,6	50,3	32,1	26,0	9,7	10,3	6,6	13,4
Clerks	42,7	37,1	28,8	24,6	14,8	18,9	13,7	19,3
Service workers, shop& market sales workers	37,4	31,5	28,4	20,0	18,9	17,6	15,2	30,9
Skilled agricultural and fishery workers	22,9	31,8	45,7	13,6	17,1	36,4	14,3	18,2
Craft and related trades workers	26,8	21,9	38,9	33,3	28,2	39,4	6,1	5,4
Plant&machine operators, assemblers	15,8	17,7	29,9	23,6	41,1	40,9	13,2	17,7
Unskilled workers	21,4	18,5	23,9	23,5	35,5	36,7	19,2	21,3

Source: Own calculations based on ESWC data (2005).

Skilled labour (high-skill blue-collar workers) in the EU-15 has a higher share of discretionary decision making and a lower share of taylorism compared to the EU-4 group. A higher share of discretionary decision making was reported in clerks and service shop and market sales persons (unskilled white-collar workers) in the EU-15 compared to the EU-4. Development in time shows up rather favourable trends in EU-4, particularly in the group of high-skilled occupations. The share of employment in lean production significantly decreased in favour of discrete learning organisation mode. On the contrary, the structure of the remaining two modes has been changed much less.

Figure 2.4. Organization modes in occupations in EU-4 (in % of labour)



Source: Own calculations based on ESWC data (2005).

Work organisation forms in countries

The structural characteristics listed above reflect differences in individual forms of work organisation. The cluster with discretion in decision making/learning includes jobs with significant responsibility and capacity for solving (new and complex) problems. Problems solved in the lean production cluster are defined within a narrower range with a limited spectrum of possible solutions. Work in this cluster is often repetitive and monotonous.

Extensive use of managing techniques such as job rotation and team work can be seen as an effort to overcome the constraints of the taylorist type of production and to support active participation of workers. A low lever of learning and absence of problem solving are typical for taylorism. Work is highly monotonous and limited by numerous constrictions, and tasks are repetitive and narrowly defined. Qualification intensity is

low and workers are easily replaceable by another person or a machine (these jobs can be easily transferred to countries with low wages or filled with immigrants from less developed countries). The traditional organisation involves less complex problems, is less individualistic than other organisational forms and less monotonous than lean or taylorist production, and often involves direct and indirect interaction with local customers and suppliers.

The structure of workers in individual EU-27 countries according to forms of organisation is presented in Table 2.4. A more detailed view of EU-4 countries as compared to EU-15 is presented in Figure 2.5. The comparison shows significant differences between individual EU members. In the EU-15, forms with discretionary decision making have the strongest presence in the Netherlands and Nordic countries, Belgium and Ireland. On the other hand, southern countries report the lowest share of these forms of organisation. The lean production form is dominant in Finland, Great Britain and Greece. The occurrence of the taylorist form is almost precisely the opposite of the organisation with discretionary decision making and is prevalent in southern countries. The traditional form of organisation is typical for Greece and Italy.

Table 2.4. Organization modes in countries in EU-27 (in % of labour force)

	Discrete learning		Lean production		Taylorism		Trad. organizat.	
	2000	2005	2000	2005	2000	2005	2000	2005
SE	52,6	62,1	18,5	22,3	7,1	9,1	21,7	6,5
DK	60,0	54,2	21,9	34,0	6,8	8,5	11,3	3,3
NL	64,0	49,5	17,2	32,7	5,3	11,7	13,5	6,2
AT	47,5	45,9	21,5	28,9	13,1	16,1	18,0	9,1
BE	38,9	43,9	25,1	30,7	13,9	14,6	22,1	10,8
FI	47,8	43,6	27,6	40,2	12,5	10,8	12,1	5,3
LU	42,8	42,5	25,4	34,5	11,9	14,5	20,0	8,5
IE	24,0	41,4	37,8	28,8	20,7	14,9	17,6	14,9
MT	20,3	39,9	57,1	34,1	11,0	13,2	11,5	12,9
SI	27,3	39,1	40,7	34,1	17,1	15,7	14,9	11,0
PL	**31,5**	**39,1**	**24,7**	**31,9**	**18,4**	**18,3**	**25,4**	**10,7**
FR	38,0	37,9	33,3	29,4	11,1	23,9	17,7	8,7
HU	**34,5**	**37,4**	**26,9**	**25,0**	**21,2**	**25,6**	**17,4**	**12,0**
IT	30,0	37,4	23,6	23,2	20,9	26,2	25,4	13,2
DE	44,3	35,5	19,6	25,0	14,3	21,2	21,9	18,3
SK	**24,7**	**34,3**	**30,5**	**23,9**	**28,4**	**24,8**	**16,4**	**17,0**
EE	35,4	34,3	40,4	35,3	13,5	15,7	10,7	14,7
LV	26,7	32,6	31,7	34,2	15,5	19,0	26,1	14,2
CZ	**32,5**	**30,4**	**31,7**	**22,7**	**19,7**	**27,0**	**16,1**	**19,9**
PT	26,1	27,6	28,1	32,7	23,0	30,4	22,8	9,3
UK	34,8	27,5	40,6	38,8	10,9	22,3	13,7	11,4
RO	16,2	25,3	28,0	40,0	40,2	24,0	15,5	10,6
ES	20,1	25,1	38,8	27,7	18,5	29,8	22,5	17,5
LT	28,4	25,0	17,4	26,0	19,9	23,2	34,3	25,8
CY	28,1	23,9	32,3	34,2	22,9	25,0	16,7	16,9
GR	18,7	23,3	25,6	34,5	28,0	24,6	27,7	17,6
BG	13,4	22,2	35,0	33,3	24,9	25,4	26,7	19,1

Source: Own calculations based on ESWC data (2005).

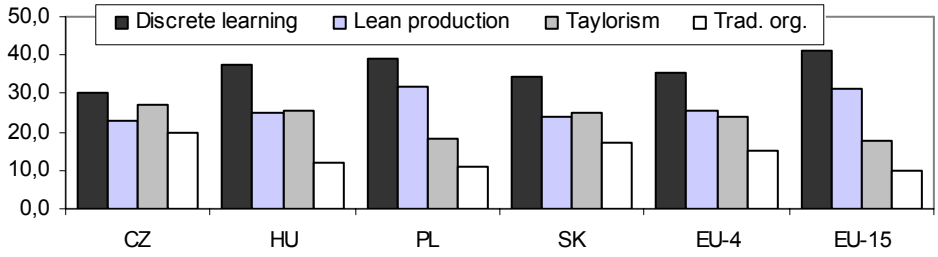
In the EU-12 (new members), the organisations with discretionary decision making appear most frequently in Malta, Slovenia and Poland (see Table 2.4). On the other hand, Lithuania, Cyprus and Bulgaria show the lowest share of this organisational form. The share of workers in lean production is by far the highest in Romania,

Estonia and Latvia. The taylorist organisation is reported the most frequently in the Czech Republic, Hungary and Bulgaria. The traditional organisation appears the most frequently in Lithuania, the Czech Republic and Bulgaria.

As to the develoment in time, the qualitative structure of labour in EU-27 showed up rather diverse trends. When only the share of dicrete learning mode is considered, an improvement has been more remarkable in a number of the less developed member countries with the exception of Sweden and particularly Ireland, followed by Greece and Italy. Although the differences within the EU-27 (as expressed e.g. by standard deviations) have been decreasing in time, they still remain rather large as to the shares of the individual organization modes.

Within the EU-4, the highest increase of the discrete learning cluster took place in Slovakia and Poland. The most stable appeared the organization structure in Hungary. In the Czech Republic, the most important was the increase of taylorist organization at the expense of the qualitatively more intensive clusters of discrete learning and lean production. Following these changes, at the end of period, the most favourably can be assessed the resulted structure in Poland, followed by Hungary and Slovakia.

Figure 2.5. Organization modes in EU-15 and EU-4 (in % of labour force)



Source: Own calculations based on ESWC data (2005).

