UNIVERSITY OF ECONOMICS AND MANAGEMENT

CES

CENTRE FOR ECONOMIC STUDIES

Innovation and competitiveness

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Abstract:

Innovation performance. The fourth part is divided into three chapters. The first evaluates the inputs and outputs of innovation performance according to the main sectors of the national innovation system. The second chapter focuses on the characteristics of the business innovation performance and its effects and barriers. The third chapter evaluates the characteristics of the business IT development in the Czech Republic in the context of global trends in information society. Inputs and outputs of innovation performance (Anna Kadeřábková, Michal Beneš, Karel Muller): The evaluation is based on the concept of national innovation system according to its inputs, specific infrastructural preconditions and outputs (scientific and technical performance). The analysis of inputs includes the characteristics national research and development system, describes the dynamics and structural changes of research and development sectors and specific problems of their internal structuration and mutual interfaces. The scope of inputs covers also broader factors influencing innovation performance, like the availability of the highly qualified experts, the level of scientific and technological activities, level and growth rate of government expenditures, cooperation between universities with companies, availability of venture capital. Business innovation performance (Michal Beneš, Michal Pazour): The chapter evaluates the key aspects of innovation performance of Czech enterprises, particularly using the results of latest Community Innovation Survey (2003-2005). The types of innovation (including non-technical), innovation activities, their effects and hampering factors are studied more thoroughly. The attention is also given to the extent and type of cooperation in the innovation process and the significance of alternative information sources. The more complex view on the innovation inputs and outputs evaluates the structure of employees in terms of the prevailing learning models and their impact on the innovation mode. The analysis finishes with references to specific conceptual and methodological problems of statistical surveying and measurement of innovation.

Structural competitiveness. This part is divided into three chapters. The first assesses the position of the Czech Republic with comprehensive indicators of micro and macro competitiveness. Furthermore, two structural aspects (industrial and regional) are applied to evaluate the performance and qualitative characteristics of the selected industrial groups of manufacturing and services and regions in the Czech Republic. Comprehensive assessment of competitiveness (Anna Kadeřábková, Michal Beneš): Complex approach to the competitiveness makes at first use of the structural indicators for monitoring the Lisbon Strategy achievements. The second approach is based on the methodology of the World Bank with an emphasis on the knowledge economy pillars in a sound institutional framework (knowledge assessment matrix). Specific accent is put on the position of the Czech Republic within European Innovation Scoreboard and its key components, though the explanatory value of the composite indicator remains rather limited, especially in the new EU members. Finally, the results published by WEF and IMD are used for the competitiveness assessment. More specifically, the position of the Czech Republic is compared in with Finland. Industrial competitiveness (Marek Rojíček): Analysis ranks industries in terms of a wide range of indicators, both performance and quality-based, such as productivity level and its growth, R&D intensity, share of qualified employees, export share, share of gross value added in foreign-controlled enterprises, output multiplier (indicating the intensity of industry linkages within the economy). Comparison is made by individual characteristics and average position in overall indicator of industrial competitiveness. Key competitiveness factors are enlisted in each industry, where manufacturing is explored in more detail. The key role is played by car industry with relatively favourable knowledge characteristics. Besides the level of individual industries, the analysis also includes groupings in terms of technology and knowledge intensity (though its actual level remains low in the Czech Republic). Regional competitiveness (Jaroslav Kahoun): Regional competitiveness is measured at level NUTS3 (there are 14 of them in the Czech Republic). Included variables are divided into the categories of economic performance, innovation performance and quality of life. Special emphasis is put on technology intensive industries and research and development inputs, foreign direct investment inflows per capita, and labour market duality characteristics. Attention is given both to the achieved level in the individual categories and their changes in time to identify regions which are catching-up, stagnating, falling behind and further improving their position.

Information society and business informatics (Josef Basl, Josef Pour): The chapter deals with the quality of informatics at three levels – at the level of the society, at the level of the ICT market in the Czech Republic and the level of informatics in firms. International comparison points out the key characteristics of the achieved level of information society, for example accessibility of the internet to firms and individuals, using of e-business and e-government applications, etc. The second part evaluates the current situation and the expected development of the ICT market in the Czech Republic. It analyses only the supply side of information applications and all sorts of related services. The evaluation is based on ad hoc survey undertaken among the company and ICT managers. The last part deals with the quality of business informatics and its influence on competitiveness. The effects of business informatics are discussed and evaluated through the filed opinion survey.

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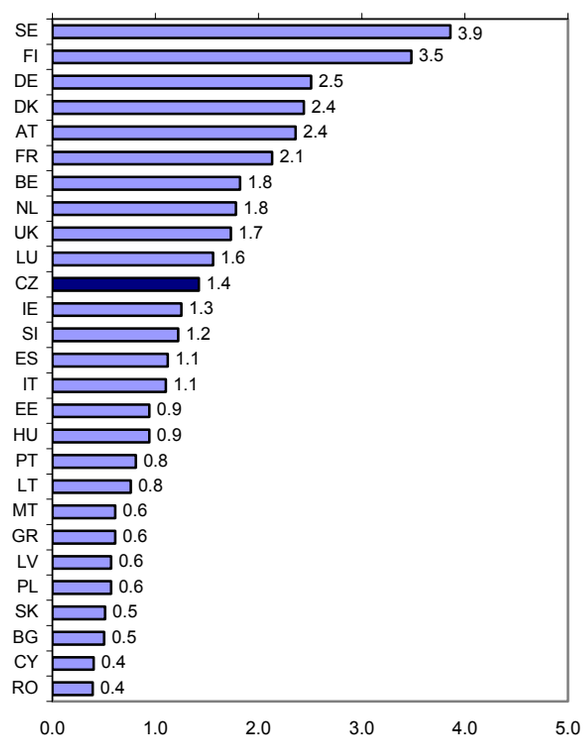
1. Innovation performance

The key concept in the evaluation of innovation performance is the national innovation system and its inputs and outputs (financial and personnel related). The structural characteristics of the innovation system (regional and industry-based) are assessed in more detail, with emphasis on research and development activities in the business sector and its innovation performance.

1.1 Innovation inputs and outputs

Measuring the inputs and outputs of innovation performance, particularly in the sphere of research and development, is based on the relatively advanced harmonisation of the **methodological approaches** used in the countries of the OECD and EU. The demands on the explanatory ability of indicators are still rising, however, especially with the growing emphasis on support for qualitatively based competitiveness. In the case of research and development activities themselves, the need to take the specifics of the service sector into consideration is stressed.

Figure 1: Gross expenditure on research and development (GERD, in % of GDP), 2005



Notes: 2005 or the last available year. Source: EUROSTAT – New Cronos, Science and Technology (at 12.8.2007).

Ever greater attention is also turning to internal innovation activities and their sources in the wider sense as opposed to the prevailing focus on (internal) research and development to date. The main thing to have happened is a broadening of the concept of innovation to include non-technical types. In the case of information and communication technology, problems are caused by the lack of a uniform approach to measuring its effects at all analytical levels thus far, an approach that would go beyond the narrow technological perspective or which would capture the impacts brought about in related activities. In terms of human capital, we are mainly lacking data on the full spectrum of forms of lifelong learning and on the qualifications and skills attained out of the system of formal education and training.

Research and development capacities are a significant source of innovation efficiency in the traditional sense. According to indicators that look at the extent of financial and human resources invested in this area, the Czech Republic occupies a leading position in the group of new EU countries (see Figure 1). Moreover, it has come considerably closer to the EU-15 average in recent years. In the case of gross expenditure on research and development, the lag of the Czech Republic behind the original members of the EU stood at 0.75 percentage points in 2002, but was only 0.49 percentage points in 2005 (see Table 1).

Even then, however, a level of expenditure amounting to 1.42 % GDP cannot be regarded as sufficient since it does not make even half of the 3 % target set out as part of compliance with the Lisbon Strategy. However, only Finland and Sweden have been able to meet this target of the other members of the EU. The feasibility of actually reaching this target level has recently been the subject of ever fiercer debate because this could be significantly conditioned by the industrial structure of the individual countries (a varying share of industry with different demands on the added value of research and development).

Table 1: Gross domestic expenditure on research and development (GERD, in % of GDP)

	EU-27	EU-15	CZ
2000	1.86[s]	1.92[s]	1.21
2001	1.88[s]	1.94[s]	1.20
2002	1.88[s]	1.95[s]	1.20
2003	1.87[s]	1.93[s]	1.25
2004	1.84[s]	1.91[s]	1.26
2005	1.84[s]	1.91[s]	1.42

Notes: s – estimate by EUROSTAT. Source: EUROSTAT – New Cronos, Science and Technology (at 12.8.2007).

There has also been a considerable improvement in the situation in terms of the relative number of **employees in research and development**. The share of such employees in overall employment in 2002 stood at 1.13 % (expressed in HC), which was some 0.47 percentage points less than the EU-15. This difference in 2004 stood at only 0.31 percentage points and the Czech Republic maintained its high growth tempo in the number of employees (and research workers) in 2005 (see Table 2).

The improvement in the situation is even more distinctive expressed as a full-time equivalent (FTE). However, a change in the method of its calculation that came into effect in the Czech Republic the previous year played a significant role here. Thanks to this the share of human resource stocks expressed in FTE against HC is now comparable with the values in the EU-25 (approximately around 2/3, with higher values in

business sector and lower values in higher education institutions). However, the Czech Republic continues to lag behind the Scandinavian countries in particular In spite of considerable increases in the stocks of human resources in research and development.

Table 2: Total R&D personnel and researchers (in % of total employment, HC)

	Total R&D personnel					
	2000	2001	2002	2003	2004	2005
EU-25	1.44[s]	1.45[s]	1.50[s]	1.50[s]	1.49[s]	..
EU-15	1.54[s]	1.55[s]	1.60[s]	1.60[s]	1.59[s]	..
CZ	1.14	1.11	1.13	1.18	1.28	1.37
	Researchers					
EU-25	0.84[s]	0.86[s]	0.90[s]	0.91[s]	0.92[s]	..
EU-15	0.88[s]	0.90[s]	0.94[s]	0.95[s]	0.96[s]	..
CZ	0.64	0.62	0.65	0.67	0.73	0.79

Notes: s – estimate by EUROSTAT. Source: EUROSTAT – New Cronos, Science and Technology (at 12.8.2007).

The constant growth trend in the supply of young, qualified research workers in the Czech Republic can also be seen positively. The percentage of graduates of doctorate study programmes in science and technology field in the 25-34 age group has roughly doubled from 0.3 ‰ to 0.6 ‰ in the past five years. However, the slight downturn in the percentage of graduates of natural and technical specialisations in the overall number of graduates of doctorate studies is less positive. Nonetheless, this percentage is still more than 10 percentage points higher than in the EU-27. Indeed it is even higher than in Finland or Sweden. However, the percentage of graduates in the population stands at 1.2 and 1.0 ‰ respectively in these countries.

Table 3: Ph.D. graduates in science and technology field

	Share in total Ph.D. graduates					
	2000	2001	2002	2003	2004	2005
EU-27	43.4[s]	43.1[s]	43.2[s]	41.7[s]	42.1[s]	40.8[s]
CZ	57.0	52.2	50.6	52.7	50.7	51.6
	Share in population 25–34 years (in ‰)					
EU-27	0.5[s]	0.5[s]	0.5[s]	0.5[s]	0.6[s]	0.6[s]
CZ	0.3	0.4	0.4	0.5	0.5	0.6

Notes: s – estimate by EUROSTAT. Source: EUROSTAT – New Cronos, Education and Training (at 1.8.2007).

The structure of financing and performing research and development according to institutional sectors is relatively stable. The Czech Republic has retained a high share of the business sector in financing research and development (54.1 % in 2005), which is comparable with the level in the EU-15 (although considerably beneath the set aim of a two-thirds share). By contrast, the share of foreign resources in financing domestic R&D is lagging behind (only 4.0 %), whilst the share of government is relatively high (40.9 %). There is a similar situation as concerns the implementation of R&D, where the share of business is comparable with the EU-15, the share of government is higher and the share of the academic sector is considerably lower. In spite of the fact that the latter has taken a bigger share of the implementation of R&D than a few years ago (its share has risen by 2.5 percentage points in five years), it is still of fairly minor significance in international comparison (see Table 4).

The structure of human resources according to their institutional affiliation tells a similar story. The Czech Republic is one of the countries with the highest share of government and lowest share of higher education in the total number of researchers. It would appear, then, that the heritage of the former separation of research from the universities to the academies of science has remained. The share of the business sector in the number of research workers is considerably lower in the Czech Republic than in the EU-15 (by approximately 10 percentage points), which contrasts sharply with the share of businesses in the implementation of R&D.

Table 4: The structure of expenditure on R&D by sources of funds and sector of performance (in %)

Source of funds	Businesses		Government		Abroad	
	1999	2004	1999	2004	1999	2004
EU-27	56.1[s]	54.9[s]	34.5[s]	34.6[s]	7.2[s]	8.2[s]
EU-15	56.3[s]	55.2[s]	34.2[s]	34.3[s]	7.3[s]	8.3[s]
CZ	52.6	52.8	42.6	41.9	4.0	3.7
Sector of performance	Businesses		Government		Higher education	
	1999	2004	1999	2004	1999	2004
EU-27	64.6[s]	63.7[s]	14.3[s]	13.3[s]	20.4[s]	22.0[s]
EU-15	64.9[s]	64.1[s]	14.0[s]	13.0[s]	20.4[s]	21.9[s]
CZ	62.9	63.7	24.3	21.2	12.3	14.8

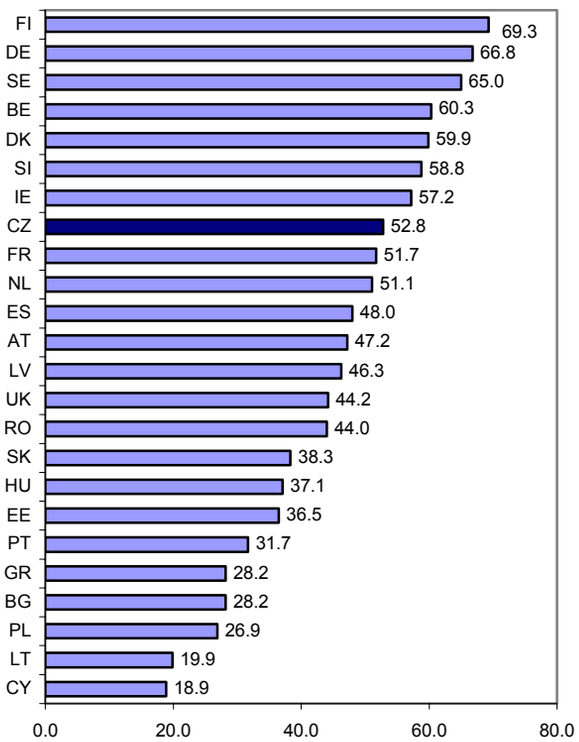
Notes: s – estimate by EUROSTAT. Source: EUROSTAT – New Cronos, Science and Technology (at 12.8.2007), own calculations.

Considerable differences can be seen between the countries in the EU-27 in terms of the characteristics of research sectors, from a considerable share of the business sector in financing and conducting research and development or by contrast a considerable share of the government sector to broadly-based systems with balanced shares of the business, government and higher education sectors. From a structural perspective, a target value for the share of the business sector in financing research and development was set at a level of at least 65 % at the Barcelona summit within the bounds of the Lisbon Strategy. According to the most recent available information, this level has reached almost 55 % in the EU-27 (61 % in the USA and 75 % in Japan) in the light of a stagnating trend. The highest share is usually shown by countries with a high share of total domestic expenditure on R&D (see Figure 2).

The most open from the perspective of **inter-sectoral flows** of financial resources in research and development in the Czech Republic is the government sector (which ensues from its function in support of this area of activity). The business sector receives a relatively large amount of resources for its own research from other sources (19.2 %), mostly from government sources (almost 14.7 %). On the other side of the coin, however, it commissions research in other sectors to a lesser extent. Therefore the openness of the business sector is not reciprocated. It accepts far greater resources for research and development from other sectors than it hands out for external implementation. Another negative aspect of inter-sector flows of funds

in the Czech Republic has in all likelihood deepened over time in that the share of higher education research financed by the business and foreign sector (0.8 % and 2.8 % respectively) has continued to fall. By contrast, the government sector (in particular the institutes of the Academy of Sciences) is still preferred by the business and foreign sectors. The extremely low share of foreign financial resources in all sectors of the national innovation system is alarming.

Figure 2: Share of the business sector in funding research and development (2004, in %)

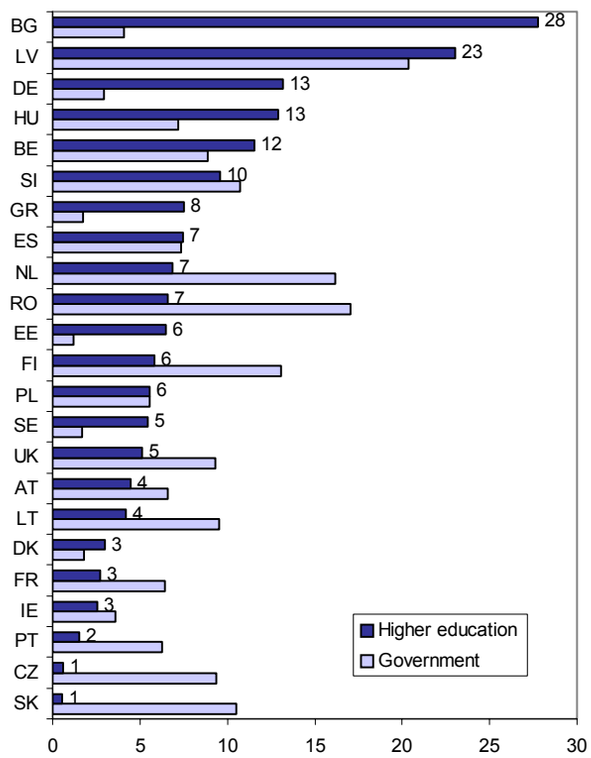


Notes: 2004 or the last available year. Source: EUROSTAT – NeCronos, Science and Technology Database (at 12.8.2007).

There is an interesting contrast between hard and soft data in **relations between universities and the business sector**. The Czech Republic and Slovakia occupy the worst position in the share of business expenditure on higher education research. However, there would appear to be an improving trend according to the assessment of an expert investigation. The Czech Republic is now even the best assessed new member state in this regard and is succeeding in reducing its lag behind the original member states. Given the specific position of the government sector in the new countries of the EU in which the research institutes of academies of science are incorporated, it is appropriate to expand the inter-sector analysis to include relations between the business sector and the government sector. According to this information, businesses within the EU most considerably share in financing the implementation of research and development in the government sector in Latvia, more than 10 % (see Figure 3).

The highest figures in the case of the share of business in research and development conducted at universities are seen in Latvia, Bulgaria, Germany, Hungary and Belgium. The share of business expenditure in the government sector in Germany has been very low for a long time now. The Czech Republic is one of the countries in the comparison in question with a relatively high share of business in the implementation of research and development in the government sector, but has an almost negligible share of business in the implementation of research at universities.

Figure 3: Business funded R&D in the higher education and government sectors in 2004 (in %)



Notes: Belgium, Greece, Luxembourg, Malta, Portugal and Sweden for 2003. Source: EUROSTAT – New Cronos, Science and Technology (at 17.8.2007), own calculations.

Business expenditure on R&D has mainly grown in the past three years and as with overall expenditure on R&D is seeing a gradual convergence with the EU-15 level. Whereas the Czech Republic lagged behind the original members of the EU by 0.47 percentage points in 2002, the gap was down to 0.3 percentage points in 2005 (see Table 5). The Czech Republic mainly has a favourable position in comparison with the other new member countries of the EU, among which it is in first position (see Figure 4).

Table 5: Business expenditure on R&D (in %)

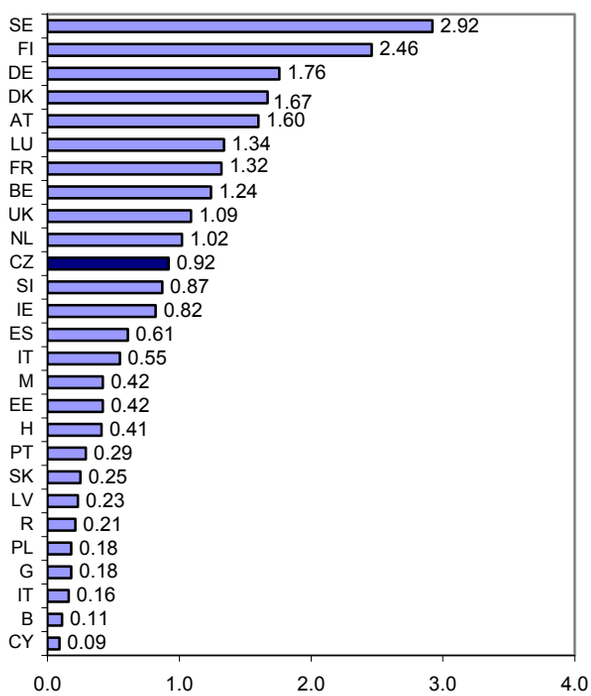
	2000	2001	2002	2003	2004	2005
EU-27	1.21	1.21	1.21	1.19	1.17	1.17
EU-15	1.25	1.26	1.26	1.24	1.22	1.22
CZ	0.73	0.72	0.73	0.76	0.80	0.92

Notes: EU-27, EU-15 – EUROSTAT estimate. Source: EUROSTAT – New Cronos, Science and Technology (at 12.8.2007).