Similarities and differences between individual EU-27 countries and the average values for the shares of workers in individual organisational clusters are shown in Table 2.5. The results show that occupational categories in a particular country strongly influence the likelihood of working in a certain type of organisation. On the whole, it is possible to conclude that the frequency of a certain organisational form in EU-27 countries is influenced by other, national factors that have not been explained in this study, such as the rate at which companies adopt new organisational forms, heritage from the historical development, attitude to organisational innovations etc.

As to the individual EU-4 countries, the Czech Republic, Hungary and Slovakia show significantly above average shares of taylorist organization (similar to France, Portugal, United Kingdom and Bulgaria). In Poland, there is significantly lower share of employment in traditional organization. Slovakia features significantly above average share of workers in discrete learning organization mode (similar to Austria), however in combination with high share of taylorist organisation.

Table 2.5. Logit estimates of national characteristics influencing organization modes, EU-27

	Discrete learning	Lean product.	Taylorism	Tradition. organiz.
Austria	0,25**	0,14	-0,28	-0,70*
Belgium	0,49*	0,48*	-0,10	-0,26
Bulgaria	-0,30**	0,45*	0,35*	0,21
Cyprus	-1,00*	-0,29**	-0,43*	-0,68*
Czech Republic	**-0,08**	**-0,02**	**0,32****	**0,15**
Denmark	0,71*	0,6*	-0,63*	-1,42*
Estonia	-0,30*	0,08	-0,56*	-0,49*
Finland	0,49*	0,76*	-0,39*	-0,96*
France	0,23**	0,33*	0,29**	-0,58*
Greece	-0,67*	0,07	-0,10	-0,29
Hungary	**0,19**	**0,14**	**0,32***	**-0,29**
Ireland	0,28*	0,27**	-0,22	-0,08
Italy	-0,09	-0,22	0,07	-0,47*
Latvia	0,03	0,43*	0,01	-0,14
Lithuania	-0,22**	0,17	0,22	0,47*
Luxembourg	-0,13	0,02	-0,68*	-1,08*
Malta	-0,35*	-0,16	-0,94*	-0,82*
Netherlands	0,59*	0,53*	-0,34*	-0,82*
Poland	**0,08**	**0,22**	**-0,17**	**-0,56***
Portugal	-0,30**	0,22	0,31**	-0,73*
Romania	-0,45*	0,36*	0,01	-0,66*
Slovakia	**0,22****	**0,21**	**0,41***	**0,18**
Slovenia	-0,17	0,05	-0,56*	-0,77*
Spain	-0,61*	-0,16	0,08	-0,31
Sweden	0,99*	0,32*	-0,41*	-0,60*
United Kingdom	0,05	0,74*	0,36*	-0,17

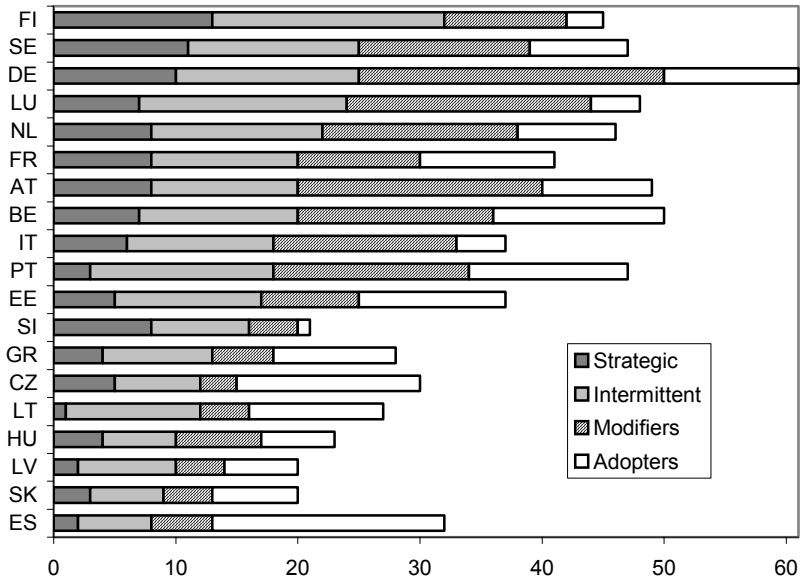
Note: *significant at 1 %, ** at 5 %. Reference value is always the EU-27 average in the given cluster. Source: Own calculations from ESWC (2005).

2.4. Relationship between types of innovators and organisations

The structure of innovators is defined mainly according to the importance of research and development activities for company innovative performance (Arundel, Hollanders, 2005) in terms of the results of Community Innovation Survey. Research and development (carried out with varying intensity) is the main source of innovation in strategically and intermittently innovating companies. Other sources of innovation prevail in the remaining types of innovators. Technology developed by other companies is modified through process innovations or passively adopted. The share of innovators in most countries (except for Germany) does not exceed 50 % (see Figure 2.6). Companies with internal research and development as the source of innovation are typically in minority.

Significant differences between individual countries can be observed in the occurrence, as well as the structure of innovators. The Czech Republic show up a low overall share of innovators and most of them merely adopt technology (developed by others). Moreover, the share of adopters in the Czech Republic is the second highest in all included countries, which may suggest that a critical level has been reached. Hungary and Slovakia show on average lower share of innovating companies than the Czech Republic, with the role of strategic innovators remaining quite negligible.

Figure 2.6. Typology of innovators (% of companies)



Source: EIS Database (2005).

Relationships between forms of **work organisation and types of innovators** are shown in Table 2.6.[9] Companies with prevailing lean production tend to be non-innovators. The intermittent and the modifying types occur rarely, similarly to strategic innovators (although with a less certainty). The adopting innovation type does not depend on this organisational form. Non-innovators are typical for the taylorist form of organisation. On the other hand, no other innovation types tend to occur in this form of work organisation. No relationship with any of innovation type can be seen in the traditional work organisation, except for strategic innovation, which tends to be totally absent in this organisational form.

Table 2.6. Relation between innovation and organization modes

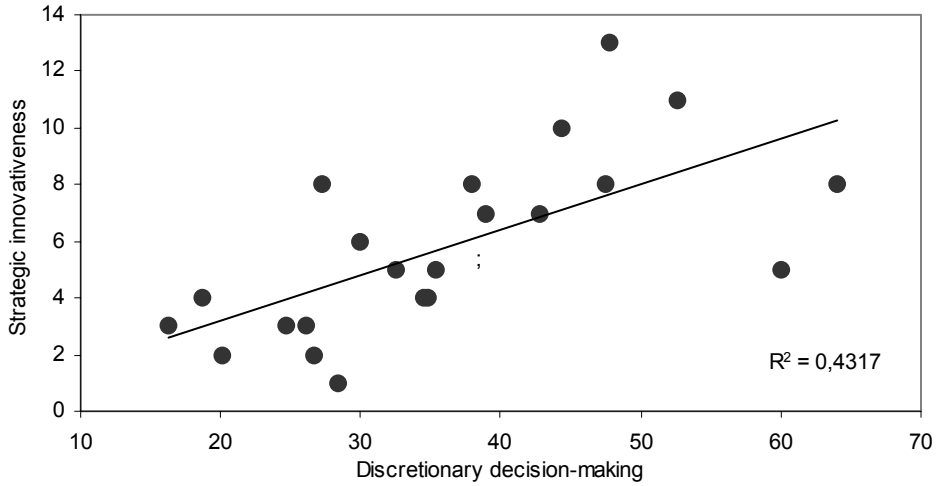
Typology	Discrete	Lean	Taylorism	Traditional
Strategic	0,66*	-0,26	-0,54*	-0,36
Intermittent	0,64*	-0,50*	-0,5*	-0,07
Modifiers	0,59*	-0,56*	-0,44*	0,02
Adopters	0,03	0,16	-0,25	0,07
Non-innovators	-0,69*	0,46*	0,62*	0,06

Note: * 5 % significance. Source: EIS Database (2005), own calculations from ESWC (2000).

The strongest relationship can be observed between work organisation with discretionary decision making and strategic innovation (see Figure 2.7), which is followed closely by the intermittent and the modifying type. Non-innovators are virtually non-existent among companies with this form of work organisation.