The implementation of research and development is significantly concentrated according to the **size perspective** of the workplaces. Larger businesses generally show a greater intensity and extent of research

activity, which mainly applies to industries with major demands on research and development. Only sufficiently large research and development teams with the corresponding history are able to keep the said company on the frontier of the best practice in such industries. Large companies (with more than 250 employees) share around two-thirds of the implementation of business R&D in the Czech Republic, which is an average value in comparison with the other countries of the European Union. Germany, Sweden and Great Britain have a considerably higher share (up to 90 %).

Figure 4: Business enterprise expenditure on R&D (BERD, in % GDP), 2005



Notes: Great Britain and Romania for 2004. Source: EUROSTAT – New Cronos, Science and Technology, OECD – Main Science and Technology Indicators (at 12.8.2007).

A major concentration of expenditure in transport engineering is clear in **industry-based division**, in particular in the production of motor vehicles. The share of this branch of industry in overall business expenditure on R&D in the processing industry is more than two-fifths and roughly half when including the production of other means of transport. The significance of this industry in the use of human resources in R&D is actually considerably lower at around a half. The research and development sector, which is specific, is dominant in service industries. Other branches of industry with prominent activity from the perspective of research and development include computing, in particular the creation of software and consultation in this field (see Table 6).

A parallel comparison of the industry-based structure according to expenditure and number of employees shows certain significant differences. For example, the manufacture of motor vehicles had a share of 42 % in expenditure on research and development, whereas the share of employees is around half. The production and repair of machinery is the exact opposite. These differences ensue from the different demands of the individual branches of industry or sectors on financial and human resources. Other inter-sector differences can be found in patent and innovation activity or (in a more comprehensive view) in the effectiveness of innovation activities. The industry-based structure of economic activities in a given country can therefore strongly influence the values of aggregate information about, for example, the demanding nature of GDP or the labour force on research and development.

The so-called **structural effect** points to this problem. For example, in an economy with a predominance of industries with lesser demands on research and development it is essentially impossible to achieve a more significant increase in the share of expenditure on research and development in GDP without a shift in the structure to technology more intensive industries.

Table 6: Business enterprise expenditure R&D (BERD) and R&D personnel (FTE) by branches of manufacturing industries and services in the CR (in %)

	Expenditure		Personnel	
	2000	2005	2000	2005
15–22 Food, textiles, wood	2.1	2.3	4.3	4.7
23–24 Coke, crude oil, chemicals	12.6	12.7	15.1	13.5
24 Chemicals and pharmaceuticals	10.3	8.4	12.6	9.4
24 – 244 Chemical products	6.0	3.5	9.4	5.6
244 Pharmaceuticals	4.3	4.9	3.2	3.7
25 Rubber and plastics products	2.1	4.2	2.4	4.0
26 Other non-metallic products	2.2	3.3	1.8	3.3
27 Basic metals	4.4	2.5	3.0	2.0
28–35 Engineering industry	76.7	78.7	73.5	75.0
29 Machinery and equipment	13.0	12.6	19.6	20.2
30 Office equipment, computers	0.1	0.3	0.2	0.6
31 Electrical machinery	3.7	4.7	5.8	8.7
32 Radio, television equipment	3.6	7.7	5.1	8.9
33 Medical and optical instruments	1.9	2.6	4.4	5.1
34 Manufacture of motor vehicles	44.4	42.3	25.9	21.4
35 Other transport euipement	7.0	6.4	7.9	6.9
36 Manufacture of furniture	2.0	0.6	2.4	1.5
Manufacturing industry	100.0	100.0	100.0	100.0
50 – 52 Sales and repairs	2.9	7.1	3.9	5.1
55 Hotels and restaurants	0.0	0.0	0.0	0.1
60–64 Transport, communications	2.4	0.4	2.3	0.3
65–67 Financial intermediation	0.0	3.0	0.0	1.1
70–74 R&D, business activities	80.2	83.7	88.6	85.1
72 Computer and related services	8.5	26.6	10.0	29.3
722 Software and consultancy	7.8	20.0	9.2	25.1
73 Research and development	66.9	45.8	71.8	43.3
74 Other business activities	4.8	10.9	6.6	11.9
75–99 Public admin., other services	14.5	5.8	5.2	8.4
Services	100.0	100.0	100.0	100.0

Source: EUROSTAT – New Cronos, Science and Technology (at 4.8.2007).

By contrast, countries with a higher share of industries that are demanding in terms of research and development have better conditions to also exhibit higher GERD or BERD values as a consequence of the structural effect. Therefore, the traditional concept is not sufficient for a comparison of structurally different economies. A conversion of expenditure according to a standardised industry structure that is the same for all countries under examination is used in order to eliminate the structural effect. The calculations show for the Czech Republic that the influence of the structural effect is gradually falling and was almost negligible by 2005.

It ensues from a **regional analysis** that R&D is mainly concentrated in Prague. The Central Bohemia Region also plays a significant role in expenditure on R&D thanks to the location of the car industry. Nonetheless, the position of the Central Bohemian agglomeration has been gradually weakening over time, whereas a number of other regions have shown a growth dynamic. However, the significance of the other regions (with the exception of the South Moravia Region) is still negligible (see Table 7).

The aforementioned undersized nature of the university sector can be seen once again in terms of the **structure of human resources** in research and development. By contrast, the government sector is more than double the average for the EU-15 (see Table 8). One specific characteristic is the percentage of women research and development workers, which is one of the lowest in the Czech Republic (whilst the other new member states of the EU are in first position here). Their role is traditionally less significant in technical sectors, which are the most prominent in the Czech Republic (with a 42 % share of research workers). Orientation on increasing the **percentage of women** employed in research now plays an important role in strategies aimed at advancing research and development. The reasons for this are mainly of an emancipative nature. However, it is also a reaction to limitations on the influx of new labour into this area.

Table 7: R&D expenditure (GERD) and personnel (FTE) by region (in %)

	Expenditure		Personnel	
	2001	2005	2001	2005
City of Prague	35.7	37.5	41.4	40.5
Central Bohemia	25.5	20.3	10.9	10.4
South Bohemia	2.8	3.8	3.9	3.8
Pilsen	2.3	2.7	3.4	3.3
Karlovy Vary	0.2	0.2	0.4	0.2
Ústí nad Labem	1.8	1.4	2.0	1.6
Liberec	2.6	2.6	2.5	3.0
Hradec Králové	2.4	2.8	2.6	3.1
Pardubice	3.5	3.9	4.4	4.5
Vysočina	1.1	1.7	1.2	1.6
South Moravia	10.8	11.0	14.4	13.9
Olomouc	2.6	3.3	3.5	4.7
Zlín	2.4	3.7	3.0	3.8
Moravian Silesia	6.2	5.2	6.3	5.5

Source: Czech Statistical Office (2002, 2006).

It is assumed that the university education of the female population could be a significant source of growth for new human resources in research and development. The possibility of increasing the percentage of women in research and development is no doubt based on the even number of women and men in higher education that is generally the case in all countries.

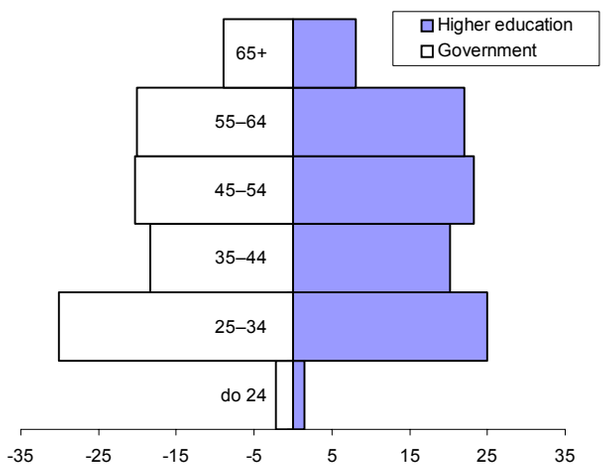
Table 8: Researchers by sector (2005, FTE, in %)

	Businesses	Government	Higher education
EU-25	49.2	13.1	36.6
EU-15	52.4	12.0	34.5
CZ	42.8	25.3	31.3

Notes: EU-25, EU-15 – EUROSTAT estimate for 2004. Source: EUROSTAT – New Cronos, Science and Technology (at 4.8.2007), own calculations.

The **age structure of research workers** in the government and academic sectors is extremely unfavourable in the Czech Republic, with a relatively low percentage of the most productive middle generation of researchers (see Figure 5). This structure indicates a "brain drain" tendency from research activities after reaching a certain age (with a similar structure affecting the other new member states of the EU). The reasons for this could be economic or career-related (insufficient financial rewards or limited possibilities for advancement and therefore professional fulfilment).

Figure 10: Age structure of researchers (HC, in %, 2005)



Source: Czech Statistical Office, own modifications.

Scientific and technical efficiency is currently low in the Czech Republic, which roughly corresponds to the level of development of the domestic knowledge base. The question is whether it is possible to expect a more significant efficiency shift in a short space of time with the resources available and at the given level of this development. The relative number of publications expressed per capita has risen significantly, but is still less than 60 % of the level of the EU-15 (see Table 9).

Table 9: Number of scientific and technical publications per 1000 population

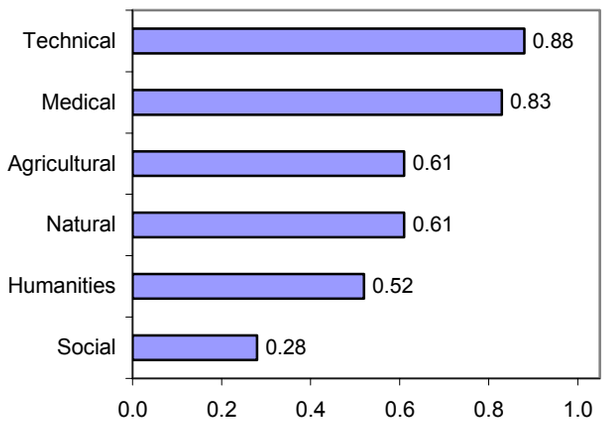
	EU-27	EU-15	CZ
2000	0.870	1.034	0.435
2001	0.908	1.074	0.512
2002	0.865	1.017	0.514
2003	1.000	1.174	0.603
2004	0.941	1.097	0.604
2005	1.121	1.307	0.730

Source: ISI Web of Science (publications, at 17.8.2007); EUROSTAT – New Cronos, Population, own calculations.

The relative **citation impact** of Czech publications is also very low (in spite of rapid growth). This is expressed as a percentage of the impact factor for the relevant country and the impact factor of the group of countries. The impact factor for a specific country characterises the ratio of the number of quotes to publications in the given country. The average relative quotation impact of Czech publications is somewhere at the level of only two-thirds of the OECD level. The

highest citation impact is from Danish, Dutch and Swedish publications. By contrast, the countries of southern Europe, Ireland and the new member states are lagging behind. The position of individual areas of science in the Czech Republic is considerably different in this regard. Technical specialisations do fairly well, but the quotation impact of publications from the social sciences is negligible (see Figure 11).

Figure 11: Relative citation impact by field of science in the Czech Republic (average 2001 – 2005)



Note: Average for OECD countries = 1. Source: Lehvo, Nuutinen (2006), pp. 36–37, own modifications.

An analysis of **patent activities** comes out even worse than that of publication activity. In spite of the fact that the Czech Republic has seen a respectable growth tempo in the number of patent registrations, its lagging behind more advanced countries has not fallen for this indicator. A growing difference is clear when distinguishing according to applicants and creators to the detriment of applicants (see Table 10). The reason for this could be the fact that the multinational corporations that conduct R&D in the Czech Republic that leads to patents tend to register these at their own parent head offices. One other explanation is that the output of local innovation activity is ceded to foreign organisations even before patent applications are submitted.

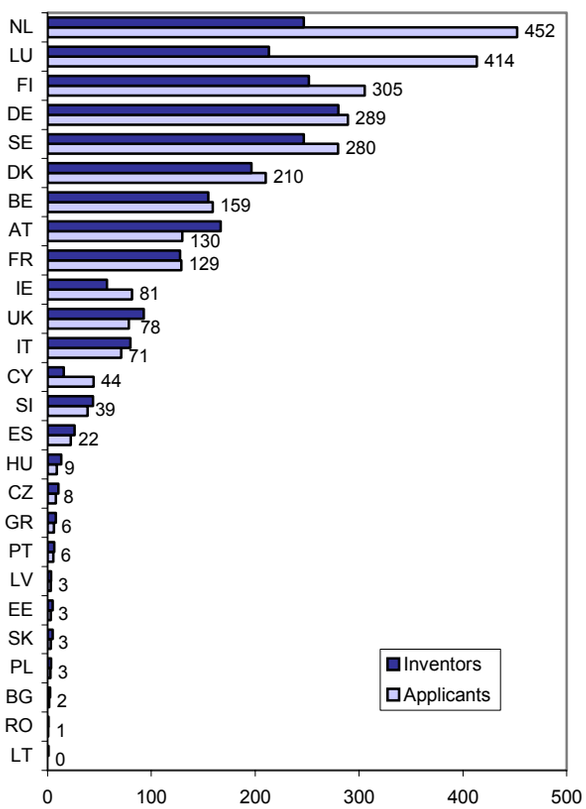
Table 10: Patent applications at the European Patent Office (per million inhabitants), distinguishing between applicants and inventors

	Applicants				
	1992–1994	1995–1997	1998–2000	2001–2003	2004–2006
EU-27	55.70	63.14	87.20	105.28	118.54
EU-15	71.39	80.62	111.07	133.34	148.97
CZ	0.90	1.58	3.14	4.69	7.79
	Inventors				
EU-27	55.23	62.17	87.59	102.40	112.32
EU-15	70.77	79.36	111.47	129.51	140.81
CZ	0.58	2.29	4.44	6.36	10.36

Source: European Patent Office (at 25.8.2007); EUROSTAT – New Cronos, Population and Social Condition (at 25.8.2007), own calculations.

The differences between the countries of the EU or their groupings are quite considerable from both perspectives (see Figure 12). Holland and Luxembourg have long been at the top of the ladder in terms of applicants (Switzerland is a similar case in Europe), which has its basis in the formal headquarters of certain multinational corporations that make use of the favourable regime in these countries. However, a comparison by patent creator is of greater significance for an assessment of the level of scientific activity. Traditionally the best here are the Scandinavian countries, Germany and Holland. The new member states and Spain, Portugal and Greece are lagging well behind the average. As for the new member states, the long-term leader is Slovenia, which is more productive in terms of patents than the countries of the southern wing of the EU.

Figure 12: Number of patent applications at the EPO per million inhabitants (average 2004–2006)



Source: European Patent Office; EUROSTAT – New Cronos, Population and Social Condition (at 25.8.2007), own calculations.

The unfavourable situation in international patent activity is caused by a whole range of factors. The lesser (economic) significance attributed to the protection of intellectual property itself when breaking into foreign markets is undoubtedly one such factor or the below average demands of economic activities on research and development and other innovation activity. The level of protection of intellectual property rights has been very poor in the Czech Republic for some time now (in particular its enforceability), which also corresponds to the generally low development of a knowledge society. On the other side of the coin, the Czech Republic is one of the countries with an above-average level of regulation for almost all aspects of business, which is a particularly unsuitable combination of characteristics with significant anti-innovation effect.

The most commonly mentioned problem in terms of implementing innovation activities is the availability of

funds, a complaint mainly levelled by smaller companies. **Financing business research and development** is strongly dependent on the type of organisation. Self-financing (within the same sector) prevails for large businesses and the role of government and foreign investment is negligible. Non-business resources are far more important for small and medium-sized businesses. In an international comparison, the Czech Republic is one of the countries with the highest share of government investment in financing business R&D (15 % of the total and 24.7 % for small and medium-sized businesses). By contrast, the share of foreign investment is low, mainly for financing R&D conducted by major businesses. The share of the government in research and development carried out by large companies is usually lower than for small and medium-sized businesses. Exceptions here are only found in Spain and Great Britain, whereby the latter's situation is affected by state subsidies for defence research undertaken by private companies (see Table 11).

Table 11: Structure of financing business enterprise expenditure on R&D in 2004

	SMEs			Large enterprises		
	Businesses	Government	Abroad	Businesses	Government	Abroad
AT	75.4	11.7	12.8	64.2	4.5	31.3
BE	69.6	8.0	22.3	89.0	3.8	7.2
CY	71.9	10.2	17.8	97.7	0.2	2.1
CZ	66.4	24.7	8.9	87.1	9.7	1.0
DE	85.9	11.6	2.1	93.9	3.8	2.3
DK	89.1	2.9	8.0	84.0	2.1	13.8
EE	73.3	7.5	19.0	..	..	..
ES	79.5	13.8	6.0	84.2	11.4	4.4
FI	88.8	8.1	3.0	97.0	2.5	0.5
GR	74.9	4.4	20.4	76.3	4.5	18.8
HU	74.4	18.6	6.4	78.1	1.0	21.0
IE	89.3	5.5	5.3	84.9	0.8	14.3
IT	77.5	15.8	6.6	76.0	13.8	10.2
LT	49.3	4.7	45.1	98.3	0.9	2.8
LV	65.7	5.2	29.1	98.1	17.8	1.9
PL	72.2	24.1	3.4	84.6	12.4	2.9
PT	84.3	10.1	5.6	92.5	2.1	5.4
RO	67.8	27.8	4.1	65.7	25.6	8.7
SE	..	..	..	87.5	5.5	7.0
SI	57.0	11.8	30.4	91.9	1.6	6.5
SK	58.0	38.2	3.7	80.8	18.5	0.7
UK	76.9	2.4	20.7	59.8	12.9	27.2

Notes: Belgium, Denmark, Germany, Greece, Portugal, Sweden and Great Britain for 2003. Source: EUROSTAT – New Cronos, Science and Technology (at 20.8.2007), own calculations.

The share of **government expenditure on R&D** (GBAORD) in GDP is still lower in the Czech Republic (0.55 % GDP in 2005) than is common in the countries of the EU-15 (0.77 %). The high share of the government in financing business R&D is therefore to a certain extent based on the weaker role of the other financing sectors. However, the lag of the Czech Republic from the perspective of government expenditure is lower if we deduct defence R&D. In the case of civil R&D, the Czech Republic is only lagging behind by 0.11 percentage points (see Table 12). The share of defence R&D is only 3.8 % in the case of the CR and is also low in most other EU countries.

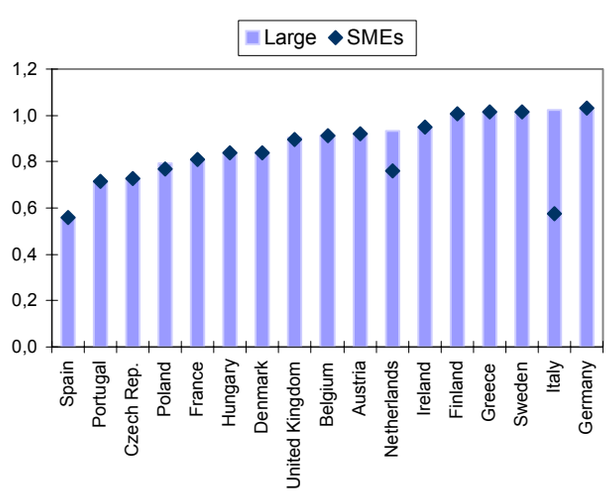
Table 12: Government budget outlays on R&D (in %)

	Total (% of GDP)			
	2002	2003	2004	2005
EU-27	0.75[s]	0.76[s]	0.75[s]	0.74[s]
EU-15	0.78[s]	0.78[s]	0.77[s]	0.77[s]
CZ	0.50	0.52	0.51	0.55[p]
	Civil R&D (% of GDP)			
EU-27	..	..	0.64[s]	0.63[s]
EU-15	0.66[s]	0.66[s]	0.66[s]	0.65[s]
CZ	0.48	0.50	0.49	0.54[p]
	As % of total government expenditure			
EU-27	1.61[s]	1.60[s]	1.59[s]	1.58[s]
EU-15	1.65[s]	1.64[s]	1.63[s]	1.62[s]
CZ	1.07	1.10	1.15	1.26[p]

Notes: s – estimate by EUROSTAT, p – provisional value. Source: EUROSTAT – New Cronos, Science and Technology (at 1.8.2007)

It ensues from a more detailed analysis of the **structure of government subsidies** that a fundamental part is directed to services, whereas the share of agriculture is negligible. According to the size structure, the most significant recipients of government support are medium-sized businesses, followed closely by large companies. The share of small companies is considerably lower, which is again in contrast with the significance of government subsidies for their R&D. Apart from direct subsidising, business R&D is also supported by the government indirectly through tax incentives. Based on an international comparison of their generosity using a so-called B-index, the Czech Republic is one of the countries with the largest support of business R&D in this form (see Figure 13).