[9] For the quantification of the relation between the organisation modes and innovation types have been used the previous ESWC survey round, i.e. taking place in 2000, so that a certain time delay is allowed.

Figure 2.7. Relation between strategic innovativeness and discrete learning



Source: EIS Database (2005), ESWC (2000), own calculations.

2.5. Relationship between sources of competitive advantage and work organisation

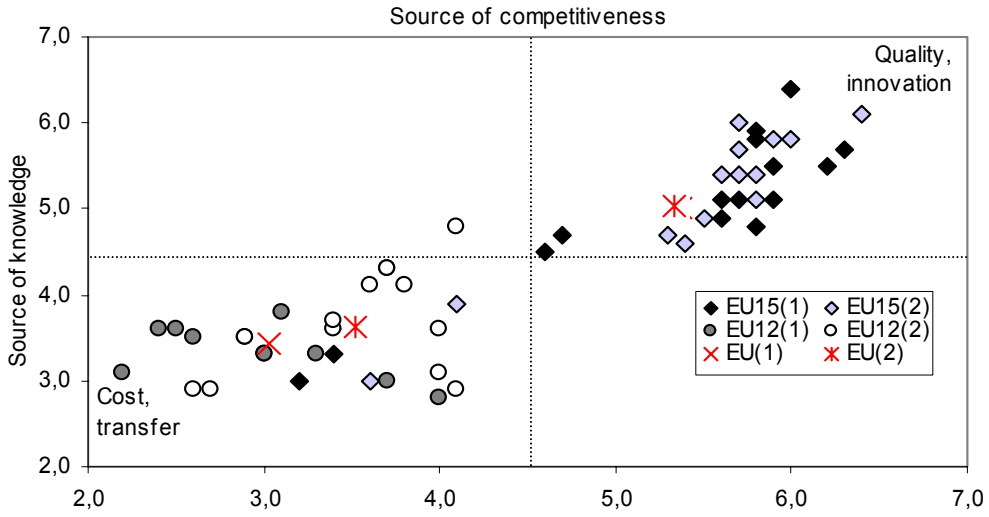
Evaluation of the positions of EU-27 members is based on an indicator distinguishing between two opposite **sources of competitiveness** – low costs or local natural resources on one hand (sensitive to price-based competitiveness or price changes) and unique products and processes that are difficult to imitate on the other. Movement between the two extremes can be referred to as transition from a cost/price-based competitiveness to a quality-based one.[8]

A closely related aspect of sources of competitiveness (cost vs. quality intensive) includes the **sources of technology knowledge** or the level of (internal) innovative capacity. Once again, we distinguish between two opposites – i.e. acquiring knowledge mainly through licences and imitation of foreign technology, and carrying out internal research activities leading to the creation and introduction of new products and processes. Naturally, there are numerous intermediate steps between the two extremes and these reflect the level of development of the local knowledge base. Individual stages in principle advance from passive adoption of external knowledge through the ability to modify external knowledge for local needs to a dominating role of internal innovative activities.

Positions of individual EU-27 countries according to the nature of their competitive advantage are shown in Figure 2.8, including comparison between 2001 and 2006. Differences between the old and new EU members persist in time. While the averages for the EU-15 show slight decline or stagnation (from 5.4 to 5.3 in sources of advantage and 5.0 in sources of knowledge), the position of the EU-12 group has improved - from 3.0 to 3.5 in sources of advantage and from 3.4 to 3.5 in sources of knowledge.

[10] For explanation of the methodology for assessing sources of a competitive advantage in terms with the data of the Global Competitiveness Report by the World Economic Forum (WEF, 2005, 2006) see Kaderabkova (2006).

Figure 2.8. Nature of competitiveness in EU-27 countries, 2001, 2006

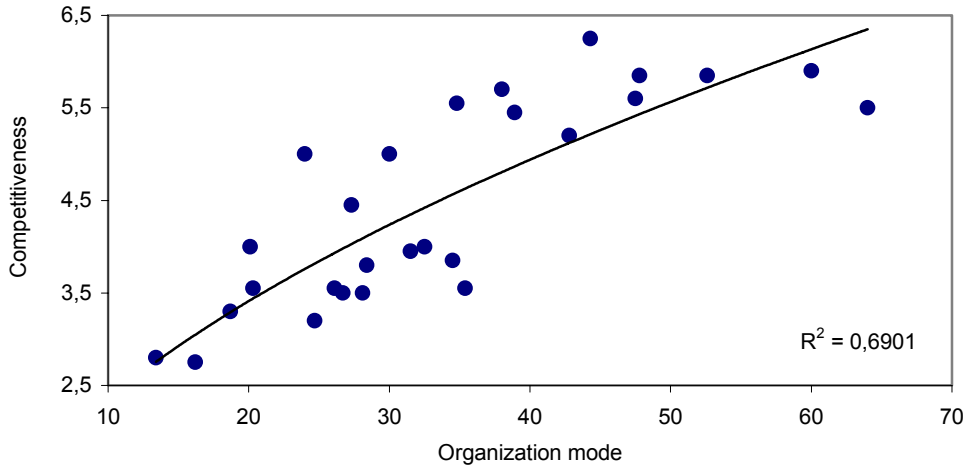


Note: Higher value = better result. (1) year 2001, (2) year 2006. Source: WEF (2001, 2006).

As to the EU-4 countries, the improvement in the position of the Czech Republic is among the strongest in the EU, in particular in terms of sources of technology knowledge. However, despite this achievement, it is necessary to point out that the position the Czech Republic reached only in 2006 equals that of Slovenia in 2001. Poland and Hungary closely follow the Czech Republic in terms of sources of innovation and competitive advantage evaluations, while Slovakia lags behind the three countries more markedly (particularly strongly perceived is still the cost-based nature of Slovakian competitiveness).

A positive correlation with the form of work organisation based on discretionary decision making can also be observed in the achieved competitiveness position (see Figure 2.9). Therefore it may be concluded that a qualitatively more advanced form of learning influences positively the resulting position of a (quality-based) competitive advantage.

Figure 2.9. Relation between discretionary decision making and competitiveness



Source: WEF (2006), ESWC (2000), own calculations.

3. The Role of FDI in Quality-based Competitiveness

3.1. Structural characteristics of globalization

The nature of global economic activity has a significant impact on the increasing mobility and range of migrating **production factors** that increasingly include, besides industrial production and physical capital, the flows of services, R&D and human capital that result in flows of skilled workforce and investment in technology and expertise. Together with the changing technology, production, investment and trade flows, the share of **emerging** markets in the global output has been increasing. By 2015, China will have become the second strongest world economy, with India increasing its economic power as well. Production factors will always be directed into the countries with the highest economic or social return that is dependent on their structural characteristics – i.e. the quality of physical and human capital, market size, growth potential, transport costs and barriers preventing the entry. The current emerging economies show a **high production** in skilled human capital and R&D expenditure (although from a significantly lower base when compared to developed countries). Therefore, in the not so far future, these countries will be, due to their strengthening domestic knowledge base, able to compete against more developed countries in a **wide range of products**, i.e. not only in low value added segments of products and services where their production costs are markedly lower.

Foreign direct investment

Since the 90s, the development of global economy has been characterized by foreign direct investment flows growing faster than world trade. Even though the position of the developed countries, i.e. the USA and EU, remains most important, the share of **emerging markets** has quickly become more significant (China's share went up from 2 % in 1990 to 10 % in 2004). Unlike in the past, they are not used just as locations for cheap production but they also attract an ever increasing share of investment in **high-quality activities**, i.e. research, development and innovation activities. Together with the growing importance of trade and services, also the importance of FDIs has been increasing in this sector. Foreign companies play a bigger role in the R&D performance in the host economies. FDIs are important for the **parent company** since they provide for a more efficient production, access to new markets and adoption of new technology. From the macroeconomic perspective, FDIs help restructure economies according to the changing comparative advantage. The majority of FDIs from EU countries go to the OECD countries, but the share of emerging economies increases as well. Differences in the FDI development are also apparent within the EU, with the old EU countries losing FDIs in favour of the new members.

3.2. International division of labour

The growth of trade flows as a result of globalization has initiated a discussion on the impacts of **international division of labour and production**. An increasingly important role of emerging markets (especially India and China) in EU trade stresses the differences in the relative factor endowment among trade partners. These differences subsequently influence industry specialization, thus affecting the labour and investment

demand in the individual member states.[11] Specific attention is given to the influence of globalization on individual industries within the EU and on the demand for groups of (differently skilled) employees and to the ability of the qualification supply to react to the changes in the qualification demand structure.

International context

Developed countries have steadily shown a long-term growth of trade openness (the share of trade in GDP). A new trend is presented by the growth of ***inter*-industry trade** within the EU from the beginning of the new millennium (and since 1996 in the USA) that was significantly decreasing in the previous period.[12] This is in part due to the increased importance of trade in raw materials (especially oil imports) but this trend also significantly impacts manufacturing. The change is attributed especially to the increased importance of trade among countries with different factor endowments – i.e. with different levels of economic development and, subsequently, trade specialization. The available empirical studies have shown so far that the fears of globalization negatively impacting the labour market are groundless – the impact on the total employment seems to have the opposite effect. However, the impact on particular industries or skills should be examined, particularly in combination with their regional concentration.

In comparison to intra-industry trade, the development of inter-industry trade may be connected to higher adjustment costs incurred as a result of the affected industries within the EU losing their comparative advantage. The increased trade importance of China and India and the related change in industry specialization of their comparative advantage provokes fears in developed countries of decreased demand for **less skilled labour force**, followed by an increase in the unemployment rate of this particular group and a decrease in relative wages (increased income inequality). These fears may be substantiated in companies that relocate their activities to cheaper locations using to a large extent unskilled labour force (outsourcing), e.g. assembly of parts, and, on the other side, increase the extent of activities performed by skilled employees (technology development and design). Nevertheless, from a long-term perspective, it may be expected that Chinese technology level will improve and this may result in a repeated change in the nature of trade with the EU countries, shifting from traditional (labour-intensive) products toward technology more sophisticated segments (in EU imports, the share of these segments has already increased significantly over the past five years).[13]

[11] Differences in factor endowment mean that more developed countries show a relative redundant supply of quality-intensive factors – such as skilled workforce, high-technology – with the less developed countries tending to provide cheaper and less skilled workers and adapted, less demanding technology. Factor endowment thus directs industry specialization of production or competitive advantage of a particular country toward high or low tech products (economic activities).

[12] Inter-industry trade is carried out among different industries. The opposite is the intra-industry trade when products are traded within the same industry (commodity group), either as final products (horizontal or vertical IIT) or in different processing stages (vertical IIT).

[13] The increase in the share of office equipment, telecommunication appliances, electric and electronic instruments in the total Chinese export is a result of a strong FDI inflow in the development of capital and technology intensive industries over the past five years. The main reason for this development is the transfer of the final (labour-intensive) stage from developed countries, with Chinese value added remaining relatively low. The increasing level of the local knowledge base in combination with a high FDI inflow will significantly speed up technology transfer, support the development of internal innovation capacities, thus contributing to narrowing the Chinese technology gap.

However, the impacts of globalization on the labour market need to be examined in a more comprehensive way, taking into account **static and dynamic effects** of the specialization development in the EU and its current less developed trade partners (including the linkages among these effects). The decrease in the demand for less skilled labour in manufacturing in the EU may be softened by its growth in the non-tradable sector (i.e. services). An important improvement in the educational attainment in developing countries may change the focus of their specialization (the sources of comparative advantage) in favour of quality more intensive activities. On the other hand, a higher external openness increases competition, supporting innovation performance. New technology requires higher skills, thus lowering the demand for less skilled labour. It also needs to be considered that among the various EU countries, there are significant **(structural) differences** in the labour market characteristics that may make the identification of globalization impact on unemployment and wages (groups with different qualification levels) more difficult. Nevertheless, this identification is necessary for corresponding adjustment of the related policies that condition their effectiveness. Initially, the position of Czech economy is assessed according to the structure and competitive advantage of foreign trade in respect to the position within the EU market, geographic concentration, industry specialization and quality characteristics of technology and factor intensities. A special attention is given to the influence of foreign investment on the position of Czech economy within the multinational value chain.

The structure and competitiveness of foreign trade

After the EU accession, the foreign **exchange of goods** in all the new members in Central and Eastern Europe became more intensive. However, the Czech Republic was the only country that had a positive trade balance in 2005. Also significant was the shift in the competitiveness reflected in the increased share of Czech exports in EU-25 imports – reaching up to 2.6 % compared to 1.5 % in 1999. Rather than the actual EU accession itself, the international trade in the Czech Republic was more influenced by long-term structural changes related to the former FDI inflows with significant export-enhancing focus. FDIs also negatively affect the trade balance by importing investment goods and production components. In general, in the first stage of FDI, the pro-import influence is predominant, with exports growing gradually afterwards. In many cases, local manufacturers replace foreign component imports which further softens the influence of FDI on imports. Currently, the main investment importing stage has ended and the pro-export effect starts to become apparent.

Quality of trade structure

In terms of competitiveness within the global market, the position of any given country in the international trade needs to be considered, i.e. the **quality intensity of the value chain**. Comparative advantages and specializations of national economies have been traditionally perceived in terms of trade in final products or industry focus of exports. However, **territorial fragmentation** enables to locate production according to factor intensities of individual stages of the production chain rather than the average factor intensities of the final products. Due to their comparative advantage in the production of labour- or material-intensive components or the assembly of final products, less developed countries may therefore get more intensively involved in the international division of labour even when it comes to producing high-tech products. From 1995 the

export structure of new (more developed) EU members shifted strongly in favour of **medium-high-tech** industries. This applies mostly to engineering, electric technologies and the production of transport vehicles. These industries are able compete in quality as documented by the current growth of export prices and the EU-15 market share (see e.g. Landesmann, Wörz, 2006).
The characteristics of specialization and geographic focus of trade linked to the intensity of integration into the multinational value chain have an important effect on the development of **intra-industry trade** (see Table 3.1). Within the multinational chain, products in different production stages are exchanged within the same industry. An increase in the intra-industry trade in manufacturing between 1995 and 2002 is apparent in the majority EU countries. In the Czech Republic, the major increase was recorded in high-tech industries, especially in the production of office equipment. On the other hand, the intra-industry trade in medium-high-tech industries was already high in 1995, and subsequently tended to gradually decrease.

Table 3.1. The development of share of intra-industry trade in manufacturing

	1995	1996	1997	1998	1999	2000	2001	2002
HU	75.0	73.1	78.1	77.0	75.8	78.2	80.6	83.8
CZ	74.1	79.7	80.6	82.3	80.1	79.5	81.5	83.3
SK	..	..	74.9	75.3	75.5	74.3	77.2	78.2
PL	62.4	61.4	61.0	60.4	61.4	68.5	72.0	74.1

Note: The share of inter-industry trade may be expressed as the difference between the above number and 100 %
Source: OECD, STAN Database (18.7. 2006), own calculations.

Comparative industry advantage may be expressed as a **contribution to trade balance** where it is perceived as a net trade concept (including imports), see Table 3.2. In this concept, the total trade deficit is divided among commodities based on their share in the trade total. In 2002, the highest contribution in the Czech Republic came from the group of medium-high-tech industries, especially the automotive industry (its contribution is the highest of all industries). Between 1995 and 2002, the contribution of high-tech industries to trade balance relatively grew, yet it still remained negative, as was the case in the majority of EU countries (with the worst results in the production of TVs, radio and pharmaceutical products).

Between 1995 and 2002, the **share of manufacturing export and import** (relative trade balance) grew in the Czech Republic from 86 % to 100 %. This share is the highest in medium-high-tech industries, especially in machinery and transport vehicles. In these industries, the Czech Republic and Hungary have the highest export-import ratio of EU countries. Between 1995 and 2002, the share of high-tech industries in the Czech Republic grew considerably, from 20 % up to 71 %. However, the position of the CR is not as strong as the one of e.g. Ireland, where exports exceed imports more than twice.