Figure 13: B-index value in 2006



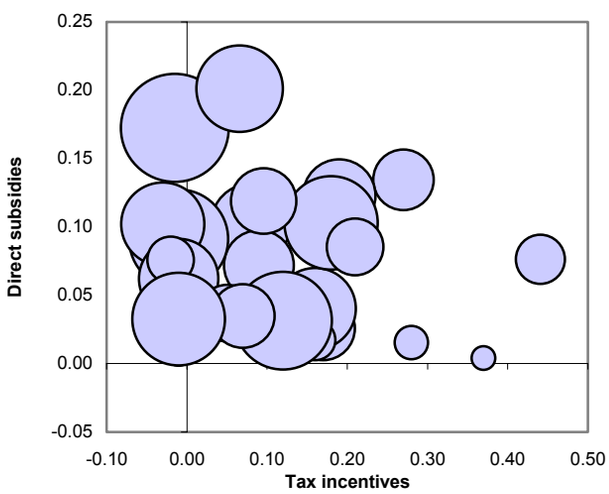
Source: OECD – STI Outlook 2006, p. 242, own modifications.

Tax incentives only represent a certain degree of potential support that directly influences the marginal costs of research and development at companies. The actual extent of this form of state aid is determined by the companies themselves based on the intensity of use of the instruments offered. The state only reduces the relative price of R&D for them. It is therefore possi-

ble that a system of tax incentives, albeit generously set up, need not actually lead to higher business expenditure. There are relatively significant differences between individual countries in the degree of use of direct subsidies and tax incentives (see Figure 14). Countries with a higher intensity of expenditure on research and development usually use more subsidies than incentives. Nonetheless, no statistically significant dependence of these variables can be proven. However, a parallel comparison of direct subsidies and the generosity of tax incentives is problematic given the aforementioned fact that tax incentives are only potential aid, whereas information about subsidies includes actually invested expenditure.

The actual increase in public expenditure in business research and development, whether direct or indirect, can (but need not) increase its overall level. It can therefore happen that public expenditure merely replaces expenditure from other sources, with the occurrence of the crowd-out effect. For this reason the so-called **additionality concept** is used as an instrument to evaluate the productivity of aid instruments. The hypothetical status without state intervention is compared in this case with the current status upon implementation. Besides the crowd out effect, we might also see the crowd-in effect of other private investment, which is invoked, for example, by state support for a project that would otherwise not go ahead since the company would not have sufficient funds.

Figure 14: Share of direct subsidising on BERD (in % GDP) and tax incentives (1 minus B-index) in 2006



Notes: 2006 or the last available year. Size of bubble = BERD in % GDP Source: OECD – STI Outlook 2006, page 225, own calculations.

One specific source of financing research and development activities and the commercialisation of their results is **risk capital** provided by individual investors or specialised financial institutions acting as brokers between primary sources of funds (banks or pension funds) and businesses. Risk capital is a significant source of financing for new, technologically-based companies and plays a key role in supporting groundbreaking innovation and the commercialisation of the scientific and technical know-how created in private and public research. However, its role in financing R&D is relatively negligible in the Czech Republic. The near zero significance of risk capital in financing the pre-launch and launch stages of company development is unfavourable (see Table 13).

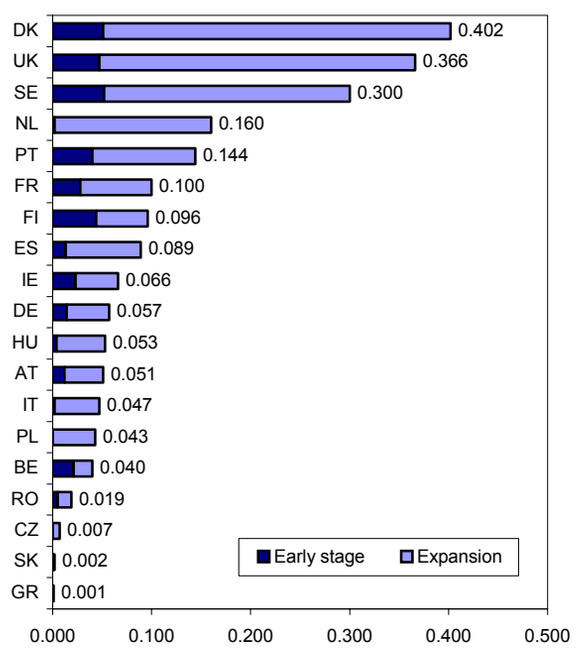
Table 13: Expenditure on venture capital by stages of business development (in % GDP)

	Seed and start-up					
	2000	2001	2002	2003	2004	2005
EU-15	0.075	0.045	0.029	0.021	0.023	0.022
CZ	0.026	0.010	0.001	0.001	0.000	0.000
	Expansion and replacement					
EU-15	0.154	0.099	0.081	0.088	0.085	0.116
CZ	0.175	0.029	0.037	0.002	0.010	0.007

Source: EUROSTAT – Structural Indicators (at 14.8.2006).

If we take the international context of the creation and application of risk capital into consideration, it can therefore be said that the significance of expenditure on risk capital in the EU is still very low on average in comparison with the USA (at half the level in 2003). On average, less than one-fifth of risk capital heads into the EU for the initial stages of company development. More than 40 % is concentrated in Denmark, Sweden and Portugal (see Figure 15). The most attractive countries for the influx of foreign risk capital are Finland, Ireland, Switzerland and Austria, which gained more risk capital from abroad than from domestic sources. Banking institutions in Sweden, Great Britain and Holland were able to create greater domestic sources of risk capital than the amount of such sources domestic companies obtained from abroad (see OECD, 2005, page 42).

Figure 15: Expenditure on venture capital by stages of business development (in % GDP), 2005



Source: EUROSTAT – Structural Indicators (at 14.8.2006).

1.2 Business innovation performance

The innovation activities of the business sector were evaluated on the basis of a Community Innovation Survey (CIS). It ensues from its most recent round that the **innovation activity of businesses** in the Czech

Republic is only slightly lagging behind the average for the EU-15 and is fully comparable with the EU-27. Lower efficiency can only be seen in services. Innovation efficiency nonetheless demonstrates a number of structural specifics. First off it is important to distinguish between types of innovation into a basic division of technical and non-technical. The role of non-technical innovation activities (marketing and organisational activities) is stressed in the most recent round of the CIS alongside traditional technical innovations (product and procedural innovations). Organisational innovation unambiguously predominates in the Czech Republic (33 % of businesses undertake this) followed by procedural innovation (24 %), product innovation (20 %) and marketing innovation (17 %).

The next structural perspective involves the size of the business. Large companies are the most innovative. Small companies lag far behind in all types of innovation (see Table 14). This characteristic is common in the whole set of counties and is reflected in the increasing disposability of innovation resources depending on the size of the company. Larger companies also show stronger orientation towards foreign markets and on average a stronger relationship between innovation and research and development. Larger companies (and companies with technical innovation) not only carry out research activity on a large scale, but more systematically.

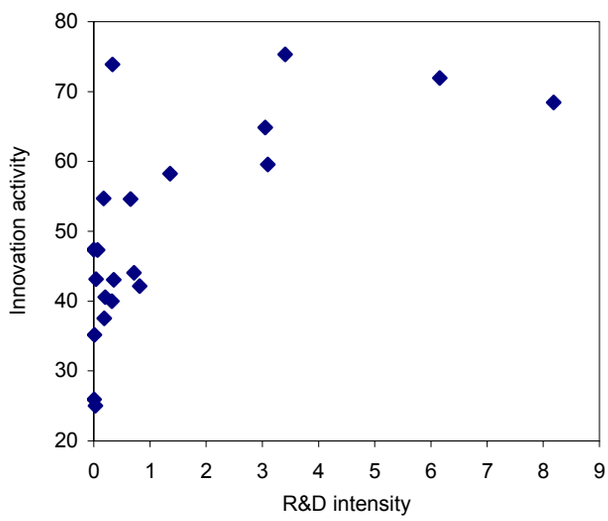
Table 14: Innovating firms by type of innovation (share in total number of firms, in %, 2003–2005)

	Product	Process	Organisat.	Market.
Czech Republic	20.0	23.9	32.8	16.7
Small enterprises	15.9	19.1	28.1	14.6
Medium-sized enterprises	31.0	37.2	45.7	22.2
Large enterprises	49.8	55.1	64.2	33.4
Extracting mineral resources	11.9	19.4	33.9	9.1
Total manufaturing	30.8	32.7	37.2	20.0
Food and tobacco	39.6	32.9	32.9	27.4
Textile and leather	19.8	16.9	27.4	22.5
Wood processing and paper	18.1	26.6	30.7	16.8
Cokes and chemicals	61.2	51.0	50.9	37.1
Rubber and plastic products	37.4	37.4	44.3	23.2
Metals and metal products	26.9	34.7	35.5	18.2
Machinery and equipment	37.9	42.7	45.9	15.0
Electr.l and optical instruments	34.0	36.6	43.2	16.5
Transport vehicles	44.1	43.2	47.8	20.8
Other manufacturing	21.9	18.3	30.1	17.0
Electricity, gas, water	10.9	24.4	30.9	4.4
Construction	7.9	13.4	30.5	7.8
Total services	16.2	20.7	30.4	17.2
Sales and repairs	14.2	20.4	31.4	19.9
Hotels, restaurants	8.1	11.5	17.9	12.1
Transport and communications	16.2	17.9	27.5	13.6
Financial services	47.7	40.2	60.2	33.3
Real estate activity	9.0	13.0	17.4	8.3
Renting services	18.7	33.1	35.3	11.2
ICT services	56.5	44.9	48.3	35.4
Research and development	58.2	48.5	51.4	18.4
Other business activities	16.5	23.6	34.5	13.5

Source: Czech Statistical Office (2006)

The **industry-specific differences** in innovation activity are also considerable. At the same time, it applies that innovation activity is not only dependent on expenditure on research and development. In spite of the fact that there exists a certain correlation between both indicators, where higher expenditure on research and development is associated with higher innovation activity, significant differences can be seen in the relationship in the Czech Republic (see Figure 16). Most branches of industry are marked by low/high demands of added value on research and development and low/high innovation efficiency. Nonetheless, in four cases a low R&D intensity is combined with high innovation efficiency (financial brokering, food and tobacco industry, production of metals and metal products, production of plastics and other non-metallic mineral products).

Figure 16: Innovation activity and R&D intensity by industries in the in the CR (in %, 2003–2005)



Notes.: Innovation activity = share of innovating companies in total number of firms in industry (CIS4), intensity of R&D = share of expenditure on R&D in value added (2005). Source: Czech Statistical Office, own modifications.

Table 15: Expenditures on innovation and innovation intensity in the CR (in %, 2003–2005)

	Intramural R&D	Extramurall R&D	Machinery and equipment	Other external knowledge	Innovation intensity
Czech Republic	22.0	13.0	47.1	17.9	3.3
Small enterprises	37.1	5.5	54.5	2.9	3.1
Medium-sized enterprises	31.3	9.0	56.0	3.7	3.6
Large enterprises	15.7	15.9	42.2	26.2	3.2
Manufacturing	24.1	18.7	54.9	2.2	3.4
Services	31.6	9.5	53.6	5.3	2.4

Source: Czech Statistical Office, own adjustments

The most significant item from the perspective of the **structure of expenditure on innovation** is machinery and equipment. Therefore the innovation process in the Czech Republic is still based on the transfer of technology rather than one's own research and development. Interaction with customers and suppliers has become more important in the service sector. Large companies direct almost half their expenses on research and

development at acquiring outside know-how, whilst internal research and development fully predominates in smaller companies (see Table 15). The innovation intensity indicator, which is gradually rising for companies in the CR, tells us about the relative costliness of the innovation process (in share in receipts). The trend of reinvesting revenues from introduced innovations in other innovation activities has become stronger among companies.

The share of receipts from innovated products evaluates the **effect of product innovation**. This varies greatly according to the individual branches of industry and the degree of newness. Whereas the effects of innovation for products new to the market are more prominent in the production of electrical and optical instruments, products new to a company are most significant in the textile and leather-making industry and in the manufacture of motor vehicles. From the perspective of inter-sector differences, receipts from innovated products have a larger share in the processing industry than in services. From the perspective of size structure, meanwhile, the share of these receipts is more prominent in larger businesses. However, the share of receipts from innovated products indicator monitors only one type of innovation and so businesses that concentrate on innovation of another type are not included in this case. For this reason a qualitative differentiation of the significance of the effects of innovation activities for individual businesses is used. In general, businesses in the processing industry consider the impacts of innovation activities to be more significant than those in services. The expansion of the range of products is stressed in the first case and the increase in the quality of services in the second. The most prominent goal in introducing organisational and marketing innovations in both sectors is to increase the quality of goods or services.

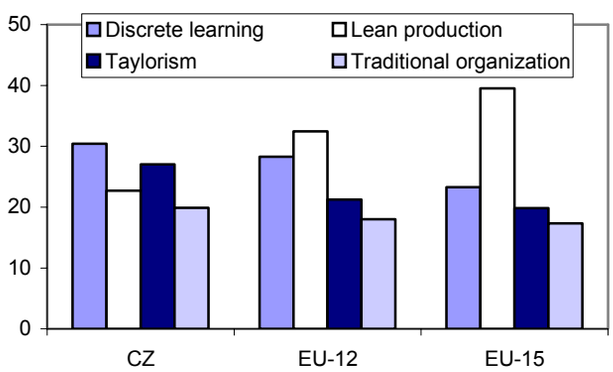
The main **barriers to innovation activities** are considered to be insufficient internal and external funds, something which concerns both innovating and non-innovating companies. Other companies, for example customers or suppliers, are mainly considered to be important in an evaluation of the role of partners in the implementation of innovation activities. By contrast the role of universities and research institutes is appraised as being relatively weak, similarly as with their use as sources information for innovation. The key organisations in the national innovation system are therefore only weakly linked in the Czech economy.

From a comparison of the structure of employees according to **clusters of forms of the organisation of work and learning** we can see a lower percentage of employees in qualitatively more intensive form, i.e. in the cluster of discrete learning. By contrast, the percentage in the form of lean production and Taylorist organisation is higher. The lesser importance of teamwork, the rotation of job positions, the complexity of tasks, learning and problem-solving are manifested from the perspective of sub-characteristics of the organisation of work in the Czech Republic. By contrast, the significance of monotony and various forms of controlling the work process is higher.

In the case of the **structural characteristics of employees** according to forms of work organisation, independent decision-making is best represented in other services. Manufacturing is marked by a very low share of independent decision-making as opposed to the old members, a lower share of lean production and by contrast by the high importance of Taylorism. From the perspective of groups of occupations, the Czech Republic is mainly lagging behind due to the low significance of the form of independent decision-making in qualitatively more demanding professions, mainly to the benefit of slimline production. The least qualified professions are marked by a higher share of Taylorist organisation.

Considerable differences in the structure of employees according to forms of work organisation appear at a national level between individual EU members or their groupings. The Nordic countries are marked by a larger percentage of independent decision-making organisation. The Czech Republic, meanwhile, is one of the new members with the highest share of independent decision-making organisation, surpassing the average for the EU-12. However, it is still some way behind the average for the EU-15 (see Figure 17). The significance of national characteristics for the quality of structure according to work organisation and training is striking. Nonetheless, a considerable part of the differences shown must be ascribed to other factors beyond the structural characteristics in question (employment grouping, branch of industry and size of company).

Figure 17: Organisation modes (in % of labour force, 2005)



Source: ESWC (2005), own calculations.

An analysis shows a strong relationship between the form of organisation and the **type of innovation activity**. If lean production is predominant at the company, there is no clear tendency to any type of innovator. The form of work organisation characterised as Taylorism is mainly marked out by a non-innovative type. All other innovative types have the tendency not to appear in this form of work organisation. A similar tendency as for Taylorist production is seen for traditional organisation.

Table 16: Relation between innovation and organization modes, EU-27

	Dicrete learning	Lean production	Taylorism	Traditional organisation
Strategic	0.69*	0.01	-0.62*	-0.53*
Intermittent	0.53*	0.19	-0.57*	-0.50*
Modifiers	0.50*	-0.15	-0.33	-0.37
Adopters	-0.20	-0.18	0.25	0.26
Non-innov.	-0.52*	0.09	0.41*	0.37

Notes: * 5% significance. Source: EIS (2005), ESWC (2005) databases, own calculations.

2. Structural competitiveness

The assessment of competitiveness is distinguished by analytical levels of the position of the Czech Republic in international comparison with an emphasis on the priorities of the Lisbon Strategy, or pillars of knowledge based economy (innovation, quality of human resources and supporting factors of information and communication infrastructure and institutional environment). This is followed by industrial and regional standards assessed on the basis of summary indicators (performance and qualitative indicators) and a detailed assessment on the levels of the individual industries and regions in the Czech Republic.

2.1 Competitiveness of countries

There is a set of **structural indicators** focusing on qualitative characteristics of competitiveness. The indicators assess the progress of implementation of the Lisbon Strategy. The position of the Czech Republic is compared to averages of the original EU members (EU-15), EU-27 and also Finland as an example of the most successful knowledge-based economy which has come through a deep structural transformation.

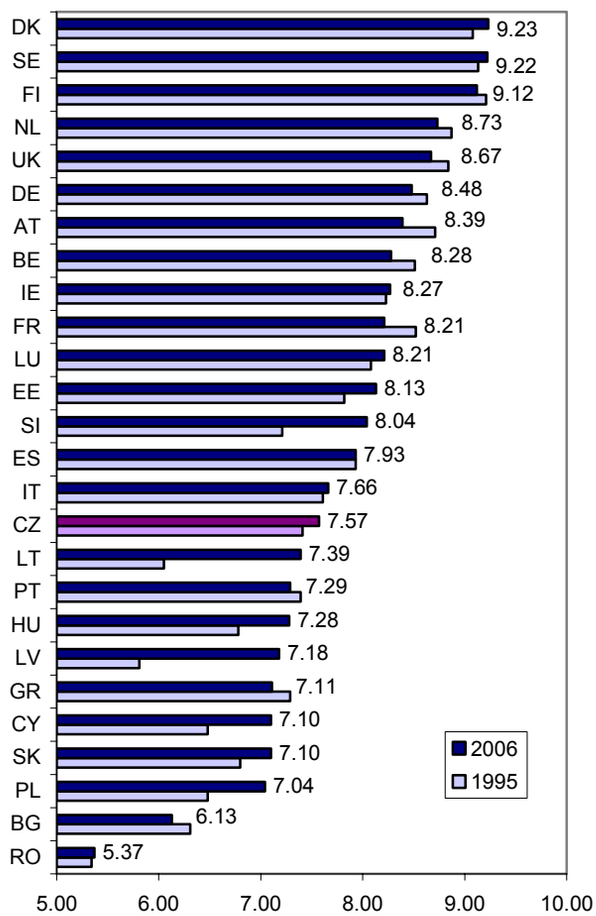
In the area of **research and innovation** the key performance indicators in the Czech Republic show the prevailing trend of lower expenditure on research and development (R&D), weak patenting activity and poor access to venture capital. Despite the remarkable progress of ICT accompanied mainly with large investment in communication technologies their use still remains less intense. In the area of education the Czech Republic lags behind in terms of low level of expenditure, share of university educated people and scope of participation in lifelong learning. On the contrary, the number of persons with at least secondary education is above average.

The **economic reform** indicators have shown a significant decrease in the relative use of state subsidies, especially of the vertical type (industrial- and company-specific subsidies), with simultaneous pressure on transparency of public procurement. Long-term issues include the low level of administrative conditions for entrepreneurship. Even though network industries gradually integrate their markets, the price of electricity keeps growing.

In the area of **social cohesion** the Czech Republic still shows favourable conditions. The share of population with an disposable income below the risk-of-poverty threshold is lower than the EU-27 average, as well as the share of population living in jobless households. Inequality of income distribution and dispersion of regional employment rates also shows favourable values. However, high rate of long-term unemployment is a serious issue Postponement of the pension and health insurance reform represents the basic problem of future social development, especially because of the ageing population. In the case of **environmental sustainability** there is a high energy intensity and a low share of electricity generated from renewable sources in the Czech Republic.

Knowledge-based competitive advantage is evaluated according to the Knowledge Assessment Methodology (KAM) of the World Bank. On its basis the Czech economy remains below average in the overall assessment based on the Knowledge Economy Index (see Figure 1). Especially lag behind Scandinavian countries is remarkable (of the new EU members Estonia and Slovenia show better evaluation).

Figure 1: Values of knowledge economy index



Note: Higher value (max. 10) = better result. Source: KAM, World Bank 2006–2007.

The reason for the low overall index of he Czech Republic is mainly the poor evaluation of the framework conditions of knowledge based economy. Morever, the institutional quality has worsen further in comparison to 1995 (see Table 1). On the other hand, the knowledge components of the overall index show improvement, mainly in the area of human resources. The poor assessment of institutional quality in the Czech Republic is mainly due to the low quality of administration in all monitored indicators, especially corruption control and legal system quality.