Table 3.2. Indicators of comparative advantage of the Czech Republic in terms of technology intensity

	HT		MHT		MLT		LT	
	1995	2002	1995	2002	1995	2002	1995	2002
Contr. to trade balance	-6.6	-3.0	-2.7	2.2	5.2	0.2	4.1	0.6
Export/import ratio	20.1	71.2	75.0	111.0	127.9	101.4	123.8	106.8

Note: Technology intensity in manufacturing: HT – high, MHT – medium-high, MLT – medium-low, LT – low. Source: OECD, STAN Database (18.7. 2006).

Between 1995 – 2004, the relative trade to production indicators in the Czech Republic were growing (see Table 3.3). This applies both to the share of **export in production** and the **import penetration** indicator. The share of export in production of the domestic manufacturing grew from 41 % to 60 %. Similarly, the import penetration grew from 44 % to 59 %. While the export/production ratio shows the importance of foreign trade for a given industry, the import penetration indicator expresses the share of imports in domestic demand, thus reflecting the competitiveness of local products against imported goods.

Table 3.3. Internationalization of production and trade in the Czech Republic based on technology intensity

		Export/production			Import penetration		
		1995	2004	Change	1995	2004	Change
Manufacturing		41	60	*19*	44	59	*15*
HT	Computers, office equipment	106	117	*11*	101	121	*20*
	Pharmaceuticals	34	57	*23*	63	83	*20*
	Aerospace	90	63	*-27*	87	71	*-16*
	Electronics-communication	63	87	*24*	80	89	*9*
	Precision instruments	45	65	*20*	72	73	*1*
MHT	Electrical machinery	53	79	*26*	54	75	*21*
	Chemicals	79	66	*-13*	82	76	*-6*
	Other transport equipment	61	63	*2*	47	55	*8*
	Motor vehicles	57	71	*14*	56	60	*4*
	Machinery and equipment	49	98	*49*	61	98	*37*
MLT	Fabricated metal products	37	50	*13*	29	41	*12*
	Non-metallic mineral products	45	46	*1*	27	31	*4*
	Petroleum refining	13	25	*12*	17	47	*30*
	Shipbuilding	97	94	*-3*	93	70	*-23*
	Rubber and plastics	52	52	*0*	58	55	*-3*
	Basic metals	46	52	*6*	41	57	*16*
LT	Food, beverages, tobacco	12	15	*3*	14	20	*6*
	Textiles, clothing, leather	61	81	*20*	54	82	*28*
	Paper and printing	32	42	*10*	37	44	*7*
	Wood and furniture	43	34	*-9*	19	20	*1*
	Other manufacturing industry	38	60	*22*	32	47	*15*

Source: OECD, STAN Database (18.7. 2006), own calculations.

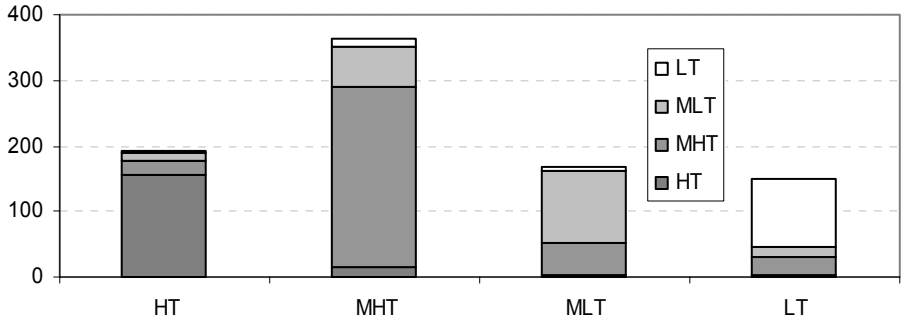
The highest share of export in production in high-tech industries was recorded in 2004, reaching 90 % in high-tech and 78 % in medium-high-tech industries. Since 1995, the ratio has grown by 33 and 21 percentage points respectively, indicating a high increase in the importance of foreign markets for high-tech industries. The share of import in domestic demand for high-tech products between 1995 and 2004 grew from 79 % to 91 %. It also grew similarly in all other industries. When looking into details of individual industries with medium-high and high technology intensity, it is apparent that office equipment and machinery and equipment have the highest share of production for export (almost 100 %).

On the contrary, the share of production for export in low-tech industries is significantly lower when compared to high-tech industries. This is most apparent in the food industry, reaching approximately 15 %. When compared internationally, the share of export in production for manufacturing in the Czech Republic was relatively high in 2004, significantly above the EU average. This share was higher in almost all industries, with the relatively highest difference in comparison to the EU average in medium-high-tech industries and engineering in particular.

Technology intensity of trade

The analysis of trade in terms of technology intensity shows whether individual industries and their groups and the economy as a whole tend to import medium-low-tech products that are then transformed into products with a higher technology intensity or vice versa.[14] Figure 3.1 shows that high-tech products have the highest share in high-tech industry imports (more than 80 %). This share is the highest for office equipment and computers, reaching approximately 95 %, and the lowest for the pharmaceutical industry (approximately 50 %). Additionally, these industries are known for their high import intensity of exports, exceeding 100 % for some industries (this indicator is again lower for the pharmaceutical industry). The import to export ratio exceeding 100 % may be caused by distorted prices during trading, a higher share of indirect exports or by import of investment goods.

Figure 3.1. Imports by technology intensity in the CR (2003, in bn. CZK)



Note: HT = high-technology intensity, MHT = medium-high-tech, MLT = medium-low tech, LT = low-tech. Source: CZSO, Database of foreign trade (1.10.2006), own calculations.

When looking at the **detailed structure** of high-tech imports, the high share of assembly activities with very low domestic value added is clearly apparent. The high import-intensity of exports also means that even strong export performance of the given industries has basically no influence on the improvement of trade balance. Within the group of **medium high-tech industries**, the core of the Czech manufacturing, medium-high-tech products represent three quarters of imports, and 20 % of imports fall in the medium-low and low-tech product category. The import intensity is lower than in the case of high-tech products (71 % on average). The highest share of medium-low-tech products in exports, almost one quarter, are represented by the automotive industry. Therefore, this industry is located in a **higher stage** of the value chain. The import intensity of exports reaches only 67 %. The automotive production has (in comparison to the volume of foreign trade) significantly positive influence on the trade balance total.

[14] For the analytical purposes, year 2003 was chosen since the product import and export matrixes structured according to industry and commodity classifications are available. It is the last year when the data from customs statistics were collected. After the Czech entry into the EU, the method of data collection has changed from customs declarations to statistic surveys. Even though the quality of data according to commodity classification remains quite high, the data concerning imports and exports for individual industries lose their documentary value as a result of a massive increase in indirect imports and exports (i.e. transactions through intermediaries).

The **product approach** provides a more detailed analysis of the importance of high-tech industries in foreign trade. It defines technology intensive industries by three to five-digit codes of the SITC classification. As is apparent from the Table 3.4, between 1999 and 2003, the share of high-tech products in total exports almost doubled from 6.4 % to 12.4 %, followed by a slight decrease in 2004. IT exports increased tenfold, i.e. most significantly. Electronics and telecommunications were the second most important group of exported products, with approximately a quadruple increase.

The imports of high-tech products were growing more slowly and their share in the total goods imported grew from 12.4 % to only 15.9 % between 1999 and 2003. In 2004, similarly to exports, this share slightly decreased. The largest group of high-tech products is represented by electronics and telecommunications, followed by information technology (6.4 % and 4.7 % respectively of the imported goods total in 2003). Approximately one half of the high-tech product value includes the processing trade in 2003. This means that the assembly took place in the Czech Republic and the completed products were reexported. This applies mainly to electronic parts and information technologies.