Table 1: Components of knowledge-based competitiveness

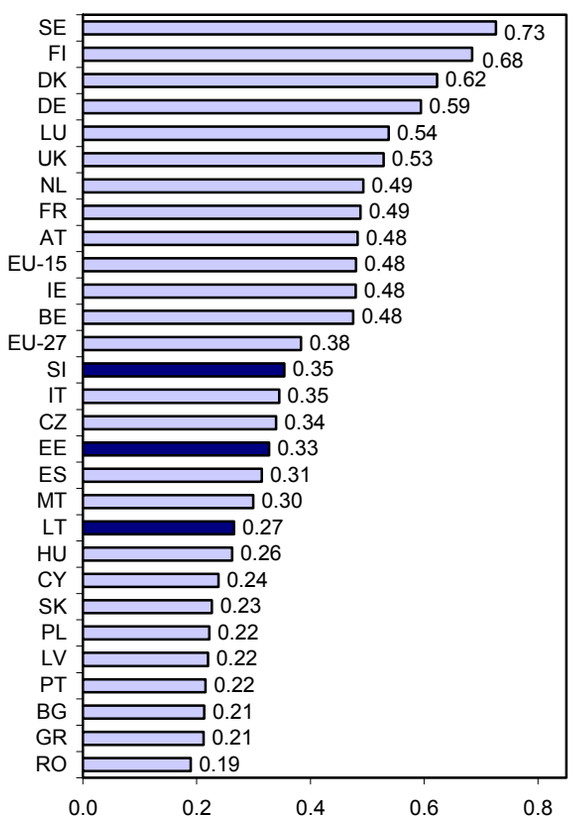
		CZ	FI	EU-12	EU-15	EU-27
Economic regime	1995	8.33	8.46	6.06	8.21	7.30
	2006	7.35	8.79	6.83	8.17	7.60
Innovation system	1995	6.62	9.56	6.35	8.31	7.48
	2006	7.34	9.71	6.73	8.40	7.69
Human resources	1995	7.20	9.15	7.09	8.46	7.88
	2006	7.55	9.16	7.59	8.20	7.94
ICT	1995	7.49	9.66	6.85	8.62	7.87
	2006	8.04	8.84	7.34	8.52	8.02

Source: KAM, World Bank 2006–2007.

In the case of partial indicators of the knowledge index the innovation performance is affected by the problem of low production of knowledge and low innovation performance, which corresponds to the achieved level of development of domestic knowledge base (with lower relevance of the own innovation capabilities). What is positive, though, is the considerable openness to business and investment flows, representing a strong potential for transfer of external technological knowledge and its adaptation to domestic needs.

In the area of human resources quality of education in natural science and technology is assessed very high, including the relatively large proportion of graduates from these fields in the total number of university graduates. Problems in this area are represented by low investment into education and low level of further training in companies. Relatively positive is the standard of development of infrastructure of information and communication technologies, especially telephone equipment. Poorer still is availability or utilisation of more sophisticated technologies and applications, including commercial use of these.

Figure 2: Summary innovation index (2006)



Source: European Commission – European Innovation Scoreboard 2006, own modifications.

Innovation based competitiveness of EU countries is comprehensively assessed in the **European innovation scoreboard** (EIS) in division to innovation inputs and outputs. In the case of the inputs three areas are monitored: innovation drivers, knowledge creation and innovation – enterpreneurship relationship. The outputs are further divided to innovation applications and intellectual property rights. A comparison based on the summary innovation index (see Figure 2) shows a strong position of Scandinavian countries and South European and new member states lagging behind. The position of the Czech Republic in 2006 was below EU-27 average (13th position), with only Slovenia being a better assessed new EU member. In comparison to 2002 both the score (from 0.31 to 0.34) and the position of the country improved (in 2002 the Czech Republic was 16th).

New EU states on average lag behind in all areas of the innovation process (see Table 2). The largest gap appears in the areas of intellectual property rights and knowledge generation. On the other hand, the new member states approach the EU-15 most in the area of innovation application. The Czech Republic lags behind EU-27 in the area of innovation drivers and intellectual property rights. On the other hand, in the area of innovation application the Czech Republic occupies a favourable 6th position among EU-27 (however, this position is significantly affected by the bias represented by the informative value of industrial-based indicators). Stagnation of innovation-based competitiveness of EU manifests itself when comparing development of the Summary Inovation Index in time. Its value has not changed for the EU-15 average and just slightly changed for EU-12.

Table 2: Components of Summary Innovation Index (2006)

	CZ	FI	EU-12	EU-15	EU-27
Innovation drivers	0.30	0.81	0.34	0.53	0.44
Knowledge creation	0.38	0.75	0.23	0.50	0.38
Innov. and entrepr.	0.38	0.62	0.32	0.47	0.41
Applications	0.59	0.62	0.39	0.48	0.44
Intellectual property	0.06	0.62	0.05	0.42	0.25

Source: European Commission – European Innovation Scoreboard 2006, own modifications.

Specification of EIS on the regional level (NUTS2) is represented by the **European Regional Innovation Scoreboard** based on seven indicators. International comparisons reveal considerable differences between European regions, including within individual national economies. The best scores are usually achieved by metropolitan areas, comparison of European countries showing the best scores of Scandinavian and German regions. In the Czech Republic a privileged position is occupied by Prague, with 15th place among the total of 208 scored regions. The other Czech regions lag behind, with the only exception of Central-Bohemian region, holding a good position in one of the partial indicators, namely corporate research and development.

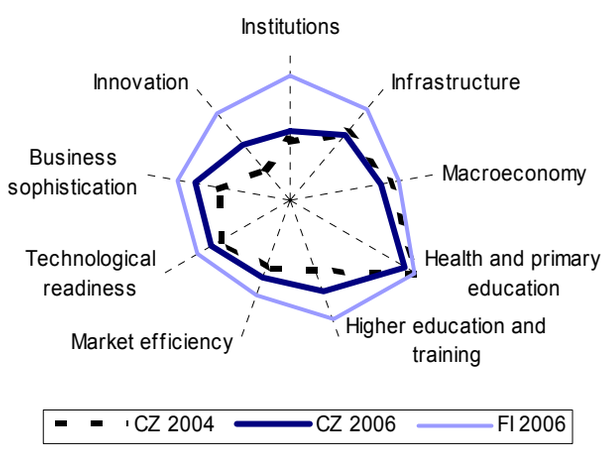
An overall evaluation of competitiveness is performed every year by the **World Economic Forum** (WEF), whose yearbook presents two summary indexes – the Global Competitiveness Index (GCI) and the Business Competitiveness Index (BCI). Following the GCI the best score is held by Switzerland, thanks to the healthy institutional environment, excellent infrastructure, effective markets and high standards of technological innovation. Leading positions have also been held by Scandinavian countries (Finland, Sweden, Denmark) with excellent score of institutional quality.

The position of the USA somewhat deteriorated in 2006 (with a drop from 1st to 6th place) due to significant macroeconomic unbalance. Stable good position has been held by Germany (8th position) and Great Britain (10th

position). Very good scores have been achieved by certain Asian economies (especially Singapore and Japan), which are characterised by high-standard infrastructure, flexible and effective markets, highly educated workforce and technological readiness and innovation capacity. The position of India and China has still been weaker. Comparisons within EU-27 show surviving retardation of the new members in comparison to the original EU-15.

The position of the Czech Republic in WEF evaluation has been stable (29th position). Of the new EU members a better position has only been held by Estonia. Following the **stages of competitiveness development** the Czech Republic has been in the stage of transition from efficiency-driven to innovation-driven. The country has still significantly lagged behind the countries with the best scores in innovation-based competitiveness, to the greatest extent in the quality of institutions and innovations (see Figure 3). In comparison to 2004 certain improvement has been achieved in these indicators: business sophistication, innovation and higher education and training. On the other hand, scoring of macroeconomic stability, infrastructure and primary education has deteriorated. Moderate improvement has been reported in the area of quality of institutions, technological readiness and market efficiency.

Figure 3: Pillars of Global Competitiveness Index



Source: WEF – The Global Competitiveness Report 2004–2007, own modifications.

Strengths of the Czech Republic mainly include quality of mathematical and technical education, weak restrictions of international ownership, the scope of technology transfer of international investment, equipment with mobile phones and availability of scientists and engineers. On the other hand, weak points are represented by quality of institutions and markets efficiency. The WEF survey also includes **assessment of business conditions** in the individual countries. The biggest issues in the Czech Republic identified by the survey include the level and system of taxes, ineffectiveness of public administration and related corruption and further regulation of job market and availability of funding.

In the context of the **Lisbon Review** published by WEF fulfilment of the Lisbon Strategy is monitored through eight key areas and their qualitative indicators (see Table 3). The last survey of 2006 shows continuing lag of the Czech Republic behind the former EU-15, especially in the area of corporate environment quality, innovation and research, efficiency and integration of financial services. Somewhat better position is occupied by the Czech Republic in the area of network industries liberalisation, level of social inclusion and sustainable development. In comparison to the previous round (2004) the overall scoring of the country has slightly improved.

Table 3: Assessment of Lisbon Strategy implementation (2006)

	CZ	FI	EU-12	EU-15	EU-27
Information society	4.10	5.41	4.02	4.83	4.47
Innovation, R&D	3.85	5.90	3.56	4.62	4.15
Liberalization	4.96	5.58	4.37	5.19	4.83
Network industries	5.16	5.93	4.59	5.76	5.24
Eff and int. fin. services	4.84	6.29	4.84	5.99	5.48
Corporate environment	3.99	5.24	4.14	4.82	4.51
Social integration	4.44	5.35	3.95	4.60	4.31
Sustainable develop.	4.90	6.23	4.22	5.47	4.91
Total	4.53	5.74	4.21	5.16	4.74

Source: WEF – The Lisbon Review 2006.

An alternative overall evaluation is provided by the yearbook of Global Competitiveness published by the **International Institute for Management Development** (IMD). The evaluation is based on four basic factors of competitiveness: economic performance, government efficiency, business efficiency and quality of infrastructure. Pursuant to IMD the most competitive economy is represented by the USA followed by Singapore and Hong Kong. The position of Scandinavian countries in the scoring of IMD is worse than in the scoring of WEF. The Czech Republic ranked 32nd in the last evaluation. The other new EU members (except Estonia and Lithuania) received worse scorings, similarly to Greece, Portugal or Italy (see Table 4).

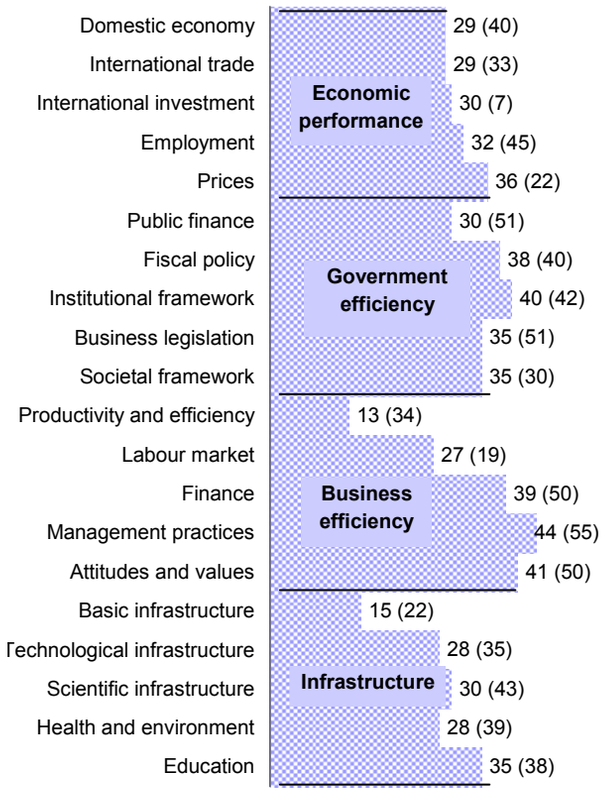
Table 4: Countries ranked by competitiveness (2007)

Best 15 and other EU countries		
USA (1)	Australia (12)	Lithuania (31)
Singapore (2)	Norway (13)	Czech Rep. (32)
Hong Kong (3)	Ireland (14)	Slovakia (34)
Luxembourg (4)	Chine (15)	Hungary (35)
Denmark (5)	Germany (16)	Greece (36)
Switzerland (6)	Finland (17)	Portugal (39)
Island (7)	G. Britain (20)	Slovenia (40)
Netherlands (8)	Estonia (22)	Bulgaria (41)
Sweden (9)	Belgium (25)	Italy (42)
Canada (10)	France (28)	Romania (44)
Austria (11)	Spain (30)	Poland (52)

Source: IMD - World Competitiveness Yearbook 2003-2007.

The so called **landscape of competitiveness** shows the partial criteria of competitiveness evaluation according to IMD in detail (see Figure 4). The comparison of the partial criteria for the Czech Republic with the year 2004 shows that improvement has been achieved in nearly all of the monitored indicators, including but not limited to the area of public finance, productivity and effeciency and quality of scientific infrastructure. Certain deterioration can be seen in the area of relevance of international investment, price development, quality of societal framework and the labour market.

Figure 4: Partial indicators of the Czech Republic (2007)



Note: Position in brackets – year 2004. Source: IMD - World Competitiveness Yearbook 2004-2007.

2.2 Competitiveness of industries

Competitiveness of industries is evaluated on the basis of a wide spectrum of indicators of economic performance with an emphasis on qualitative aspects. Out of the eighteen industrial branches in the Czech Republic ten belong to manufacturing industry. The individual industries show large differences in the **productivity level**. In 2005 above-average manufacturing industry branches in the Czech Republic, measured by average productivity, through gross value added per employee, included raw material mining, chemical industry and manufacture of ransport equipment. On the other hand, below-average values were reported in textile and leather industry, and manufacture of furniture. The most productive branches in the service area included transport and communications, with the other services showing low productivity.

Significant differences were also shown in **dynamics of productivity** (see Table 5). Some industries grew by more than 8 % a year, with high dynamics, paradoxically enough, shown by textile, clothing and leather industry, where productivity grew by 8.4 % on average, with value added only growing by 1.0 %, though. The increase of productivity was mainly caused by the deceasing employment.

Employment rates dropped in many industries in that period, in addition to textile, clothing and leather processing industry also in agriculture, forestry and mining. More than 10 % increase in annual productivity was achieved by electrotechnical industry, other industries with high dynamics further including mechanical engineering and manufacture of transport equipment, but also agriculture and forestry. Productivity dropped in food processing and tobacco industry, and stagnated in paper production and publishing. The overall average annual productivity growth across the manufacturing industrie amounted to 5.6 %. Dynamics of the services sector was maintained by trade, hotel, restaurants and financial intermediation.

Table 5: Annual real growth of labour productivity and gross value added in the Czech Republic between 2000 and 2005 (in %)

	GVA	LP
Total	3.8	3.7
Agriculture, forestry, fishing	3.5	8.3
Industry	4.8	5.1
Mining	-2.2	4.7
Manuf. of food and tobacco	-3.3	-1.6
Manuf. of textile and footwear	1.0	8.4
Manuf. of wood, paper, printing, publishing	3.0	0.0
Manuf. of coke, petrol. prod., chemicals	6.2	6.8
Manuf. of rubber, plastics, mineral products	8.8	7.3
Manuf. of metal products	1.1	0.9
Manuf. of machinery and equipment	7.5	7.5
Manuf. of office mach., TV, optical instr.	13.0	10.2
Manuf. of transport equipment	13.5	8.8
Manuf. of furniture, manuf. n.e.c.	1.7	4.0
Elektricity, gas and water supply	0.5	3.5
Construction	1.5	1.2
Trade, transport, hotels and restaurants	4.9	4.8
Financial intermediation	2.6	3.8
Real estate, renting and business activities	3.8	0.5
Other services	1.3	0.8

Note: GVA – gross value added, LP – labour productiivty. Source: Czech Statistical Office, Database of National Accounts (June 30, 2007).

With the help of analysis of **inter-industrial relationships** (based on input-output model) the major drivers of growth were identified whose development most significantly affects the other industries of national economy (multiplication effect). Above-average values are mainly achieved by wood processing industry, refineries, steel industry, energy industry, construction, and some branches of services such as transport and communications and business and finance services. In comparison to 1995 a certain drop has been observed in engineering for only small part of machinery is produced in the country, the rest relying on imports. The main cause is the increasing openness of Czech economy, with the rising share of cross-border transactions.

Table 6: R&D intensity of value added by technological intensity, 2001–2003 (in %)

	CZ	SE	FI	GE	UK	ES	IE
Total	2.1 (2.4)	15.2	10.4	7.7	6.9	2.4	1.9
High	3.0 (5.2)	62.5	28.1	24.1	26.0	16.3	5.3
M-high	5.0 (4.9)	14.9	10.6	10.4	8.2	3.6	0.5
M-low	0.8 (1.0)	2.7	3.6	1.8	1.8	1.0	1.7
Low	0.2 (0.3)	1.5	2.0	0.8	0.7	0.6	0.7

Note: Figures for Czech Republic (2005) in brackets. Source: STAN Database OECD, August 31, 2007, Czech Republic – Czech Statistical Office, National Accounts, Indicators of research and development 2005, own modifications.

Industries are distinguished by **technological intensity** (in the case of manufacturing industry), or **knowledge intensity** (in the case of services). International comparisons, however, are problematic, for the reason of differences in the actually reported R&D intensity. Due to international fragmentation of production chains there is the trend of localisation of segments based on routine operations in less developed countries, while strategically significant segment demanding advanced technology and high qualifications remain in the knowledge-developed countries.

The industrial point of view also entails often large differences between companies in R&D intensity and innovation performance. R&D intensity in terms of the standard classification of technological intensity in selected EU countries shows that the average technological intensity in Swedish manufacturing industry is seven times higher than in the Czech Republic or in Ireland (see Table 6).

Evaluation of economic activities on the basis of the aspect of technological and knowledge intensity shows a high share of industries with lower or low technological intensity in value added and employment (see Table 7). The share of industries with lower and low technological intensity represents more than 50 % in both indicators. What is especially important is the low **share of value added in production** of industries with high technological intensity, pointing to the role of manufacturing segments of assembly type. Services show dominance of less knowledge-intensive market services in all indicators.

Table 7: Structure of economic activities by technological and knowledge intensity in the Czech Republic (in %)

	Output	GVA	Employment
HT	10.6	6.4	6.9
MHT	35.1	35.0	30.3
MLT	29.4	30.9	28.4
LT	24.8	27.7	34.4
Total Manufacturing	100.0	100.0	100.0
KIS_HT	7.5	8.1	4.9
KIS_MS	23.5	20.7	15.2
KIS_FS	6.5	5.5	2.9
KIS_OS	13.4	16.7	21.2
LKIS_MS	38.6	36.7	41.4
LKIS_OS	10.5	12.3	14.4
Total Services	100.0	100.0	100.0

Note: GVA – gross value added, technology and knowledge intensity in manufacturing: HT – high, MHT – medium-high, MLT – medium-low, LT – low. knowledge intensive services (KIS): HT – high-tech, MS – market, FS – financial, OS – other. Knowledge less intensive services (LKIS): MS – market, OS – other. Source: Czech Statistical Office (CSO), June 30, 2007, own calculations.

The highest **level of productivity** was achieved in 2005 by industries of medium technological intensity, while the high-tech industries ranked third. The relevance of the medium technological intensive industries is also evidenced by the one-third share in value added creation by manufacturing industry and the 15 % higher productivity than the average in the manufacturing in general. Also productivity dynamics on this level is above-average. On the other hand, industries with high technological intensity show lower productivity level than industries with lower technological intensity (see Table 8).

Table 8: Level (thousands of CZK, current prices) and average real labour productivity change and gross value added by technological intensity (in %)

	Productivity		GVA	Product
	Level		Growth	
	1995	2005	1996–2005	
High	243	474	7.1	4.2
Medium-high	219	596	9.0	7.9
Medium-low	267	561	-1.9	-2.0
Low	209	416	1.6	3.4

Note: Data in real terms were obtained by using GVA deflator a) for chemical industry (NACE 24), b) for manufacturing of other transport equipment (NACE 35). Source: CSO, Database of national Accounts (June 30, 2007).

With regard to **innovation performance** (share of innovating businesses the highesr values in the Czech Republic have been achieved by coke and chemical industry, research and development, computer technology and financial intermediation, electrical and optic instruments, machinery and equipment, transport equipment, manufacture of metals, manufacture of plastics and food processing industry. Industries with higher innovation potential in the Czech Republic therefore also include some of the less technologically intensive activities (see Table 9).

Table 9: Shares of innovating enterprises in the Czech Republic (in %, 2003–2005), and R&D expenditure (in % of gross value added, 2005)

	INO	R&D
Mining and quarrying	40.0	0.32
Manuf. of food and tobacco	54.7	0.17
Manuf. of textile and footwear	42.2	0.82
Manuf. of wood, paper, publishing	47.3	0.07
Manuf. of coke, chemical products	75.3	3.40
Man. of rubber, plastics, miner. products	58.2	1.36
Manuf. of metal products	54.6	0.65
Manuf. of machinery and equipment	64.9	3.05
Manuf. of electrical and optical equip.	59.6	3.09
Manuf. of transport equip.	68.4	8.18
Manuf. of furniture, manuf. n.e.c.	43.1	0.36
Electricity, gas and water supply	40.6	0.20
Construction	37.5	0.19
Trade, repairs	43.1	0.04
Hotels and restaurants	25.9	0.01
Transport, communications	35.2	0.01
Financial intermediation	73.9	0.33
Real estate services	25.1	0.03
IT services	71.9	6.16
Other business services	44.1	0.72

Note: INO = proportion of innovating companies, R&D = research and development intensity .Source: CSO (2006), Annual national accounts database (June 30, 2007), own modification.

On the basis of the **Overall indicator of industrial competitiveness** (OIIC) the position of the industries within Czech economy has been specified (see Table 10). The index is constructed on the basis of seven partial indicators, including: level and dynamics of productivity, share of exports in production, share of highly qualified employees, share of cost of research and development in revenues, share of businesses under foreign control in gross value added, production multiplier.

The industries are further monitored with a view to the **share of gross added value in production**, capital coefficient, levels of unit labour costs and share of exports and imports. The most successful industries on the basis of OIIC clearly are manufacture of transport equipment followed by finance and insurance and electrotechnical industry. The least successful industries include other services, construction, agriculture, forestry and fishing.

Table 10: Industries ranked by OIIC in the CR (2005)

		OIIC
DM	Manufacture of transport equipment	5.3
J	Financial intermediation	6.6
DL	Manufacture of electrical and optical equip.	6.9
DF+DG	Manuf. coke, petrol. products, chemicals	7.0
DK	Manufacture of machinery and equipment	7.4
DH+DI	Man. of rubber, plastics, mineral products	8.0
E	Electricity, gas and water supply	8.7
K	Real estate, business services	8.7
DJ	Manufacture of metal products	9.6
C	Mining and quarrying	10.1
DB+DC	Manufacture of textile and footwear	10.4
DA	Manufacture of food and tobacco	10.7
G+H+I	Trade, accom.& restaur., transport, commun.	10.9
DN	Manuf. of furniture, manuf. n.e.c.	11.6
DD+DE	Manuf. of wood, paper, printing, publishing	11.9
A+B	Agriculture, forestry, fishing	12.3
F	Construction	12.4
L–P	Other services	12.6

Source: CSO, own calculations.

The importance of **agriculture, forestry and fishing** dropped significantly in the period 1995 to 2005, with the share in employment decreasing from 6.4 % to 3.8 % and the share in value added dropping from 5 % to 2.9 %. The development of the sector was strongly affected by EU accession (and the subsequent involvement in the Common Agricultural Policy) and by the two strong waves of floods. The branch lags behind in nearly all partial indicators of competitiveness except for productivity, which increased significantly mainly due to the large decrease of employment. Another favourable feature is the relatively high proportion of value added in production. On the other hand, the role of qualitative factors in competitiveness is much below the average, with especially expenditures related to R&D highly lagging behind.

Mining and quarrying has experienced a drop in the share in employment and value added. The most important branch of mining is represented by energy materials, mainly coal. Higher dynamics has been observed in crude petroleum and natural gas mining and mining of other minerals. About one fourth of the total production is exported. Majority of the raw materials are imported to the Czech Republic and consumed, mainly by the refineries and by power generation. With a view to competitiveness raw material mining is one of the average industries.

Food processing industry is one of the four most important branches of manufacturing industry with about 10 % share in the revenues. At present the industry faces transformations in agriculture following from the Common Agricultural Policy, and pressure on price reductions from retail chains. According to the competitiveness indicator the industry is classified as one of the less competitive (bottom half of the hierarchy). The industry shows a relatively high proportion of businesses under foreign control and the highest value of production multiplier.

Textile, clothing and footwear industry has been put under extreme pressure recently especially from Asian competitors, using cheap labour. Czech manufacturers often cannot resist, especially in leather industry. That is why the relevance of the industry keeps decreasing. Despite that the industry has managed to keep a relatively high percentage of exports (today up to 90 %). Segments capable of international competitiveness include for example the knowledge-demanding segments of textile industry (nano-fibre) or fashionable collections of the higher price categories. The industry structure is characterised with a relatively low level of concentration and strong specialisation.

The industry of **wood processing and paper production** represents a very heterogeneous group with wood processing industry representing its major part. Wood processing is very much export-oriented and uses sufficient domestic supply of raw material. Wood processing is closely connected with other industries, such as manufacture of paper and fibre (and further print and publishing), but also furniture manufacturing and construction. With regard to competitiveness this group is very low in the ranking. The reasons include low technological intensity of the production and nearly zero investment into research and development. What is relatively high, though, is the share of employees with higher qualifications and the share of value added in the production.

Revenues of **refineries and chemical industry** strongly reflect fluctuations of global oil prices. In contrast to chemical industry with a high share of exports (about 70 % of all production) the share of exports in production of refineries is relatively low. Evaluation of competitiveness placed the group on fourth position mainly thanks to the high standards and dynamics of productivity, the share of qualified staff and investment into R&D. Further development of the industry will mainly be affected by increasing energy prices and more and more stringent environmental legislation.

Manufacture of **plastics and other non-metallic mineral products** is dynamic with a growing share in GDP. High dynamics is especially typical of manufacture of rubber and plastics products, supported by the conjuncture in automotive industry. The high domestic demand has somewhat decreased the share of exports but still the industry keeps positively contributing to the trade balance. Traditional exporting industries also include glass production, with a trend towards decline of consumer glass and inclination towards technical glass. The group can be found in the top third of the competitiveness hierarchy, especially thanks to high productivity (more than double the average of the CR, despite employment growth). There is also the high investment into R&D, but on the other hand a very low proportion of highly qualified staff.

Metallurgy is strongly affected by globalisation trends, accompanied with growing concentration. Similar characteristics can also be traced in the Czech Republic (the largest local metallurgical company has become part of

the strongest global group of steel manufacturers.) The industry has invested a lot into improvement of product quality and transfer onto segment with higher value added. At present the industry is on the way up, which is mainly caused by the construction boom, and participation in implementation of large investments into automotive and electrotechnical industry. The position in the competitiveness ranking in the Czech Republic still remains around the middle, though.

Manufacture of machinery and equipment has a long tradition in the Czech Republic and a strong base of qualified workforce. The strong revival after 2000 was caused by the inflow of foreign investment. The most serious current issue is insufficient supply of workforce, which generates pressure on wage increase. Mechanical engineering is currently the export industry of Czech economy with the biggest output and the highest positive commercial balance at the same time. As for competitiveness the industry ranks fifth thanks to the high proportion of export production and high productivity dynamics. The industry also shows above-average investment into R&D.

The most dynamic industry of Czech economy certainly is **manufacture of office equipment, computers and communication technologies.** The growing significance of this industry is reflected in the massive inflow of foreign investment. A substantial part of the production (nearly 100 %) is exported, but the level of component import is high. Therefore it does not create much value added in the Czech Republic, with the manufacture being of rather assembly nature. The low value of production multiplier points to negligible impact on other industries of economy. The group shows relatively low R&D investment, which means that the knowledge intensity of the industry does not correspond to the classification as high-tech industry.

Manufacture of transport equipment is the key industry of Czech economy. The dominant role is played by automotive industry, representing about one fifth of overall exports, and the greatest number of job opportunities. The industry performance in exports keeps increasing (now covering about three quarters of the whole production). As mentioned above, the competitiveness evaluation places the industry on the very top, mainly thanks to high investment into R&D and the high share of foreign capital. Another favourable indicator is above-average standard and dynamics of productivity and export output. The below-average indicators include the low share of qualified workforce.

In the context of **other manufacturing industry** the most important role is performed by furniture manufacture, characterised with high material but low investment demand. This is why most of the companies in the field are SMEs. The present boom of the industry is due to the boom in construction. However, there is the high pressure from competitors, especially Polish. The growing pressure on environmental waste disposal and exhaustion of natural resources of non-ferrous metals in the Czech Republic create a good perspective for development of recycling. As for competitiveness the industry is rather below-average.

Energy sector is currently characterised with strong globalisation trends and growing international importance. Liberalisation within EU leads to growing cross-border flows and weakening of the former national monopolies. Prices of energy have grown significantly in the recent years, especially electricity. Generation of electricity and production of gas, water and heat shows the highest productivity of all industries of national economy. The significance of the group is also evidenced by the high value of production multiplier.

Construction is very sensitive in relation to the economic cycle. The boom after 2000 has mainly been due to significant investment into transport infrastructure, industrial and administrative centres but also residential housing. Continuing expansion, however, is threatened by lack of workforce. The sector can be characterised as a group with a high concentration showing a relatively high production multiplier. As for competitiveness evaluation construction is one of the lowest positioned.

The group of industries including **trade, hotels, restaurants, transport and communications** is quite heterogeneous. The trade, transport and communications business is highly concentrated with a strong effect of foreign investment. A substantial proportion of public companies still prevails in transport and mail services, even though the role of the public sector keeps decreasing. Thanks to the EU accession and geographical position of the country in combination with development of telecommunications the role of transport and communications in the service sphere has been significantly strengthened. Important factors of demand in this group include tourist industry.

The industry of **finance and insurance** has undergone a substantial restructuring resulting in a significant increase of the proportion of foreign entities, currently controlling around 75 % of the value added. In the competitiveness hierarchy the industry ranks second, especially thanks to the high production multiplier and share of qualified workforce, above-average share of foreign investment and a high level of productivity. Provisions of loans to households, both by banks and by non-bank institutions, have increased considerably recently.

The industry of **businesses services** globally belongs to the most dynamic activities with increasing presence of supra-national activities. The reason is the trend towards stronger linkages between industry and services, with growing share of services in the value of industrial ouput and increasing outsourcing in industry. The most dynamic industries in the Czech Republic include job intermediation. Competitiveness evaluation placed the industry on the eighth position.

Other services are divided into public administration, education and healthcare. The low position in the competitiveness scale is mainly due to the low level and dynamics of productivity and low proportion of international control. The industry growth mainly depends on the dynamics of final demand, which is quite elastic depending on pensions.

2.3 Regional competitiveness

Competitiveness of regions (on the level of NUTS3) was evaluated on the basis of three key aspects: economic and innovation performance and quality of life. The comparison of the **overall competitiveness of regions** in 2005 with development dynamics in the

years 2001–2005 rather shows deepening of regional disparities (see Table 11). The differences in the average dynamics of all indicators are not as significant as the differences in the average level of these indicators. Even so certain deepening of regional disparities exists and generally regions with low levels of competitiveness achieve rather lower development dynamics and vice versa.

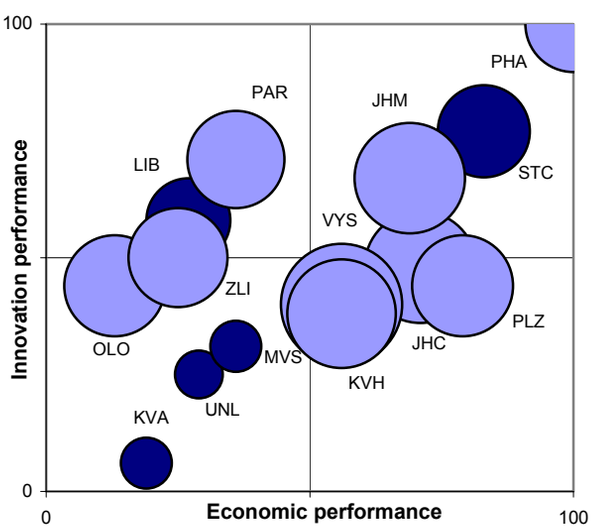
Table 11: Level and dynamics of regional competitiveness development in the Czech Republic

	Level (2005)		Dynamics (2001-2005)	
	Value	Ranking	Value	Ranking
PHA	84	1	51	7
STC	69	2	65	1
JHC	63	4	48	11
PLZ	60	5	60	3
KVA	13	14	24	14
UNL	22	13	40	13
LIB	42	10	48	9
KVH	54	7	52	6
PAR	54	8	48	10
VYS	60	6	61	2
JHM	69	3	51	8
OLO	38	11	55	4
ZLI	44	9	53	5
MVS	28	12	45	12

Note: PHA – Prague, STC – Central Bohemia, JHC – South Bohemia, PLZ – Pilsen region, KVA – Karlovy vary, UNL – Ústí, LIB – Liberec, KVH – Hradec Králové, PAR – Pardubice, VYS – Vysočina, JHM – South Moravia, OLO – Olomouc, ZLI – Zlín, MVS – Moravia-Silesia. Source: own calculations.

From the long-term perspective the **position of Prague** is the most favourable, while above-average economic and innovation performance is also shown by South Moravia (with also above-average quality of life) and Central Bohemia. The worst position is occupied by Karlovy Vary region, Ústecký region and Moravia Silesia region with low economic and innovation performance and quality of life (see Figure 5).

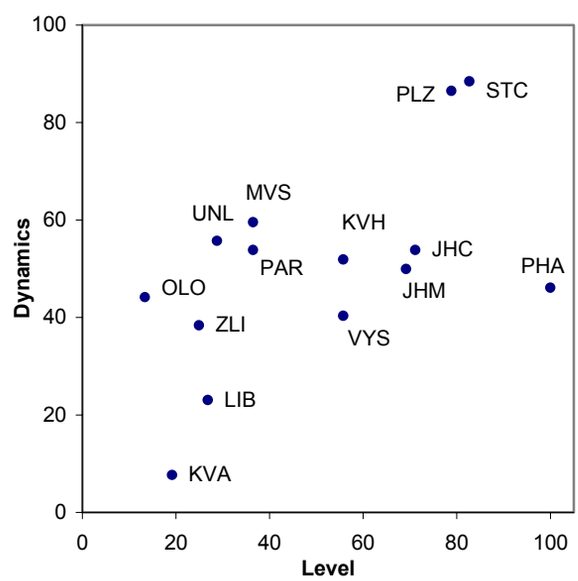
Figure 5: Components of regional competitiveness (2005)



Note: Values are averages of percentils for individual indicators. Size of bubbles = value of quality of life index. Dark bubbles are regions with below-average quality of life. Source: Czech Statistical Office, Czech National Bank, Ministry of Labour and Social Affairs, Police of CR, Hydrometeorology Institute, own calculations.

Economic performance was evaluated on the basis of the index of economic performance constructed from GDP per capita, productivity of work, unemployment rate and gross fixed capital formation. Comparisons of the level and dynamics of economic performance show continuing deepening of regional disparities in the Czech Republic after 2001 (see Figure 6). High economic level and dynamics has mainly been kept by Central-Bohemia and Pilsen region, with Karlovy Vary and Liberec regions lagging behind. Certain improvement has been achieved by Moravia-Silesia and Olomouc regions. Position of Prague in terms of dynamics of economic performance is much worse than the reached economic level. It is caused by the significant growth of industrial production which is concentrated in other regions. Effects of the EU accession and FDI, that are the main sources of the current economic growth of the CR, are not so important in Prague.

Figure 6: level and dynamics of economic performance in regions of the Czech Republic (percentiles, 2001–2005, 2005)



Source: Czech Statistical Office, own calculations.

There are considerable differences between the regions of the Czech Republic in **innovation performance** based on the level of relative intensity of research and development activities (see Table 12). Prague has kept its dominant position in this. Another major centre of R&D has been South Moravia region and Central Bohemia, the latter mainly thanks to automotive industry. Considerable regional differences can be seen in innovation performance on the sectoral level with a difference between innovation activity in manufactuting industry and in services.

With regard to the share of **technologically and knowledge intensive activities** in gross value added per employee an exceptional position is again held by Prague, followed by Central Bohemia, Pardubický and Královéhradecký Regions. In the case of **foreign direct investment** (FDI) their highest accumulated inflow is again seen in Prague and Central Bohemia, followed with Liberec and Ústí regions (here, however, the high inflow of FDI is not accompanied by a higher share of

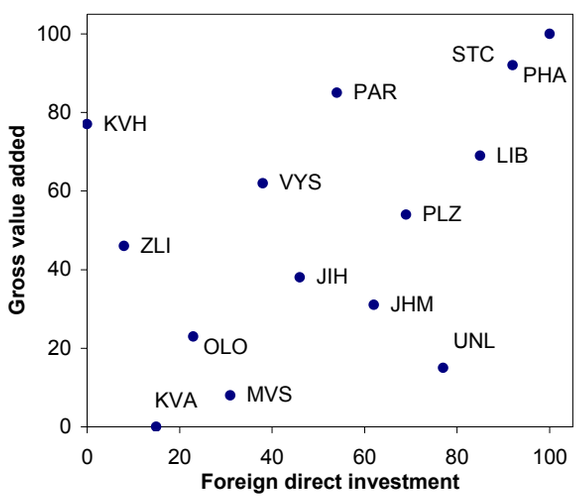
technologically and knowledge intensive activities in gross value added, see Figure 7).

Table 12: Expenditures and employment in R&D in regions of the Czech Republic

	Expenditures per capita (CR=100)		Expenditure in % of GDP (GERD)		Employment per 1,000 inhabitants		Share in R&D employment in (in %)	
	2001	2005	2001	2005	2001	2005	2001	2005
CZ	100	100	1.20	1.42	5.1	6.4	100.0	100.0
PHA	314	327	1.83	2.22	18.1	22.7	40.7	40.8
STC	232	181	3.00	2.76	3.7	4.4	8.0	7.7
JHC	47	62	0.62	0.99	3.0	3.9	3.6	3.7
PLZ	43	50	0.55	0.74	3.3	4.2	3.5	3.5
KVA	8	6	0.12	0.11	0.8	0.5	0.4	0.2
UNL	22	17	0.33	0.30	1.2	1.2	2.0	1.5
LIB	61	63	0.84	1.12	3.4	3.7	2.8	2.5
KVH	45	52	0.59	0.82	2.8	4.1	3.0	3.5
PAR	71	78	1.01	1.35	4.0	5.2	3.9	4.0
VYS	22	34	0.31	0.57	1.1	1.7	1.1	1.3
JHM	97	100	1.27	1.54	8.0	10.1	17.6	17.4
OLO	42	52	0.64	0.95	2.9	4.7	3.6	4.6
ZLI	42	65	0.60	1.14	2.4	3.8	2.8	3.4
MVS	50	42	0.78	0.73	2.9	3.1	7.1	5.9

Source: CSO – Research and development indicator of the Czech Republic (2001–2005); own calculations.

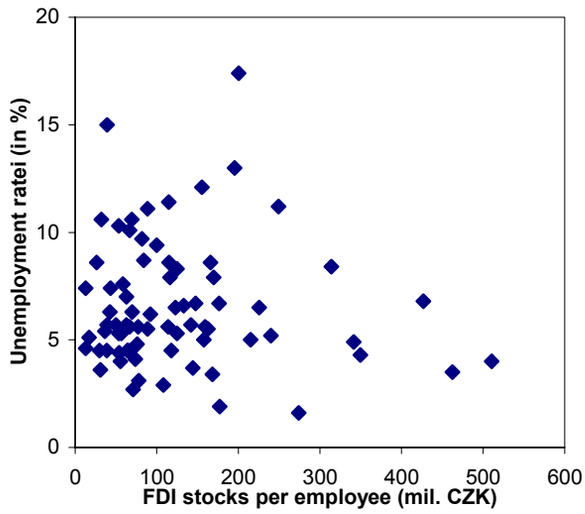
Figure 7: Positions of regions in level of foreign direct investment (2004) and level of gross value added in high-tech industries (percentiles, 2005)



Source: CZO, Czech National Bank, own calculations.

Closely monitored aspects of FDI represent their effect on the **labour market**. A comparison of unemployment rate and FDI stocks per employee by region shows a weak relationship between the two variables (see Figure 8). Development of unemployment in groups of districts with the highest or the lowest supply of foregn direct investment was similar. This fact is also confirmed by analysis based on correlation coefficients. There is a stronger relationship, though, between FDI and new job offer. FDI therefore plays a positive role in creation of new job opportunities. Regarding the generous social system and often relatively low wages offered by foreign investors in the new establishments the creation of new job opportunities does not lead to any significant drop of unemployment. The new jobs, in addition, are often occupied by foreign workers.

Figure 8: Unemployment rate (2007) and FDI stocks (by the end of 2005) in districts of the Czech Republic



Source: Czech National Bank, Ministry of Labour ans Social Affairs, own calculation.

Prague occupies exceptional position among regions in the Czech Republic as for economic and innovation performance. The position of Prague is considerably affected by the geographical location, thanks to which Prague does not include the closest surroundings, for which it serves as the economic centre (which manifests itself by the high proportion of commuters). The metropolitan nature of the region reflects in a high level of added value created by the government sector, in concentration of most services industries and a higher price level, which is not taken into consideration in the regional differences in recalculations of GDP by purchasing power parity. Prague shows a high dynamics of GDP growth, the lowest unemployment rate, the best innovation performance, and just slightly worse quality of life. The exceptional position of Prague is also supported by the fact that Prague is the twelfth wealthiest region of EU on the level of 157 % of EU average in GDP per capita based on purchasing power parity.

Central Bohemia forms workforce source for the metropolis, which affects some of the characteristics of the region thanks to the high number of commuters working in Prague and living in the region. Even though the economic indicators of the region are underestimated thanks to this, the region showed the highest dynamics of development of economic performance in the years 1995–2005. The quick economic growth, supported with massive inflow of foreign direct investment, contributed to the very low level of unemployment. The region makes use of quality infrastructure and tradition of developed industry. The best position among regions of CR held by the Central Bohemia region relates to research and development investment, especially thanks to automotive industry. Closeness of the metropolis and industrial activities of the region negatively affect quality of life, though.

South Bohemia region is characterised by low population density, strong share of agriculture (and the lowest share

of industry) and well preserved environment, creating good prerequisites for development of tourism. A positive role in the region´s development is performed by the closeness of Austria and Germany. The region has reported one of the highest increases of GDP, successfully achieved mainly in the period 1995–1999. Thanks to the rather rural nature the region has not undergone the deep structural changes in the beginning of the transformation process, which is reflected in long-term low unemployment rate. However, the region lags behind in innovation performance indicators. Obstacles to further development of the region include insufficiently developed transport infrastructure.