Table 3.4. Export and import of high-tech products in the Czech Republic - direct and indirect (processing) trade shares (%)

	Export				Import			
	Direct		Indirect		Direct		Indirect	
	1999	2004	1999	2003	1999	2004	1999	2003
Total high-tech	6.4	12.1	4.8	94.1	12.4	15.1	22.8	49.7
Aerospace	0.36	0.25	0.6	91.4	0.62	0.34	5.3	5.0
Comp., office equipm.	0.87	6.02	1.6	93.6	2.84	4.78	16.5	51.9
Electr., telecommun.	1.26	3.22	2.7	131.4*	4.24	5.82	32.6	76.6
Pharmacy	0.26	0.15	0.0	8.1	0.84	0.69	0.1	0.3
Scientific instruments	0.51	0.83	7.6	61.5	1.32	1.38	31.1	17.9
Electrical machinery	1.50	0.77	0.2	83.7	0.58	0.63	64.9	50.6
Chemistry	0.38	0.19	0.1	2.2	0.68	0.72	12.1	6.9
Non-electrical machin.	0.98	0.58	20.1	25.8	1.19	0.68	5.3	5.2
Armament	0.31	0.13	5.3	0.9	0.06	0.06	5.7	0.8

Note: * Shares of high-tech trade in total trade, shares of high-tech indirect trade in direct trade. Data on the total exports and exports after processing are not consistent. Source: CZSO, Database of foreign trade (1. 11. 2005), own calculations.

3.3. Internationalization of research and development

The benefits of FDI to the host economy and their role in economic and technology catch-ups may be differentiated as exogenous (short-term) and exogenous (medium to long-term). **Exogenous benefits** include transfers (improved and redirected production processes, new equipment and machinery, new products, capital imports, new production methods, new corporate functionalities) related to localized effects for foreign affiliates (an improved linkage between the costs and quality of products, increased production factor efficiency, accelerated upgrading and restructuring).

The subsequent development stage brings about **endogenous impacts** in terms of adoption of the knowledge transferred from the parent company to the foreign affiliates (technology, know-how, best practices) and diffusion of new processes and knowledge spillovers into the local companies. There are also indirect effects in the host economy (development of more complex activities with higher value added) as well as direct effects (vertical links to local suppliers and other producers, increased level of spillovers and diffusion of new processes).

The extent and intensity of spillovers are decisively influenced by the prevailing type of innovation strategies in the foreign affiliates especially distinctive in terms of motivation and intensity of internal research activities (see UNCTAD, 2006).

International context

New EU members attract an increasing amount of investment in activities intensive in **higher skills** (e.g. precision engineering, design, research and development), often requiring upgrading of the existing equipment and leading to the focus on export-oriented manufacturing, especially in the automotive and engineering industries. New members have also seen an increasing amount of investment from EU-15 small and medium-size enterprises due to reducing political and economic risks after the enlargement. The main motives for investing in the new members have not changed much so far. These include high growth rates as well as favourable future forecasts (thus enabling market expansion), low unit labour costs (increasing efficiency), with the wages reaching one fifth of the EU-15 level with one third productivity,[15] lower corporate taxes (20 % on average as compared to 31 % in EU-15).[16] EU accession may also support improvement of the business environment (institutional framework).

On the other hand, investors in new members still perceive persisting risks (see the survey in Kearney, 2005). These include underdeveloped infrastructure, high level of corruption and inevitable weakening low-cost advantage as a result of the increasing average income level. Economic and social costs of adjusting to the proposed EU reforms may be significant. New regulatory restrictions at the Communities level may decrease relative tax or labour cost advantages of new members for foreign investors and redirect them further to East and South (including the latest EU enlargement to Romania and Bulgaria).

Fragmentation of multinational value chain

The importance assigned to the (multinational) value chain structure reflects the position of EU members with less developed knowledge base combined with the strong presence of FDI business sector. While assessing the competitive advantage of these countries, the geographic fragmentation of the value chain must be considered, when different (qualitatively distinctive) segments are located in different countries. Less developed countries mostly host segments exploiting the advantages of low cost inputs. Location in countries at a similar or higher level of knowledge development is more motivated by the access to specific assets (e.g. new technology).[17] The quality of factor endowment (factor intensity) together with the level of technology capacities thus affect the depth of trade specialization as well as the motivation for the FDI inflows as a (possibly) important source of technology transfer.

[15] According to some estimates, the average wages in the new members will still be at 40-60 % of the EU-15 level in 2020 (see UNCTAD 2005, p. 87).

[16] The assessment of the tax burden must be more comprehensive and include other characteristics as well – e.g. the tax base, specific tax modes, see below.

[17] International production theories examine the motivations leading companies to expand their activities abroad (i.e. answer questions how, where and when). The reasons are divided based on the advantages they seek (in the OLI paradigm), whether they are unique assets as an income source (ownership advantage), possibility to internalize advantages resulted from the undertaken transactions exploiting economies of scale (internationalization advantage) or by making advantage of a particular location (localization advantage).

As to the value chain structure differentiated in terms of input quality intensity, the production segment is usually the least developed. It can be based on imported technology, employing the staff trained for simple operational tasks (e.g. automated assembly lines). On the other hand, the complete chain includes not just the production itself but also the R&D activities and other knowledge-intensive segments. However, they usually remain located in the home country of foreign investors where the knowledge base has already been appropriately developed.

The value chain fragmentation brings about a number of effects as to the **sources and direction of the competitive advantage**. As it has already been mentioned, the role of intra-industry trade becomes more significant. In this type of trade, similar products are exchanged, especially products in different production stages within multinational chains (as it is reflected in increasing volume of intra-company trade). If production costs increase, the pressure for moving labour-intensive segments into cheaper locations becomes stronger. Catching-up economy must therefore be able to replace them by activities that are more technology and skill intensive.

Such a transition, however, may be quite time and resource demanding. Specialization in **assembly of imported parts** (typical for countries with the advantage of relatively cheap labour force), even in industries classified as medium-high and high-technology intensive, has rather a very limited effect on technology capacity improvement in the host economy. The technology and skill intensities of these activities remain low, mostly not exceeding the averages in other industries. Their statistical export performance therefore do not as much reflects the ability to produce high-tech products but rather the specifics of (low-cost based) comparative advantage in the global production system. When foreign subsidiaries still develop their own R&D activities, the scope of knowledge spillovers in the host economy need to be assessed, as they are strongly affected by the linkages to the national innovation system and its key agents. These linkages mostly depend on a (relatively) small knowledge gap between domestic and foreign sectors, high level of human capital and the presence of technologically competent universities closely linked to the businesses.

Foreign investment in knowledge-intensive activities

According to the World Investment Report (see UNCTAD 2005), multinational companies dominate global R&D activities in both parent and host economies. Within the internationalization process, the newest trend is a fast increase in research activities of foreign subsidiaries in less developed countries in Asia and, to a lesser degree, in other regions, including the new EU members.

A survey conducted as a part of the *FDI Confidence Index* focused on location preferences of foreign investors in R&D, based on groups of countries and the most important decision-making factors. Almost a half of global investors (48 %) plan to increase R&D expenditures within the next three years, with only 3 % planning their decrease (see Table 3.5). Almost three quarters of these increased expenditures will be directed to emerging countries of Asia and Eastern Europe, especially from North America and Western Europe (thus negatively affecting R&D expenditures in these countries). Poland and Russia are considered the most attractive countries for R&D investments in Eastern Europe. From the global perspective, both China and India lead the chart, leaving others far behind. (More than 40 % of respondents plan to invest in these two countries).

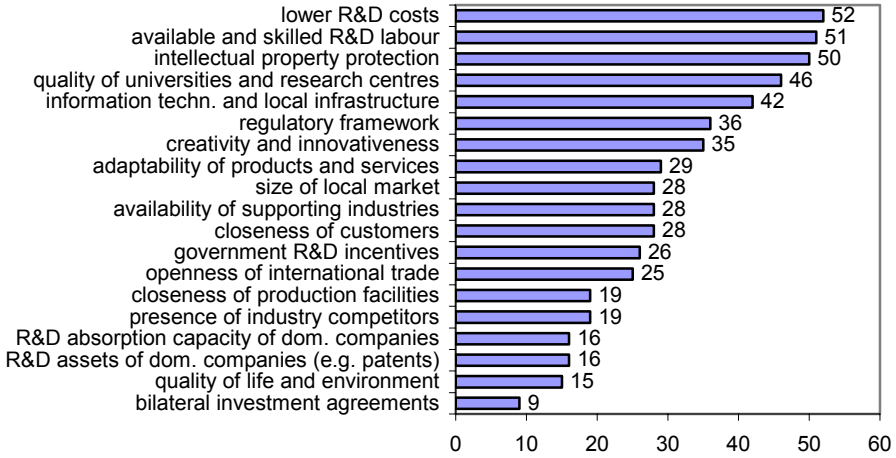
Table 3.5. Shares of foreign investors planning to change regional focus of R&D expenditures, 2005 (%)

	Asia (excl. Japan)	Eastern Europe	North America	Western Europe	Latin America	Japan	Mid. East, Africa
Increase	50	22	20	18	10	9	7
Decline	3	2	18	23	3	5	3

Source: Kearney (2005), p. 8.