Pilsen region is specific with the strong role of the regional capital as a significant economic centre. Like South Bohemia the region draws from the proximity of developed countries and shows low population density. The region, however, is more industry-oriented and its transport infrastructure is better developed. In the period of transformation the region underwent considerable structural problems. FDI became a strong stimulus for the region´s development. GDP showed fourth highest growth in the Czech Republic and the unemployment rate is well under the national average. As for indicators of innovation performance the region lags behind in investment into R&D.

Karlovy Vary region is the least populated region with specific population structure. A significant role in the region ´s economy is performed by spa and tourism, which, however, is unable to outbalance the burden of decayed industry with a concentration of industries with low gross value added share in production. The region shows the lowest gross domestic product dynamics and the unemployment rate ranks third highest in the country. Very weak is innovation performance and quality of life in the region.

Ústí region is characteristic with strong concentration of industrial production. The region reports the second lowest dynamics of gross domestic product, reflecting economic problems related to industry restructuring and attenuation of coal mining. The region has long belonged to regions most affected by unemployment. One of the worst values is also shown in the area of innovation. Social and economic problems together with the industrial nature of the region very negatively reflect in quality of life indicators.

Liberec region is the second smallest region as for area and population. Historically the region belongs to major centres of industrial development. GDP dynamics was below-average of the Czech Republic. In comparison to other regions, however, the region managed to cope well with restructuring, as the long-term decay in textile and glass industry was outbalanced with development of electro-technical and automotive industries (thanks to a high inflow of foreign direct investment). This is manifested in a below-average unemployment rate. Relatively favourable is the region´s position in innovation performance indicators.

Hradec Králové region holds a strong position in agriculture and tourism. The region showed the third largest increase in GDP, especially thanks to development of automotive industry. The region also shows one of the lowest unemployment rates in the country. Investment activity of the region is low, which is related to the relatively weak inflow of FDI. In the area of innovation performance indicators the region shows an average position, while in quality of life it is one of the best.

Pardubice region is largely agricultural, with a high share of village population. Industrial structure of the region did not undergo significant changes in the period of transformation. Even though GDP development was rather below-average, the region has kept a relatively low unemployment level. The region has also been very successful in development of indicators of innovation performance, especially thanks to the significant share of high-tech industry, and relatively high research and development investment.

Vysočina region showed the third largest growth of GDP in the country, thanks to which it moved from the least developed to the above-average regions. Despite that the unemployment rate in the region has been relatively high, with strong intra-region differences. The region shows a high share of high-tech industries, with low investment into R&D, though, as well as the share of university graduates in workforce (which suggests a prevailingly assembly nature of the activities). As for quality of life Vysočina ranks first in the Czech Republic.

South Moravia is specific in the high contrast between the developed centre, the regional capital Brno, and the underdeveloped rural districts. GDP dynamics was below-average, resulting in a high level of unemployment. The region was not very successful in FDI inflow. The innovation performance indicators are opposite to Vysočina, i.e. the share of high-tech industries is low, while R&D investment is high. Quality of life ranks among the best in the country.

Olomouc region is distinguished by the relatively developed central part and the underdeveloped marginal districts. As a whole the region belongs to the economically weakest in the Czech Republic, with rather above-average GDP dynamics in the past period, though. The unemployment rate in the region is high thanks to the remote mountain areas. As for innovation performance indicators the region rather belongs to the below-average ones, with the exception of the high share of university graduates thanks to the Olomouc university. The quality of life in the region is above-average.

Zlín region, despite its geographical remoteness, can boast of good industrial tradition thanks to the Baťa business. Economic development is unsatisfactory, though, thanks to the structural difficulties related to extensive restructuring. The region therefore shows long-term high unemployment rate. Low is the level of investment activity, and FDI inflow, due to low transport accessibility. As for innovation performance the region´s position is somewhat better, with especially high investment into R&D. The well preserved natural environment reflects in above-average quality of life.

Moravia Silesia is the most densely populated region of the country with a high concentration of the population in the Ostrava-Karviná agglomeration. The region is traditionally industrial with a high proportion of mining and steel industry. Restructuring in the period of transformation resulted in strong unbalances accompanies with a high level of unemployment, prevailing until today. However, the region reported a relatively high increase in GDP, drawing from mass inflow of FDI, and its situation has been improving. The innovation performance indicators are unfavourable, though, thanks to the prevailing economic structure. The quality of life in the region is very poor, too.

3. Information society and business informatics

The quality of business informatics has gradually become one of the key resources of the competitiveness of companies and organizations. It is influenced by many factors, mainly the level of rendered informatics services, and the quality of application within business information systems and also the degree of the quality of business informatics management. The substantial influence on the development of business informatics has also reached the level of the entire **information society**, i.e. development of the infrastructure, informatics qualification of the workforce, quality and absorption faculty of the ICT market. This means that if we want to analyze the status and development of business informatics in our country, we have to do so in the broader context of development of the information society.

3.1 Business informatics in the information society

Information and communication technology represent one of the key sectors which contribute to increasing the competitiveness of companies and also entire national economies as they fuel economic growth and provide new jobs. The quality and **efficiency of business informatics** is even more important for small- and medium-sized companies, on whose growth and prosperity to a large extent depends the efficiency of the European economy. Even this is the conclusion of strategic documents of the EU, the Lisbon Strategy and others.

Information society and European initiatives

At the end of 2005, the European Commission adopted a vision of further development of the information society for subsequent years. The following main conclusions resulted from analyses of the current status of the development of the EU information society and realization of the eEurope program (EUROSTAT, 2006). Although a series of **realized projects** and programs remain in the development and use of ICT, many others stay unrealized or entirely non-initiated. In EU countries approx. 80% of the population was able to access high-speed internet in June 2004, but only 7.7% on average were, in fact, connected. The presented difference represents a huge potential for future development along with the upcoming third generation of mobile devices.

The influence of ICT on the economy and society dramatically increases with the entry of new, highly important subjects on the world market. Great progress in the years 1992 – 2001 was made in the ICT area mainly in China, India and Brazil, which noted a year-to-year increase in production in the region of 20-35%. The EU must make provision for these trends and react to their impact. Such participation in decision-making on the global structure and management of IT networks, navigation systems and other infrastructural solutions of this type is therefore highly strategic for the EU.

The dynamic entrance of China, India and other, mainly Asian countries, forces leading ICT companies to use so-called **off-shoring**, i.e. to move the research and development of mainly basic software systems and technical equipment to these countries. Huge development centers of Hewlett-Packard, IBM and other companies in India (e.g. Bangalore), which employ tens of thousands of high-quality developers, are examples.

Effective utilization of ICT is becoming **more complex** and preparation-intensive over time. Hence the quick adapting of new software standards and tools including assurance of their effective connectivity, i.e. the ability to easily, quickly and mutually communicate and exchange data, is necessary.

An important customer as well as supplier of ICT is **government and government organizations**. Examples are activities and programs such as e-government, e-health and e-learning. Stress placed on the efficiency and effectiveness of the public sector, which must adapt their services to company and citizen needs, has been increasing.

Among areas identified as a priority for development of the information society after 2005 are mostly included the development of services of ICT, e.g. in the field of multimedia and audiovisual technology, of the support for the incorporation of all citizen groups into structures of the information society and prevention of their possible exclusion due to unavailability of information resources and services, the development of comprehensive public ICT services executed on the basis of ICT, the creation of programs for the development of skills and jobs associated with informatics tools and services, the support for citizens' confidence in the application possibilities of ICT and boosting their active approach to ICT and communication capacities, the utilization of ICT tools for rationalization of business procedures and for various forms of cooperation between companies.

EU ICT Strategy until 2010

The European Commission adopted in June 2005 the **European Information Society Strategy 2010-i2010** as a consequence of fulfillment of Lisbon goals. The Strategy determined three following basic directions for development in the information society: (1) to create an open and competitive single market for information and media services within the EU, (2) to increase investments of the EU into the development of innovative programs in the area of information and communication technologies by 80 % (currently, the EU is, with its 80 EUR per capita, drastically lacking behind Japan with 350 EUR and USA with 400 EUR), (3) to clearly define priority areas of the information society and to prepare the realization plans for them, e.g. to execute a plan for assurance of services for inhabitants by 2006, to make accessible outputs of the European culture by 2007 in the form of multimedia and multilingual digital libraries, to render various information and navigation services for the support of safer car traveling etc.

One of the priorities of the **National Reform Program** in the Czech Republic is an implementation of high-speed networks with focus on broader use of new electronic services by mostly small- and medium-sized companies and by households with anticipated reaching of high-speed access to the Internet for 50 % of the population. The current trend shows that while in the 4th quarter of 2003 the availability of the high-speed Internet access was on the level of approx. 2 %, in 2nd quarter of 2006 it was already 15 % of households.

The condition is especially a liberalization of the telecommunication sector and increase in service offer in electronic communication with the public service within the framework of the e-government. Also services within the

framework of the Public Service Portal, which maps the availability of the high-speed internet access in the entire Czech Republic, come up to that approx. 90 % of the areas of the Czech Republic are currently covered by ADSL (Asymmetric Digital Subscribe Line) technology and with the use of wireless technologies it represents nearly 100% of the population.

Another significant trend leading towards increase of the quality of the information society is the advanced integration of information systems and technological resources within the public service. Information nucleus of the e-government in the Czech Republic should comprise three central registers – Territory Identification and Address Register, Economical Register and Inhabitant Register. Operation launch of the Economical Register is planned since 2010. It will centralize data of approx.2.4 mil. business subjects and will replace tens of current information systems and sources.

A substantial shift in the development of the Czech e-government means wider possibilities for registration submissions to the health insurance and other functions. The main organization for receiving electronic submissions is the Czech Social Security Administration, which had received approx. 11 mil. electronic documents by 2006 and this offer is used by more than 65 % of companies and organizations. These development trends are positive, however EUROSTAT measures the progress in e-government of member countries based on 20 given criteria. According to this evaluation, the Czech Republic has dropped in last years from 19th to 21st place and is on 5th place among new EU members. Unfortunately it is necessary to emphasize also an utterly poor qualification preparation in this entire area, including university study programs.

While observing the impacts of ICT, the attention is mainly focused on facilities and infrastructure as an inevitable assumption for execution of the informatics in business activities. Three key characteristics were used for the evaluation in 2006: the quality of technological infrastructure (mainly the accessibility of information and communication technologies), the utilization of ICT applications (e.g. in e-business) and the utilization of ICT in development of the public service (e-government).

Availability of ICT

Here are, beside the very technical availability, monitored indicators evaluating also an economic availability of information technologies and sources, a number of connectable telecommunication equipments, in position of telecommunication operators and, generally, an expenditure on information and mainly communication infrastructure. With regard to trends in availability of mainly broadband Internet it is very significant to look at its use in a business area (the situation is illustrated in Figure 1).

Table 1: Availability of internet in companies (in %)

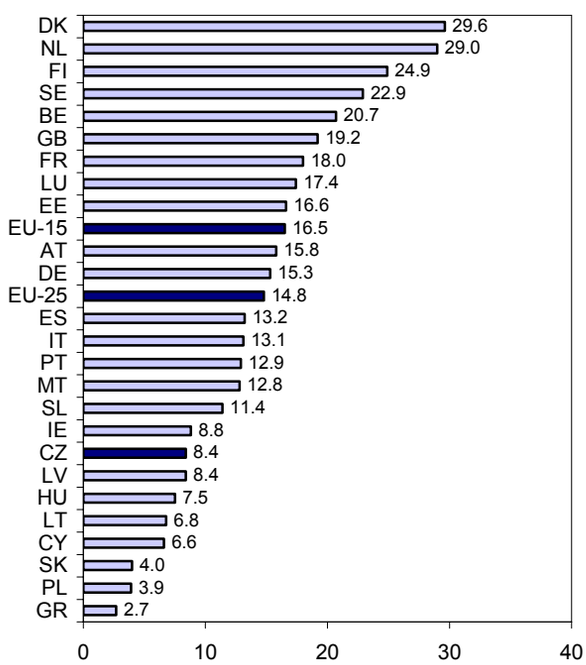
	2005	2006
EU-27	..	92
EU-25	91	93
EU-15	92	94
CZ	92	95

Source: EUROSTAT – New Cronos, Information Society Statistics/Structural Indicators (as of May 1, 2007).

The Czech Republic does not occupy a good position in EU-25 (with no data available yet for EU-27) according to the rate of penetration of broadband connection to the Internet, as expressed in number of connections in relation to the number of inhabitants. Despite the number of connections nearly doubled year-to-year, the Czech Republic still reaches the value of just 8 %, with the EU average of approx. 14 %. In case of the Internet access in companies is the situation in the Czech Republic more favorable (see Table 1).

However, for the information society development is also important the ICT availability and Internet access on the part of households, where the Czech Republic occupies one of the last positions in the EU (29 % in CZ compared to 49 % in EU-27). This situation is, among others, a reason for even lower use of the Internet ordering and purchasing goods or services and generally for use of e-commerce and electronic execution of e-government.

Figure 1: Availability of broadband internet (in %, for 2006)



Source: EUROSTAT – New Cronos, Information Society Statistics/Structural Indicators (as of 1st May, 2007).

Use of ICT in e-business

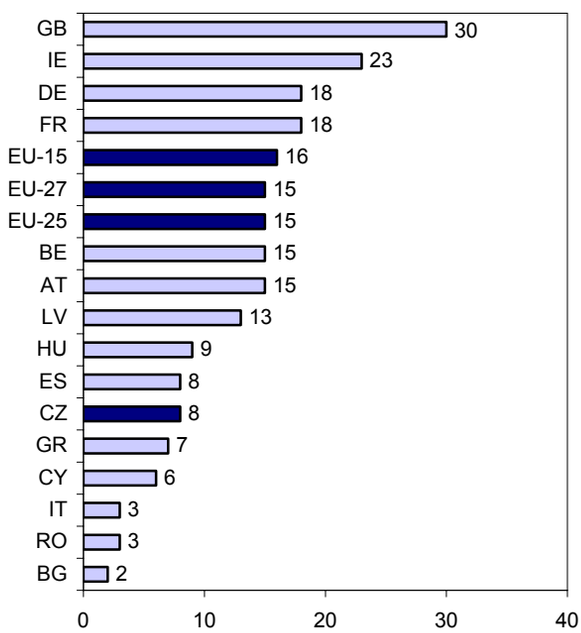
Electronic business (e-business) belongs to the basic areas of use of ICT. It is expected that the informatics supports finding of new business methods, effective approaches for penetration to new markets, the support for launching new products and services on the market etc. To this area belong also possibilities of support of business processes through the informatics, i.e. mainly support by Internet services but also features of mobile phones, electronic communicators, PDA (Personal Digital Assistant) and laptops.

For electronic on-line commerce, an appropriate legislation environment, which ensures a legislative frame and protection of trading subjects including payments for delivered goods, must be ensured besides a technological base. One of the key pieces of legislation is an Act on Electronic Signature. This technology is used by Czech

companies in relative scarcity, regardless of the size of the company.

The use of on-line commerce is often linked to a certain industry. E.g. suppliers of automotive industry belong with their own data standards and use of Electronic Data Interchange (EDI) to pioneers and important users in this entire area. A second standpoint is the type of traded goods, where consumables and ticket booking dominate. A wider use of electronic on-line commerce is yet impeded by not only the availability (technical and price) of required ICT, but also the customers´ confidence in relation to the protection of their personal data including execution of on-line payments. A typical problem in this context is also assurance of highly effective logistic processes coherent to electronically realized information processes. Differences in their speed and flexibility sometimes depreciate the quality of the whole system. Figure 2 shows the level of the use of the ICT in e-business for accepting of orders in companies in EU-27.

Figure 2: Companies accepting on-line orders (in %, for 2006)



Source: EUROSTAT – New Cronos, Information Society Statistics/Structural Indicators (as of May 1, 2007).

A special attention in this area is paid to **small- and medium-sized companies (SME)**, which is confirmed also by prepared EU operation programs for 2007 – 2013. Use of technologies and applications of e-business is a key factor for efficiency and competitiveness of SME. Relatively high costs cumbered a broader expansion mainly of e-procurement based on EDI technologies so far. However, this is being solved by a gradual changeover to the XML (eXtensible Markup Language) environment.

As shown in Table 2, the situation in the area of **on-line company purchases** is not so bad in the Czech Republic; however, the recorded decreasing trend is somewhat surprising. The differences are noticeable in comparison with advanced countries though. (51 % in Great Britain, 53 % in Ireland). Backwardness of Czech companies has a very negative impact on their performance and total competitiveness, e.g. impacts on common periods and flexibility of executed orders.

Table 2: Companies purchasing on-line (in %)

	2005	2006
EU-27	..	27
EU-25	24	28
EU-15	26	31
CZ	21	17

Source: EUROSTAT – New Cronos, Information Society Statistics/Structural Indicators (as of May 1, 2007).

Looking at the total use of **e-commerce** and its share in turnover of companies, the situation of the Czech Republic is also under the European average with decreasing trend in time (see Table 3). All types of e-business are included in this evaluation. It includes e-procurement based on relationships between two trading companies, e-commerce and e-marketplaces.

Table 3: E-commerce in % of company turnover

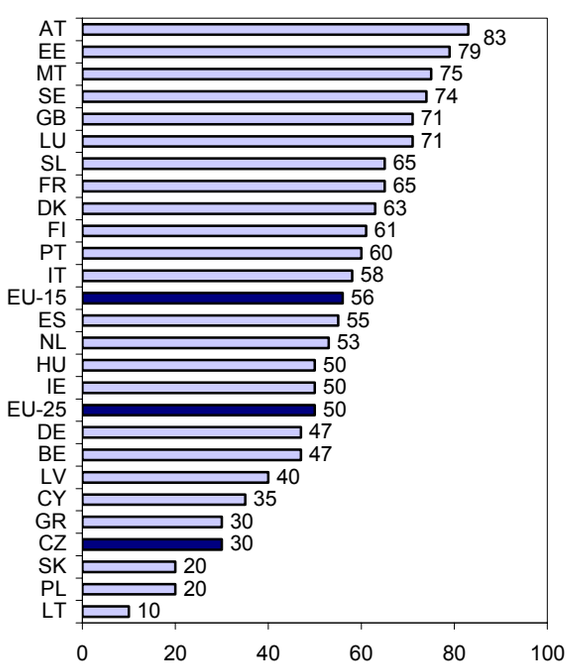
	2005	2006
EU-27	..	4.0
EU-25	2.7	4.0
EU-15	2.8	4.1
CZ	3.3	3.1

Source: EUROSTAT – New Cronos, Information Society Statistics/Structural Indicators (as of May 1, 2007).

Use of ICT in communication with Public Service

One of the basic goals of the utilization of ICT in the **public service** is to offer the citizens and companies professional, faster and less complicated services. E-government is one of the basic monitored area in eEurope and i2010 Strategies.

Figure 3: E-government availability – offer side (in %, for 2006)



Source: EUROSTAT – New Cronos, Information Society Statistics/Structural Indicators (as of May 1, 2007).

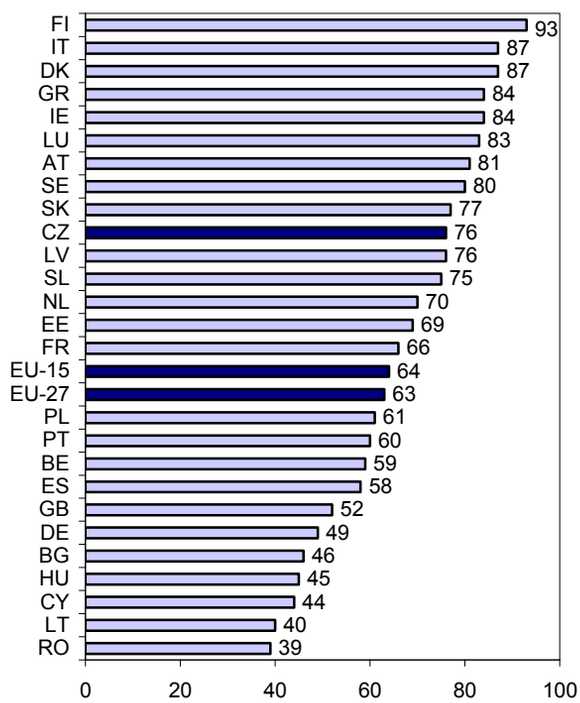
Part of the available statistics is data on use of the Internet by individuals and companies in relation to the public

service, mainly data on use of web pages of the public service for searching information, downloading forms and on-line fill-out of the forms. Figure 3 illustrates the e-government availability for companies in 2006.

Average values of e-government availability differ for EU-15 and EU-25 (no data available yet for EU-27) by 6 p.p. with the Czech Republic and its 30 % on 5th place from the end. This bad position in relation to other EU members persists despite above-mentioned partial improvements. Nordic countries of Finland and Sweden, Estonia has been developing rapidly reaching highly above-average values in all areas of the e-government. The problem of low efficiency of the Czech e-government services then influences also the efficiency of the commercial sphere. It represents spending of time and financial costs for needless or completely ineffective operations in communication with the public service.

Figure 4 and then also Table 4 show the position of the Czech Republic in use of e-government by **companies** in the area of communication with the public service. The Czech Republic had been reaching comparable, or better values then the EU average, in 2006, however, it fell behind in the growth rate.

Figure 4: Companies using e-government for communication with public service (in %, for 2006)



Source: EUROSTAT – New Cronos, Information Society Statistics/Structural Indicators (as of May 1, 2007).

Table 4: Companies communicating with public service electronically (in %)

	2005	2006
EU-27	..	63
EU-25	57	64
EU-15	56	64
CZ	79	76

Source: EUROSTAT – New Cronos, Information Society Statistics/Structural Indicators (as of May 1, 2007).

Changes of information society on company level

Changes of the information society come primarily **from outside** of the company and represent new possibilities of product and processes ICT-based digitalization, whereby the Internet plays the key role. Further, changes coming from the company itself and incumbent on effective understanding and mastering of these new tools and methods as evoked or conditioned with ICT by nearly all workers. The changes must, at the same time, regard also their behavior and re-engineering of business processes. Especially projects of BPR (Business Process Reengineering) represent very strong perspective for increasing company's efficiency, for the documentation and optimization of business processes is often a basis for their subsequent work-flow management and automation.

Changes brought by the information society include all important aspects of a company and its business – customers, suppliers, partners, competitors and own employees. Changes come to light in the absolute **company paradigm**, as, owing to the globalization, protected markets are disappearing, and the life-cycle of products is being shortened up. Other products must be scheduled already at the time of launching novelties on market; markets behave globally not only in terms of possible locations, where producers place their companies.

Reduction of protective measures is happening on closed markets on which both new companies and new alliances of well-established companies dynamically operate. The key factor of success is to sell offered goods and services, as a number of professions are currently overdimensioned in capacity and the possibilities surpass an actual level of possible consumption by customers for a given product. Therefore all employees of the companies must be **customer-oriented** with the bigger portion of passion and creativeness. So not only vendors and businessmen are concerned, but also e.g. call center workers, designers of new products and their implementers into the production. Apart from necessary quality and low price, a short term of the product delivery on the market is expected.

Changing **customer behavior** then causes the prediction of the further market development to be nearly impossible. It is not possible to use traditional decision tools anymore, as former conceptions and strategies gradually cease to work, boundaries between spheres of business and customers´ loyalty are changing. The companies seek a new position on the market with previously unthought-of activities. Traditional boundaries between spheres of business are changing, as banks offer insurance, insurance companies deal with hospital management, vendors of information systems operate with leasing. The traditional customer loyalty yields to the need of yet more colorful and individualized product demands. The number of new products is quickly growing and the time for their launch on the market is constantly being shortened. PC´s and mobile phones can be taken as examples.

Companies try to react in various ways on the new conditions. Generally, their approaches can be divided into two groups. In the first one, mainly organizational changes and those also focused on the social-psychological area domain, in the other one, the bigger emphasis is given on a dominant role of ICT. Primarily, there are changes inside the company and the key role in this process is played by human resources. – literally every employee of the company from the management to the represen

tatives in the important first line of customer contact or on realization of the product or service. ICT´s are being understood in this case as a necessary and essential success condition of the changes in company's culture. The second type of approaches focuses mainly on the integration into the outer relationships of the company. The goal is to on-line link with other business subjects on the market. Modern ICT´s occupy a dominant position in this sense. An important role is therefore played by concepts or management models, of virtual company, company's cluster, and management of suppliers´ chains, or networks (SCM), customer relationship management (CRM).

Restructuring of global ICT market

Some segments of the ICT market show especially **high dynamics**, mainly investments into internet technologies and applications, mobile application and applications oriented on end-user. The growth of the ICT market is expected also for the next couple of years, although not at the level of 20-30 % as in the end of the nineties. **ICT expenditure** grew by 5.6 % on average in 2000-2005 worldwide, mostly due to developing economies. ICT expenditures are growing the fastest in China, Russia and India, which is shown also in the growth of their proportion in the world market, in the amount of investments into the ICT sector and the number and amount of acquisitions. The employment in the top ICT companies had a decreasing trend and has been slowly increasing only since 2003. On the other hand, revenue from and expenditure for research and development was showing a fluctuation and a slow decrease until 2002 at 250 most important companies, yet they have shown a strong growth recently.

Mostly manufacturers of electronic products and equipments from Asia have been expanding. Apart from an increase of the share in the ICT products market of countries like Chine or India, also services realized in the off-shoring form (a transfer of servicing activities abroad either from the company's headquarter to its foreign branches or to external providers, which is a specific form of outsourcing) have been expanding. A significant increase has been recorded for expenditures in the ICT **research and development**, mainly in the area of the development of new basic electronic and communication components, software solutions and ICT services. Permanently decreasing prices of electronic products with increasing its performance and qualitative parameters, thus an improving price performance ratio has brought a revival in the volume of international trade. The current proportion of the ICT products is only slightly higher compared to the 10-years-ago level.

An orientation of the business and direct foreign investments has dramatically changed with the production and, to a certain extent, even the ICT services having been moved outside of the advanced countries. A further intensification of these trends with the movement also in case of products with high added value and, at the same time, even services demanding more qualification is expected. Another characteristics of the current ICT market is also a high proportion of new acquisitions (such as Oracle, Microsoft, Infor, SSA Global), which was in 2006 ever the highest from the start and the sharp progress of so-called dot.com companies.

Future development on the ICT market will be followed by various trends. Above all, a convergence of various technologies such as nanotechnology, biotechnology and ICT towards integrated solutions and products is happening as well as the development of navigation and localization systems for monitoring the move of vehicles, goods etc. RFID (radio frequency identification) technologies are ever more available and have been completely changing the nature of most of the business and logistic processes. So-called participation web (Web 2.0) technology enabling the Internet users to markedly more effectively participate in creation of its information content has been undergoing a rapid development. ICT applications have been developed and spread into nearly all spheres of human activities, whereby systems for identifications and warning against natural disasters have been gaining a special position.

The rapid development of ICT enables significant changes in the **geographical distribution** of rendered information services. Off-shoring and the information services market have, however, two sides. Countries like India successfully accept a global business model for services rendered worldwide, which are based on their availability thanks to the Internet. On the other side, a domestic services demand has been growing, which opens the markets even for a foreign competition and an increase of its quality. Therefore in China, India and other countries the development of ICT export is shifted from the production and supplies of PC components to considerably more sophisticates information services together with a growing level of the qualification of their information and communication technology specialists.

The position and possibilities of the Czech Republic in the off-shoring of information, or strategic services and the offer of investment incentives related thereto are a very actual topic of the development of the information society. The efficiency of investments into the off-shoring of these services actually highly surpasses even the success of foreign investments e.g. into the manufacturing industry.

3.2 Expected development of Czech ICT market

In the first half of 2007, a survey of the CES and the Czech Society for Systems Integration oriented on the conditions and expected trends on the Czech ICT market was carried out. Suppliers of ICT were the respondents with the participation of more than 60 most important suppliers. Results of the survey are summarized in this chapter. One of the key questions was current level of the saturation with various types of applications such as ERP, business intelligence, CRM. Based on the survey as well as studies by analytic companies (Gartner, IDC, IDG), basic development tendencies on the Czech ICT market can be anticipated.

Enterprise information systems

About 80 products designed for big and medium-sized customers represent at the moment the offer of **enterprise applications** in the Czech Republic. Basically all top suppliers of these software products have their representations on the market. Therefore the segment of enterprise applications (ERP, enterprise resource planning) is one of the segments, which at the moment show the biggest saturation (see Table 5).

Table 5: Forecast of market saturation for ERP in the Czech Republic (in % of the respondents, 2006)

	Market Saturation in %								
	10	20	30	40	50	60	70	80	90
Respond.	0	0	0	2	5	2	12	19	8

Source: Own survey.

Currently, this most important category of business software records a high dynamics in the number of installations and then even implementations. Big market saturation entails in this case also a very strong competition and the endeavor of the suppliers to seek new opportunities mainly in rendered services and the orientation on products with limited distribution among customers up to now. Another distinctive characteristic of the current ERP market is the orientation on small- and medium-sized enterprises (SME). Specific license conditions, adjusted implementation methodologies, and rendered services for running the entire information system are also offered to the small companies.

From the **further expectation development** point of view, a vision of further expansion of ERP solutions into the area of small- and medium-sized enterprises (60 % of positive answers) and also the public service (27 %) generally prevails at the suppliers. The expansion into the area of services or other companies is being considered only exceptionally (the market saturation is the biggest here). The increase in positive expectation of the market development compared to the last year is visible with 20 % of the respondents going to 28 % (see Table 6). Meanwhile, the functionality of the ERP systems is not being changed dramatically. Changes in the approach of the suppliers towards the implementation of individual ERP products, e.g. significant shortening of the implementation time (from 9 to 12 months in 1996 to current 3-4 months) is becoming more evident.

Table 6: Expected development of Czech ERP market (in % of respondents, 2006)

Market Development	%
will worsen	1
will be stable	18
will improve	25
will significantly improve	3

Source: Own survey.

Shorter period of the implementation is evident not only in lower price and customer employees´ load but also brings sooner the planned effects. These effects have been changed in the last years as well. In the mid-1990s, the main goal was to implement the ERP for reducing the warehouse stock, degree of completion of the production, overrunning of normative times, total price of material purchase and thus a total reduction of costs. Current analysis and future expectations rather mention better data availability, superior support of decision-making, improvement and enhancement of business processes and also improvement of feedback on customers´ demands. Also the ability of ERP to support the integration and communication with company's surroundings are significantly evaluated nowadays.

Analytical and planning applications

The estimated market saturation with analytical and planning application of **business intelligence** (BI) is significantly lower then with ERP and the majority of estimations move around 20 – 40 % (see Table 7). IDC surveys however show at the same time that the medium-sized and big companies put more and more stress on increasing the total capacity. BI applications provide in this respect not only the needed information on e.g. company's growth rate but also analyses factors that impact the growth rate. Special BI applications are offered for the needs of SME segment.

Table 7: Estimations of market daturation with BI in Czech Republic (in % of respondents, 2006)

	Market Saturation in %								
	10	20	30	40	50	60	70	80	90
Respond.	3	15	5	8	7	2	0	0	2

Source: Own survey.

Exactly BI applications improve the quality of company's informatics in a decisive way. However, this area is burdened with various problems, though. BI does not yet play the expected **integration role** of information systems and the solutions are oriented on isolated projects, which only bring partial effects. That completely and legitimately derogates the usage and support of BI for an increase of the capacity and quality of basic cross-sectional business processes.

An **insufficient co-operation** between user and ICT departments is another problem. A specific role is played by the activity or resistance of the middle management, for the most of the BI functionality is usually against its interest and replaces the activities, which the middle management carries out (consolidation of information, processing of consolidated reports etc.). BI projects must be oriented on the entire company though, with the whole concept for the complex solution of business processes. That needs substantially bigger activity of the users on all levels of company's management than it is with other applications. Another problem is an insufficient link of business and technological knowledge on the part of the users and informatics and a low quality of source data.

A demand for BI solutions is gradually growing strong. The BI become **strategic tools** for business management and penetrate all its levels (so-called pervasive BI). Applications and tools will be more and more available to the majority of the company's employees, i.e. as basic office products or transaction applications. Simplifying of BI tools and their significantly better economic availability contributes to that.

According to survey, BI is the third **priority area** of ICT managers; where they intent to invest (right after the integration of corporate applications and security of IT systems). A dynamic market growth is in the Czech Republic expected until 2010. The influencing factors include mainly the state regulation and requirements for the quality and standardized reporting (see e.g. Sarbanes-Oxley), competition forces, increasing dynamics of the market, new customers´ requests and so evoked pressure for the increasing quality and efficiency of the business management.

Supply chain management

The integration of the corporate informatics is oriented in the long term on the management of material flows, which enables to ensure high availability of products for custom-

ers as well as reducing of logistics costs. A mutual supply chaining is based on the complex support of ICT and applications of supply chain management software (SCM). The shortening and improvement of liability of product deliveries happens through SCM. The co-operation and integration of companies in bigger units, in which they share key information and optimize basic processes within the entire chain, therefore becomes a significant competition advantage on the market. The area of **market saturation** in the Czech Republic moves around 30 – 40 % for SCM applications (see Table 8).

Table 8: Forecast of market saturation for SCM (in % of respondents, 2006)

	Market Saturation in %								
	10	20	30	40	50	60	70	80	90
Respond.	2	5	15	15	3	3	2	2	2

Source: Own survey.

The applications were initially limited to the ability to forecast customer demand and thus ensure as smooth functioning of the entire chain as possible. Current technologies offer entirely new possibilities and use of effective management methods: **(**1) Continuous replenishment planning (CRP), (2) Vendor managed inventory (VMI), (3) Efficient customer response (ECR), (4) Collaborative planning, forecasting and replenishment (CFPR).

Customer relationship management

The main task of **customer relationship management** (CRM) is to create the relationships to customers and improve them by using various communication channels including the Internet. The main functions of CRM are (1) Monitoring of customer demands and their assessment, (2) Creation of a new value with the utilization of complex and consistent information on customers, (3) Focus of business resources on activities leading towards creation of long-term and economically valuable customer relationships.

Market saturation with CRM applications in the Czech Republic is between 30 – 60 % (see Table 9), the representatives of foreign companies mention 30 – 40 %. The difference is caused by a different understanding of this term by suppliers of mainly inland solutions. A considerable revival of customers´ interest in these kinds of applications is happening though; after a certain decrement caused by smaller effects as compared to expectations.

The majority of customer disillusions from launching of CRM applications has been caused by a wrong strategy and errors in the implementation. As experience show, if the CRM is not executed in a close link on the re-engineering of corporate processes its contributions are very limited. It is expected that with new supplier experience will also come other positive shifts in the offer and demand on the ICT market. A demand increase can therefore be definitely expected in the CRM area.

Table 9: Forecast of Market Saturation for CRM in Czech Republic (in % of the respondents, 2006)

	Market Saturation in %								
	10	20	30	40	50	60	70	80	90
Respond.	3	3	14	8	3	12	2	0	2

Source: Own survey.

Expected development of application products

Product development can be distinguished according to the extent and way of realization, i.e. adjustments from tiny appearance and functionality changes to changes in algorithms and significant technological innovations (see Table 10). The situation of the market saturation forces the suppliers to bigger innovation of their ERP solutions. It is developed both of enhancing the algorithms (increase of positive answers by 30 % compared to last year) and also includes extension of the functionality. The proportion of products with significant innovation does not change.

Table 10: Expected development of ERP products in Czech Republic (in % of respondents, 2006)

ERP Products Development	%
No Changes	17
User Interface	15
Functionality Changes	8
New Algorithms	18
New Functionality	30
Conception Innovation	11

Source: Own survey.

One of the sharp development tendencies of the ERP products is a use of various means and technologies for the function of **e-commerce** (see Table 11). The representation of XML environment is very strong on 92 %, which leads to the support of mostly specialized applications for exchange of business documents with external partners. The representation of the support of already classic EDI standards (electronic data interchange), such as EDIFACT, ANSI X.12, ODETTE and other standards for electronic data exchange is a bit lower.

The support of **on-line shops** implementation and use of mobile devices (mobile phones, communicators and others) is very strong as proved by a significant and so-far much unfilled potential for applications of this type. On the other hand, the development in functionality of e-marketplaces in consideration is significantly lower. Rather specialized products are asserted in this area with lower integration into basic enterprise applications.

Table 11: Support of E-commerce in ERP products in Czech Republic (in % of respondents, 2006)

ERP Support	%
Market Places	19
Online Shops	66
Supplier Auctions	22
EDI Support	76
XML Support	92
Mobile Devices	66

Source: Own survey.

Another, significantly establishing group of products on the ICT market are applications for **enterprise content management** (ECM). Here belong technologies and applications for data and document management characterized as non-structured (in contrast to databases for ERP, BI and other applications) – they represent up to 80 % of data in the company on average. The functionality of offered ECM solutions gradually increases. A convergence and an integration of once independent applications is happening, their enrichment by other modules.

Expected development of ICT services

Informatics services are a phenomenon on the current ICT market. One of the problems with analysis and estimations of further progress is their structure. OECD divides services into twelve groups (e.g. technical consultations services in ICT, design and development services, hosting services, implementation services and others). In the case of services connected to the implementation of standard applications on the Czech ICT market becomes evident a tendency to increase a proportion of costs on the administration and maintenance oft these systems. A decrease in proportion of income from the sale of licenses and, by contrast, an increase in proportion of income from services is indicated also in information as published by most of the suppliers.

From the long-term perspective the tendency towards increasing of the percentage proportion of administration and maintenance costs of these systems results on the Czech market of services associated with the ERP. Changes in this area are indirectly symbolized in a way, in which financial values of the implementation and subsequent maintenance of applications, or the application software are shown. Looking at the results of this year's survey compared to the previous years, there was less percentage formulation of these amounts from purchase prices (which then the user has to recalculated for possible basic comparison of the products) or their value is only shown absolutely in relation to one month, which causes their optical decrease.

The nature and types of offered **implementation services** in the next years is illustrated in Table 12. Completely dominating endowment of suppliers with their own implementation methodologies (i.e. recommended procedures for analyses, projection and launching of ERP solutions into operation) and their rendering to customers is evident. Relatively high percentage of offered services appears in the improvement area, or re-engineering of corporate processes. Another tendency towards a very strong support of process automation (workflow) integrated in the basic corporate ERP applications can be therefore expected.

Table 12: Nature of rendered implementation services in Czech Republic (in % of respondents, 2006)

Service Nature	%
Own Methodology	93
Process Improvement	61
ASP	27
Consultancy Co.	27
Virtual Company	22
Knowledge Databases	63

Source: Own survey.

The anticipated development of the range of implementation services connected with the implementation of application products (see Table 13) is nearly identical with previous years.

A certain shift compared to previous years represents a fact that, even in 2005, the suppliers promised their extension in approx. one third of the cases, whereas in 2006 it was only approx. 2 % of suppliers, which in our case means one supplier. All the others assume an identical level of services within the common maintenance.

Table 13: Presumed development of implementation services in Czech Republic (in % of respondents, 2006)

Service Progress	%
No Changes	56
Scope Decreased	2
Scope Increased	32

Source: Own survey.

As shown in the overview, the Czech ICT market is very dynamic and its further positive development, mainly towards services and more advanced applications, can be expected.

3.3 Evaluation of effects of business informatics

Results of executed corporate surveys in given area during 2006 are shown in this section. The survey included three main spheres of respondents: top managers on the Czech market (18), workers in middle management and operative level management (33) and managers and specialists acting directly in ICT area (67). Respondents come from companies of various sizes – from small to big – and act on markets of various sizes (national to worldwide). Results assessment is divided into the following parts: (1) analysis of really reached effects in companies in the view of their content, significance for company and then according to the level of their management, measuring and evaluation, (2) analysis of effect sources, i.e. main components of the corporate informatics and their management.

Effects of informatics and their management

Effects connected with an increase in process capacity of the company and the quality of its management prevails on evaluation of achieved effects in the informatics according to their **content definition** (see Table 14).

Table 14: Informatics effects distribution according to their content (in % of respondents, 2006)

	Informat-ics	Middle man.	Top man.	Total
Direct Benefits	33	6	6	21
Added Value	13	9	0	10
Economical Effects	19	36	12	23
Company's Position	10	33	29	20
Process Efficiency	37	33	47	38
Management Quality	46	36	71	47

Source: Own survey.

Answers, which accentuate the economical effects, are in the middle. On the other side, the use of the informatics as an added value to the basic offered products and services, e.g. in support of project and design works (e.g. in construction and furniture industry), consultancy services etc. is shown as very low. Furthermore, there was no positive answer in this case of top managers.

The distinction of informatics effects is, due to its use on the market, a key based on the **significance for company**. The breakdown of respondents´ answers is illustrated in Table 15. The prevailing part of the answers is related to the basic assurance of serviceability of a com-

pany, i.e. accountancy and financial operations, common business transactions etc. This value was the highest in all three groups of respondents, with top management group representing nearly 80 % of the answers. Similarly it is with values of increasing of total efficiency of a company (i.e. process, managerial and analytical). Significance is also given to the strengthening of the company's image both in top management group and middle management group. On the contrary, the image has an insignificant share in informatics group.

Table 15: Distinction of informatics significance for company (in % of answers)

	Informatics	Middle man.	Top man.	Total
Strategic Importance	40	33	18	35
Competition Advantage	27	24	35	27
Competitiveness	22	30	24	25
Company's Image	16	33	41	25
Efficiency	42	52	65	48
Serviceability	54	64	76	60

Source: Own survey.

Portions of answers in the case of the strategic importance of the informatics, or importance for the competition advantage and competitiveness may appear as relatively low. However, in comparison with the situation in the past it represents a significant move; at that time the informatics only meant a basic serviceability of a company. With respect to yet more increasing number of progressive applications we can expect even further positive development in this area. A limiting factor represents the ICT qualification of managers, yet even here we can see desirable changes.

Table 16 shows respondents´ preferences for the **measurement of effects** of the informatics. Direct financial indicators domain. Only a small part of the companies do not measure the effects at all. So-called soft indicators are preferred mainly by the group of informatics, whereas middle management inclines clearly toward the combination of hard, direct indicators and soft scaleable values. In any case these results imply a positive change compared to the past, when the opinion that the influence of the informatics can be measured with difficulty or not at all was prevailing in practice. This change is caused by already mentioned pressure of the competition and by companies owners on the direct determination of the effects, but also by the development of methodologies and models, which are used in this area more often.

Table 16: Forms of determination of effects of informatics (in % of answers)

	Informatics	Middle man.	Top man.	Total
Financial Indicators	33	27	41	32
Non-financial indic.	24	27	0	21
Soft Indicators	30	12	24	24
Combination	25	52	0	29
Nothing At All	12	15	18	14

Source: Own survey.