Investors assess the factors affecting the location of research and development investments ranked according to their importance. More than half of them stress the following three: lower R&D costs, availability and quality of domestic workforce for R&D activities and a corresponding level of intellectual property protection. Figure 3.2 shows the importance of individual determinants of R&D investment location factors.

Figure 3.2. Determinants of foreign investment in R&D (2005, % of respondents)



Source: Kearney (2005), p. 9.

Table 3.6. Position of the Czech Republic and the key determinants of its innovation system

	R&D activities	CR	EU-25
R&D expenditure	R&D expenditure in % of GDP	1.3	1.9
	- Percentage financed by business sector	51.4	55.3
	- Percentage financed by government sector	41.8	34.0
	- Percentage financed by higher education sector	2.2	2.0
Human resources for R&D	Number of researchers in % of employees	0.73	0.92
	Business sector	0.26	0.36
	Government sector	0.17	0.10
	Higher education sector	0.30	0.45
	Ph.D. graduates of science and technology fields*	0.5	1.2
Intersectoral linkages	Business R&D financed by government	12.0	10.6
	University R&D financed by businesses	1.0	6.6
	Government R&D financed by businesses	7.8	5.5
Scientific output	Scientific publications per 1000 inhabitants	0.505	0.789
Innovation output	Share of innovative companies	25.9	36.2
	Number of EPO applications per mil. inhabitants	10.9	133.6
Venture capital in % of GDP	Start-up stage	0.008	0.049
	Expansion stage	0.048	0.093
Environment	Intellectual property protection	3.52	3.95

Note: *Per 1,000 inhabitants aged 25-34. Data for the latest available year. Source: EUROSTAT – Science and Technology Database, 1.8.2006, Kaderabkova et al. (2005).

In comparison with the EU average, the Czech Republic weaknesses in the key indicators of the **national innovation system** (see Table 3.6) include especially the availability of human resources for R&D, intensity of links between the business sector and universities (and the intensity of their R&D activities) and in science and innovation output and the exploitation of venture capital. The relative expenditures on R&D as well as the protection of intellectual property are also lower.

Knowledge-intensive activities of foreign companies

The importance of FDI subsidiaries for knowledge-intensive activities in the Czech Republic has been steadily increasing (see Table 3.7). By 2004 they had already reached almost one half of R&D expenditures of the business sector. Out of the total new patent applications submitted to the European Patent Office (EPO) by Czech inventors in 2002, 55 % were owned by foreign entities, i.e. they were carried out at subsidiaries of foreign companies. Based on the structure of manufacturing FDI at the end of 2004, medium-low-tech industries tend to slightly prevail (52.3 %). Foreign companies have a significant part in the trade in high-tech products.

Table 3.7. Structure of manufacturing FDI (as at December 31, 2004) and the role of foreign companies in the Czech Republic in terms of technology intensity, 2002 (% of the business sector)

	High	Medium-high	Medium-low	Low
Manufacturing FDI	14,5	33,2	32,4	19,9
Export	91,3	77,7	56,9	49,3
Import	88,0	84,5	48,5	64,1
Employment	47,0	41,3	26,0	20,9
Value added	48,8	52,3	35,8	42,3

Source: CNB, FDI Statistics, OECD – AFA Database 2005, 1.11. 2006.

The participation of foreign subsidiaries in R&D activities (see Table 3.8) is especially strong in manufacturing. The share of foreign subsidiaries in manufacturing R&D expenditures rose up to 65 %, and up to 50 % for researchers in 2004 (with the share in value added at 50 %, and the share in employees at 33 %). The share of foreign subsidiaries in R&D expenditures and the number of researchers are strongly industry-specific. The most apparent is the presence of foreign subsidiaries in the automotive industry (up to 95 % of R&D expenditures and 83 % or researchers in 2002) that belongs to the group of medium-high-tech industries. In this industry group, the R&D share of FDI companies significantly exceeds their share in value added.

Table 3.8. Business sector R&D expenditures (in CZK million), the number of researchers (FTE) and the share of foreign affiliates (FDI) in the Czech Republic (%)

	Expenditure				Researchers			
	2003		2004		2003		2004	
	Agg.	Affil	Agg.	Affil	Agg.	Affil	Agg.	Affil
Manufacturing	**1251**	**59,0**	**1368**	**65,0**	**3440**	**43,5**	**3654**	**49,9**
High technology	2251	36,6	2567	54,7	865	27,4	980	35,2
Medium high technology	8430	73,4	9114	76,5	2024	56,2	2169	60,9
Medium low technology	1409	19,1	1473	26,0	423	19,1	385	28,6
Low technology	423	25,1	531	27,1	128	32,0	120	38,3
Services	**7055**	**24,9**	**8535**	**22,7**	**3088**	**16,1**	**3614**	**21,1**
Knowledge intensive	6077	21,3	7634	20,7	2761	15,4	3317	20,5
High technology	4942	19,5	6163	18,5	2292	13,0	2744	19,9
R&D	3257	7,2	4215	8,6	1563	4,2	1674	4,8
Business services	697	45,9	762	34,6	267	46,1	282	35,8
Financial services	25	36,0	240	70,8	4	50,0	54	63,0
Less knowledge intensive	978	47,3	901	40,2	327	22,0	297	27,6

Source: Czech Statistical Office, R&D Statistics Database.

When comparing the individual industries in terms of their **R&D intensity** in the Czech Republic, its still quite low level becomes apparent in international comparison, reaching only one third when compared to developed countries (see Table 3.9). The R&D intensity in the automotive industry (and, to a lesser degree in other transport equipment) comes at least closer to the value justifying its classification as a medium-high-tech industry. The most extreme contrast between these two viewpoints is apparent in the office and computer equipment (classified as high-tech industries in developed countries), in respect to which the R&D intensity in the Czech Republic reaches the values comparable to food or wood industries. To conclude, we may say that in terms of R&D intensity there are yet no industries in the Czech Republic reaching high-tech intensity.

Based on the **actual R&D intensity**, only pharmaceutical industry and the aforementioned automotive industry and possibly other transport appliances could be placed in the medium-high-tech group in the Czech Republic. All other manufacturing industries fall under the medium-low or low-tech category. In this adjusted definition of technology groups, the share of medium-high and high-tech industries in Czech exports would reach only 18.6 % in 2003 (in comparison with the reported value of 59.4 %).

Table 3.9. Structure of manufacturing export and the R&D intensity of value added, the share of foreign affiliates in value added and in R&D expenditures in the Czech Republic (%)

Technology intensity		NACE	Export 2003		R&D intensity 2002		Foreign affil. 2002	
			CZ	EU	OECD	CZ	V.add.	R&D
High	Aerospace and aircraft	353	0,4	3,2	27,5	..	..	1,5
	Pharmaceuticals	244	0,8	5,6	25,8	9,2	..	46,1
	Computers, office equipment	30	6,6	4,0	15,1	0,1	79,7	0,0
	Electronics-communication	32	5,2	5,6	22,4	3,6	65,8	50,2
	Precision instruments	33	1,7	3,5	11,9	2,5	33,6	30,3
Med-high	Electrical machinery	31	9,2	4,3	6,7	1,3	48,8	34,7
	Motor vehicles	34	16,8	14,8	11,7	9,5	83,8	94,8
	Chemicals excl. pharmaceut.	24	4,7	10,5	7,1	2,2	38,8	41,0
	Other transport equipment	35	1,0	0,6	7,9	4,2	25,1	4,2
	Machinery and equipment	29	13,0	11,5	5,3	2,6	27,3	30,6
Med-low	Petroleum refining	23	1,1	2,6	2,7	..	..	..
	Rubber and plastics	25	5,2	3,3	3,0	0,9	57,7	20,8
	Non-metallic min. products	26	4,3	1,8	1,3	1,1	47,8	23,9
	Shipbuilding	351	0,0	0,7	2,9	..	..	..
	Metal products	27-28	12,2	7,5	1,4	0,5	21,5	11,6
Low	Other manufactur. industry	36-37	4,0	2,8	1,2	0,3	27,4	9,8
	Paper and printing	20-22	5,3	4,9	0,3	0,1	31,1	25,3
	Food, beverages, tobacco	15-16	2,9	7,1	1,0	0,1	43,9	39,3
	Textiles, clothing, leather	17-19	5,6	5,9	1,0	0,7	22,1	26,3
Manufacturing		15-37	100,0	100,0	6,5	2,2	41,4	59,0

Notes: R&D intensity for OECD expressed by the median for 12 developed members in 1999. Source: OECD (2005), p. 182, 207-208, CZSO – Science and technology indicators (2004), p. 269 (updated at 1.8. 2006), OECD – AFA Database, 1.11.2006, modified.

According to the survey on **innovation activities** for the period of 2002 – 2003, 41 % of foreign subsidiaries (companies located in the Czech Republic with the HQ abroad) carry out innovation activities as compared to 24 % of Czech companies (see Table 3.10). In comparison to innovation performance of the total sample, foreign subsidiaries show up higher values in manufacturing, especially then in the food industry, rubber and plastics,

electrical and optical appliances. As for services, innovation results of foreign subsidiaries are significantly better in all industries. However, innovation intensity in foreign subsidiaries is only slightly higher compared to the total sample.

Table 3.10. Share of innovative companies (INNO) and innovation intensity (INT) in the Czech Republic, 2002-2003

	Total		Foreign affiliates	
	INNO	INT	INNO	INT
Total	25,9	1,6	41,1	1,7
Manufacturing	**28,4**	**2,4**	**41,5**	**2,1**
Food, beverages, tobacco	31,6	1,9	64,9	1,4
Textiles, clothing, leather	19,7	2,2	29,7	0,6
Paper and printing	21,5	3,1	28,5	3,2
Petroleum refining, chemicals	57,3	3,5	56,0	7,1
Rubber and plastics	27,7	1,8	52,0	1,6
Metal producst	25,8	1,4	24,9	0,9
Machinery and equipment	39,2	3,0	41,5	3,2
Precision, optical and electrical instruments	30,9	4,6	42,6	4,8
Motor vehicles	42,9	1,4	48,7	0,8
Furniture, other manufacturing	21,3	2,6	17,7	0,9
Services	**22,8**	**0,8**	**41,3**	**0,8**
Wholesale and retail	23,5	0,6	38,4	0,7
Transport, telecommunications	13,6	0,8	34,2	1,5
Finance and insurance	25,3	0,4	50,6	0,5
Data processing and related activities	55,1	8,6	66,0	10,1
Research and development	54,4	35,9	75,3	31,3

Source: Czech Statistical Office. Database of Technology Innovation.

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.

The starting comparison of the distribution of workers among alternative **clusters of work organisation and learning** shows significant differences between the old and the new EU members, as represented by the country groups EU-15 and EU-4. A lower share of workers in the organisational form with the highest qualitative intensity, i.e. in the cluster of discretionary decision making, and, on the contrary, a higher share in

lean production and taylorist organisation are evident in the new members. With regard to individual characteristics of work organisation, new members are characterised especially by lower importance of team work, job rotation, task complexity and problem solving, and higher significance of task monotony and various forms of constraints on the working process.

The assessment of **structural characteristics** of workers according to forms of organisation in the new members shows the most frequent occurrence of discretionary decision making in financial and other business related services. Manufacturing reports a significantly lower share of discretionary decision making, a lower share of lean production and higher significance of taylorism compared to the old members. In terms of groups of occupations, the new members lag behind due to the slightly lower importance of the organisational form with discretionary decision making in occupations with the highest skill intensity, and this is mainly in favour of lean production. Occupations with the lowest skill intensity in the new members are characterised by a higher share of the taylorist organisational form.

At the **national level**, significant differences between individual members or their groups appear in the structure of workers according to forms of organisation and learning. The Nordic countries are typical especially for their higher share of organisations with discretionary decision making, while southern European countries hold almost exactly the opposite position. Although the importance of national characteristics for the quality of structure of work organisation and learning is significant, a large portion of the observed differences can be attributed to other factors not included in the presented variable set.

The analysis shows a strong relationship between forms of work organisation and learning and **types of innovative activities**. A larger share of workers involved in discretionary decision making positively influences the intensity of innovative activities (development of internal innovative ability). Any support of innovative performance should therefore also take into account the development of a pro-innovative working environment (rather than merely increasing research and development expenditure itself, which is strongly influenced by the structure of industries). Unexplained national factors (such as institutional characteristics) are also very significant. Moreover, a very strong relationship exists between the initial importance of organisation with discretionary decision making and the resulting level of quality-based competitiveness.

More specifically, the position of **Visegrad countries** can be assessed as rather positive, particularly when the development in time has been considered. Although the data comparability between the two survey rounds may be rather limited, on average the share of discrete learning organisation form in the EU-4 is increasing (especially in knowledge intensive services and in high-skill occupations). Nevertheless, the qualitative position of manu- facturing (dominated by companies under foreign control and playing a key role in export performance) remains inferior, i.e. with relatively low share of discrete learning work organisation. The ufavourable structure of manu- facturing may bring a demanding challenge in the inevitable process of structural adjustment, related to the weakening cost-based competitiveness.

In terms of structural globalization characteristics, the export dynamics to the EU countries have increased significantly over the last few years following strong inflows of foreign direct investment to the Czech Republic. At the same time, the export structure has been changing as well, with engineering, and the automotive industry especially, gaining an ever increasing share. Pro-export effect of foreign investments started to prevail over the influence of imports of investment goods in the first stage of the FDI life cycle. The strong geographical concentration of trade on Germany may present a potential trade balance problem, as may product over-specialization in industries related to automotive production. Within EU-15 imports, machinery and transport vehicles are dominant, while the imports from the new EU members include predominantly products with lower technology intensity.

Within the last ten years, the trade structure of new EU members, including the Czech Republic, has shifted significantly in favour of technology more intensive products that represent approximately 60 % of imports to EU countries. Medium-high-tech industries (especially the automotive industry) have the highest contribution toward trade balance, with the contribution of high-tech industries still being negative, though gradually improving. These industry groups have also the highest share of products for export. However, since the predominant part of the production is assembly-based, value added remains relatively low (especially in the office and computer equipment).

The importance of foreign companies in the total R&D expenditures has been recently significantly growing especially due to changes in the ownership structure of large companies. The share of value added in knowledge-based activities still remains relatively low when compared to developed countries, both in terms of R&D intensity and quality-intensity of employment, a fact that is also reflected in low economic performance achievements (especially in production). This is predominantly the case of the industries that are traditionally classified as high-tech. The combination of a high level of foreign direct investments and the low quality of value chain requires an intensive policy support expanding the supply of domestic knowledge-intensive inputs and developing infrastructure of the national innovation system.

In terms of foreign direct investments in R&D activities, the region of Central and Eastern Europe receives very positive ratings by investors, with almost one quarter expecting an increase in R&D expenditures (however, for Asian countries almost one half expect this development). As far as the location determinants for R&D expenditures are concerned, the Czech Republic lags behind especially in the availability of human resources for research, in the intensity of linkages between the business sector and universities, the level of scientific and innovation output and in exploitation of venture capital. Foreign companies in the Czech Republic play an increasingly important role in knowledge-intensive activities, covering almost a half of business sector R&D expenditures, with this share growing up to 65 % in manufacturing (yet in services it is less than one fourth).

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