The quality of the informatics and its actual effects are normally linked also to the way of their **planning** within the whole management of the corporate informatics. On managerial level, the planning is systematical and regular only in a small number of cases; the proportion of the planning of the effects together with the preparation and assignment of new projects is higher, which results from existing methodologies. On the other side, only in a very limited number of organizations the effects are not planned at all.

Table 17: Method of planning of effects of informatics (in % of answers)

	Informatics	Middle man.	Top man.	Total
At project assignment	45	15	35	34
Regularly	39	33	18	34
Randomly	9	45	29	24
Not at all	6	8	18	8

Source: Own survey.

The basic impacts on the success is in this case apparently the pressure for determination of the real effects already within the project solutions and also ever more intensive need on standard project methodologies, which directly demand the specification of the target effects for each proposed project.

A favorable proportion of answers can be seen in **time distribution** of the analyses of actually achieved effects, which are carried out continuously or in regular time intervals; analyses after project completion are significantly less frequent. The effects are not analyzed at all only in a negligible number of companies (see Table 18).

The answers are mainly favorable (57 % of companies relate effects to individual corporate processes, 37 % don't) for the evaluation of relationships of the effects of the informatics to the **individual management areas**, or key corporate processes (e.g. order management, maintenance management).

Table 18: Method of evaluation of business informatics effect (in % of answers)

	Informatics	Middle man.	Top man.	Total
At project closure	30	12	13	23
Regularly	35	26	27	32
Continuously	18	29	20	21
Randomly	13	24	20	17
Not at all	3	9	20	6
Other	1	0	0	1

Source: Own survey.

The trends relates to the insistence of the management on a clear allocation of the liability of the users not only for expensed ICT costs but also planned and actually achieved effects. The actual interest in shortening of running times of the corporate processes and increasing of their flexibility changes approaches and priorities in management and operations of ICT.

Sources of informatics effects and their management

Sources of effects of the informatics are divided into personal and financial (i.e. informatics costs) and then applications, services and innovation methods of the informatics. A level of the **HR set-out** of the company is a decisive resource impacting the quality of the information system. Users according to management

levels and specialists of ICT departments can be included into the HR. The actual users determine the final effects of the informatics at a decisive rate, for the high-quality ICT and related investments may be completely depreciated in hands of incompetent and demotivated users. Therefore the analytic companies assume a significant increase in investments into the qualification programs for users.

According to the evaluations of the partial results of the survey and practical experience, the problem seems to be an appropriate structure of the qualification programs oriented mainly on the possibilities of the use of the implemented applications with respect to the needs of a company. The actual insufficiencies related to the incorrectly oriented qualification programs lead often to the functionality of the high-quality application software being used in practice in some cases only around 30 %.

Even with the prevailing number of big companies among the respondents (above 250 workers) prevail subjects with departments of 1 to 3 workers. There are only 34 % of big ICT departments (with more than 20 workers). This clearly illustrates strong tendencies towards outsourcing not only for system development but also for their operation. The tendency towards all sorts of outsourcing and thus orientation on external specialized services is definite here. Decreasing of the number of own informatics is often also lead by the determination to decrease costs and thus reaching better price-and-performance ration of the whole system.

The open question in many companies is the professional orientation of internal informatics. As the survey shows these workers focus more and more on analytic and project activities, mainly while solving strategic or specific projects compared to common operational or development works. Relatively high percentage of companies with big development teams is influenced by a strong representation of ICT companies and a high portion of big companies, which solve specific and difficult development tasks (in telecommunication, banks or utilities).

Corporate informatics costs are around 5 % of the company turnover on average. The important role is played by the industrial orientation and other company characteristics. Still relatively high costs enforce the execution of analyses specifically for the informatics. Costs are analyzed continuously in 31 % of the companies and regularly, i.e. in annual or monthly intervals even in 56 % of the cases.

In terms of details of the executed analyses, 73 % of the respondents mention a higher number of applied criteria. A frequent problem of cost analyses in the informatics is however the availability of required detailed source data from the analytical accountancy. Perhaps the most interesting observed fact is that 51 % of the companies allocate the informatics costs to individual departments, with companies where the costs are paid from budgets of specialized departments (21 %) and companies where they are paid from the ICT department budget (30 %). This is a relatively high percentage, mainly with making provision for the problems, which are brought with such allocation exactly in the informatics (e.g. re-calculation of infrastructure costs and costs of some services, questions of the license policy of the suppliers and other). Positive movements in this area can be credited to the increasing interest of the managers in the structure of users of ICT resources, in some cases with the calculation of ICT costs per individual, e.g. analyses as to what costs to allocate to one user.

In cases of **ICT applications** it has clearly resulted from the survey that the decisive use has standard enterprise ERP systems in the companies. By individual application modules, in companies are operated e.g. financial modules (71 %), modules for management of sale, purchase, warehouse (65 %), HR management (71 %), production management (41 %) etc. The utilization of currently highly perspective BI application was very different according to their types. Definitively the biggest use has the standard reporting. The use of data warehouses as the core of a BI complex is on 30 %, which represents a favorable movement, but in comparison with the Western Europe (50 %) or even USA (80 %) it is still a very humble number. Similarly, the use of data-mining applications is very low.

In e-business area, applications of e-commerce dominate, i.e. applications ensuring usually the sale through business web applications to the end users (see Table 19). It is obvious that in this case these are mainly companies of a retail nature, which impacts the utilization scope. The use of roles of e-procurement is very low, i.e. applications and tools ensuring direct communication and business links between two companies. These results are partially compensated in the actual use of e-marketplaces and systems of supplier chain management.

Table 19: Use of e-business applications (in % of answers)

	Informatics	Top man.	Total
E-shop	22	12	20
E-procurement	3	6	4
E-marketplaces	7	6	7
Supplier chain management	7	12	8
Mobile commerce	0	0	0
Other applications	3	0	2

Source: Own survey.

Applications complex, so-called enterprise content management (ECM) shows higher use, mainly with applications of tools of clearly infrastructure nature (e.g. document management, groupware, web content management, and workflow) – see Table 20. From the perspective of the company's performance is the scope of the use of workflow management important and with its integration into other application products (e.g. EPR) it can be expected its further positive progress.

Table 20: Use of enterprise content management applications (in % of answers)

	Informatics	Top man.	Total
Groupware	39	41	39
Document Management	43	47	44
Workflow	36	29	35
Web Content Manag.	33	35	33
Product Management	7	6	7
Multimedia Management	6	12	7
Knowledge Management	13	18	14
Other	0	0	0

Source: Own survey.

4. Conclusion

In the long-term horizon, following a period of temporary slow down of economic performance in the latter half of 1990s, the Czech Republic experiences a considerable **acceleration of growth dynamics.** Significantly pro-growth was the impact of the system changes related to the economic transformation (privatisation, liberalisation, openness towards outside) in combination with robust structural changes, thanks to which resource allocation (static efficiency) and technology level of production (dynamic efficiency) improved. The external openness played a key role in penetration of domestic producers to the qualitatively more demanding international markets and their inclusion to the supra-national value chains (through inflow of foreign direct investment).

The high growth performance also reflects in successful **conversion of CR economic level** to the (present) EU-27 average. This, however, at the same time, causes inevitable exhaustion of the so far prevailing sources of competitive advantage based rather on low costs and adoption of foreign technologies (both in export performance and in attractiveness for foreign investors). The new EU members thus face the major challenge of **qualitative shift** of sources of their competitiveness, especially through development of their own innovation capacity.

The loss of cost advantage requires **new sources of competitiveness** – a supply of unique, constantly innovated products and processes with high added value produced and applied by educated workforce in a flexible business environment. In fact, the necessity of changing sources of competitive advantage in the environment of knowledge-based global economy has been faced by most EU countries.

Even though the year 2010 has been approaching, the **Lisbon Strategy** has not yet achieved a convincing result in relation to the originally defined objective. Europe has not yet significantly approached its main competitors (USA, Japan) and, in addition, new ones have emerged (India, China and other emerging markets). Regarding the approaching deadline of 2010 sharper discussion may be expected on further progress of the Lisbon agenda. Various levels of this discussion largely reflect the prevailing, or growing differences in sources of competitiveness among countries and regions of EU.

The position of the Czech Republic is typical of the group of the less developed EU members, i.e. with prevailing reliance on adopted technologies, own innovation capabilities being still less developed. Even though **increased innovation performance** is in the focus of interest in the all EU members, on the national level there are considerable differences, especially manifested by the advance of Scandinavian countries both in innovation inputs and in innovation outputs. The position of new members in development of innovation-based competitiveness represents a great challenge for formulation and implementation of the supporting policies. Their specifics are not yet sufficiently considered on the EU level and their position is often perceived as second-rate.

The Czech Republic is one of the best among the new EU members, which means an average position among EU-27. The key issue therefore is the form ad scope of the impulse that might stimulate a shift towards **above-average results** in knowledge production and their use in knowledge high intensive industry and service activities. This shift is absolutely necessary for sustainability, let alone increase of innovation-based competitiveness.

The new EU members, thanks to their medium-technology intensive structure in the traditional manufacturing industries, are most threatened by competitors from the emerging Asian and Latin American economies. Their qualitative position in global economy begins to change – they penetrate more and more to the segments with **higher technology intensity**, they are able to offer attractive conditions for technology intensive foreign investment, including above-average production of highly educated human resources. EU countries will inevitably face external competition on ever higher levels of technology knowledge.

Skill levels increase globally, with an especially quick increase in emerging markets (allowed by availability of cheap and skilled workforce in large masses). A new dimension is represented by support of inflow of high-skilled human resources by means of selective immigration policy. This inflow, however, is in the first place affected by the knowledge and economic attractiveness of the domestic innovation system for talented individuals. In that point the discussion starts about policies attracting high-skilled workforce to EU, including application of the "green card" instrument (in a blue card version). On the other hand, the new EU members face the outflow of qualified workforce to the more developed members and the EU as a whole faces brain-drain to the USA and the weaker attractiveness for non-European brain inflow in competition with the USA.

Trade, foreign investment and research and development in the emerging markets show ambition as well as potential to cover the whole product spectrum, i.e. including skill and technology intensive outputs. The share of emerging markets in total foreign investment will keep growing and at the same time the structure of trade and investment will include an ever growing share of flows into industries with higher value added. Europe is thus increasingly facing competition of the less developed countries even in skill and technology intensive industries with an unrivalled cost advantage on their side.

The ever growing role in the national innovation system is played by **foreign companies**. It is therefore desirable to maximise their contribution to development of domestic knowledge base, i.e. technology transfer. EU countries ever more intensely strive to attract technology intensive foreign investment competing with each other and with emerging Asian markets. Even within EU there are tensions related to the ongoing or expected relocation of production chains to cheaper destinations, including segments more intensive in terms of in-house research activities. Even though in the Czech Republic the share of foreign companies in investment into research and development keeps growing, their share in the value added remains below the EU average.

Technology progress, especially in ICT, the relative growth of the service sector and change of business models allow for increased share of services, research and development and financial and human capital in cross-border flows. The increased mobility of knowledge intensive production activities requires a corresponding

form of **business environment** with an emphasis on deregulation and flexibility of product and factor markets. The key role of SMEs with high growth and innovation potential in these segments requires minimisation of regulatory burdens (in the first place negatively affecting these entities), easy access to financing sources and flexible labour supply. Discussed is the orientation and effectiveness of policies specifically focusing on this segment of businesses (small, with high growth and innovation potential).

Competitiveness and its sources are region- and industry-specific. The most dynamic industries in the Czech Republic include **electro-technical industry**, i.e. production of office technology, computers and communication technologies. Nearly all production is exported and at the same time most components are imported. Therefore in the Czech economy this industry creates low value added and contribution to trade balance. Despite the industry classification as high-tech, the stages of production chain located in the Czech Republic still show very low level of investment into research and development and include mostly assembly operations. The principal competitive advantage is based on low labour costs together with geographic position. Growing wages will therefore increase the risk of relocation of the production capacities to countries with more competitive labour costs.

Pillars of Czech economy include industries with medium technology intensity and long tradition in the country, such as **production of transport vehicles and mechanical engineering.** These industries are largely export-oriented and their demand for imported components is lower, which positively affects trade balance. There is also a strong influence of automotive industry onto the rest of economy through supplier-customer relationships (manufacture of rubber and plastic components, glass industry).

Both mechanical engineering and, above all, automotive industry relatively largely invest into research and development and improvement of their workforce skills. The Industries face increasing lack of suitable candidates for jobs on the Czech labour market, which results in recruitment of foreign workers. Despite the strong pressure on wage increase (so far balanced by productivity increase) relocation of production into cheaper destinations is not very likely at the moment. Increasing labour costs and lack of skilled workforce, however, may lead to attenuation of investment and stagnation of production.

The declining industries include mainly **textile and clothing.** Especially the other is strongly affected by competition from cheaper Asian producers. Prospering segments include production of fashionable and stylish collections achieving relatively high profit margins. Even this segment, however, experiences relocation of the labour-intensive parts of production to cheaper countries. In textile industry the most competitive activities include production of technical textiles with its relatively strong cooperation with applied research. In this area the Czech Republic should make use of its competitive advantage based on strong tradition and skilled workforce. Even in low-tech industries there are parts of the value chain that create high value added. Examples include research and development activities in production of nanofibres, or marketing in clothing industry. The role of design keeps increasing in all segments of production of consumption goods.

Development of individual industries is closely connected with **regional competitiveness.** Industrial regions face loss of competitiveness as a consequence of the strong Czech currency and increasing wage costs. Most large foreign investments in the past went to industries mostly threatened by price competitiveness of countries with low production costs. The regions making currently best use of the prosperous manufacturing (especially Central Bohemia, Pilsen Region and Moravian Silesia) can face structural problems in the future due to the potential loss of competitiveness. In addition there may be an unfavourable impact of global demand on certain industries on which the regions rely (manufacture of metals, manufacture of cars and car parts, electro-technical industry). What may also be expected is unfavourable impact of the growing lack of skilled workforce and filling of the attractive industrial zones, which is mainly the case of Central Bohemia, South Bohemia and Pilsen region. Lack of workforce may be partially compensated by increased mobility of citizens under the pressure of the reform of the social system and inflow of foreign workers.

The Capital City of Prague will on the one hand deal with absence of contributions from the EU Structural Funds and lack of skilled workforce, but on the other continue to make use of its importance as a centre of services, institutions of public administration, research and development and natural significance as a metropolitan area. The strong concentration of services and the significance of the country capital provide Prague with better protection against potential global economic recession.

Moravia-Silesia, in the period of transformation one of the regions whose structure was most negatively affected, is now in the stage of favourable economic development. Sustainability of this development depends on the global demand for commodities forming the basis of current regional prosperity, i.e. especially production of steel, cars and car parts.

The continuing growth of foreign demand, interest of foreign investors, the convenient geographic position and extensive supply of workforce may represent an impulse for development of the regions with most negatively affected **structure in the past** in North Bohemia – Liberec and Usti regions. On the other hand, in the case of the Karlovy Vary region the interest of foreign investors is minimal. The basic preconditions of more dynamic development include improvement of transport accessibility.

Modern production capacities become a potential factor of increase of innovation activities in a number of **off-Prague regions**, including those where in the past hardly any research and development activities existed (such as the Vysocina region). On the other hand, long-term unfavourable development is shown by indicators of innovation performance of Karlovy Vary and Usti regions and Moravia- Silesia. Potential boom in these regions is therefore rather based on production with low value added. The threats following from loss of cost competitiveness are therefore the highest in their case. One of the ways out may be more dynamic development of services and technology more intensive production (unlike the to-date focus of investment incentives).

In the case of **periphery regions**, today mostly badly affected by structural problems, it is worth considering revaluation of their position as fringe regions (especially to Prague) to parts of other areas with their natural centres. An alternative to connection of every region to a motorway may be connection of the regions with important metropolises abroad. Due to accession to the Schengen area

increased mobility of inhabitants of the **border regions** may be expected. A good example is Moravia Silesia (very narrowly connected with Polish Silesia and North-West Slovakia) or South Moravia (close to Vienna and Bratislava country capitals). As shown by Korean investment in the northern regions of the Czech Republic, some companies already take these deeper interconnections into consideration. Besides maximum efforts at exploitation of the Structural Funds, regional policies should in future also focus on the disparities between cities and the countryside, which is mainly a problem of Moravian regions.

System changes, the growth of external openness, use of technology transfer and development of educational and research capacities in the CR have favourably affected above all the so-called **absorption capacity** for successful technology catch-up. Thanks to integration into supranational value (mainly production) chains the share of industries with higher (medium-high) technology intensity has significantly increased, while their actual knowledge intensity has still remained low. There is the prevailing reliance on adopted technologies (external technology knowledge) with eventual modifications for local needs.

In just a small number of companies **innovation activities** (whether in-house or external) represent a strategic source of their competitiveness. Another problem is strong specialisation to traditional manufacturing industries with rather limited technology potential and strong sensitivity to decreasing cost competitiveness. Underdeveloped remains the segment of industries with **high knowledge intensity** (based on top technology and development of own innovation capacities) and thus high value added both in manufacturing and in services (the so called science-based industries, or industries of specialised suppliers).

The reason for this underdevelopment lies above all in low knowledge intensity and development dynamics of the national innovation system and therefore its **low productivity** – with the result of missing top quality human and technology resources (outdated infrastructure), or low efficiency of their exploitation. The cause is a poorly adjusted system of **public support** (both innovation performance in narrow sense and innovation-friendly institutional environment) in combination with the so far low level of innovation demand of the business sector and weak linkages between the key agents of the innovation system.

The formation and development of top innovation capacities and innovation environment **is not effectively supported** – neither systemically nor specifically. Despite the growing expenditure on education and research (as necessary but not sufficient preconditions for increasing innovation performance) the technology level of production and innovation performance increase rather slowly – the expended support resources (including generous investment incentives) therefore show weak pro-innovation impact.

Traditional manufacturing industries with **medium technology intensity** are not sufficient for a more remarkable improvement of competitiveness of the new EU members. Long-term competitive advantage requires development of activities with higher value added, i.e. an effective innovation system with a dynamic core of top technologies wrapped in a cluster of knowledge-intensive, closely linked industries (innovation clusters). Modern **innovation policy** plays a significant role in development of such a system, combining horizontal support (of closely related research, education and innovation activities and pro-innovation environment) with measures focusing on excellence with strong spillovers. However, the so far formulated concept and especially the practice of innovation support are very remote from a policy of such a type.

What survives in the Czech Republic in particular is the traditional concept of the key role of the **basic (academic) research** in the national innovation system with broad support mostly without a reference to (objectively measurable) performance. While in the developed countries second generation innovation policy has developed since 1990s with a focus on systematic approach supporting the key agents and activities of the innovation system, in the Czech environment such integration has not even started yet, and there is not yet even any qualified discussion about a shift from the outdated policy of research support to the innovation policy.

The growing attention paid to the relevance of innovation for economic and social growth necessarily invoke efforts at identification of the decisive **pro-innovation factors.** Following this historic experience there is a discussion about use of targeted support for innovation performance. The innovation process changes especially thanks to the importance of non-technical innovation in the service sector. There is a clear growing inclination towards **vertical**, i.e. industry- or region-specific support (e.g. in technology platform initiatives), in addition to the traditionally preferred horizontal support. Transfer of innovation knowledge is easier, transforming the traditional approaches to protection and thus measurability of results of innovation activities.

The individual agents of innovation systems and their groups are more and more closely **linked** and their interactions represent the key precondition of innovation success. The problem faced by most EU members is particularly the weak linkage between the individual institutional sectors of the innovation system – in the first place between the academic and the business sectors. Czech companies contribute very little to financing of university research. Rather weak is also the involvement of innovation activities in long-term strategies of regional development.

In addition to targeted pro-innovation measures ever greater attention is paid to the relevance of the **broader environment** for innovation performance – quality of regulation, tax policy, business conditions, or job market flexibility. The pro-innovation environment requires flexibility of markets and minimisation of burden to its players, unbiased relationship between the incurred costs and the resulting benefits, stability and predictability of conditions for decision-making in the long run, corresponding remuneration for success and willingness to undertake a risk. European countries are characterised by generally stronger aversion to risk and uncertainty which, however, represents a necessary accompanying feature of innovation activities.

The Czech Republic lags behind more developed economies mainly in the **innovation outputs**. Recently the input indicators (financial and human resources) have significantly improved, converging to the average levels in EU-27, or even EU-15 in some cases. Therefore, besides further increase of the inputs, the economic policy should focus more on qualitative indicators, structure and effects of the expended resources. Efforts to make up for the underdeveloped **infrastructural conditions** of research activities in public institutions is certainly desirable (subsi-

dies from the EU structural funds have the same focus), but their future exploitation primarily depends on sufficient numbers of top researchers and prospective projects bringing about innovation outputs and being at least partly financially self-sufficient.

The size of **human capital** in research and development has increased considerably in the Czech Republic recently and not only due to the revised methodology of their statistical evidence. However, its structure in government and higher education sectors appears problematic, especially in terms of its age. Statistics show that especially middle-aged researchers are missing, whose productivity is the highest. This shows that it is not that much difficult to attract young specialists to Czech science, but to keep them in when they become older (mostly after they finish their Ph.D. studies). The reasons may be financial, in combination with the prospects of further career growth or opportunities for independent professional work with adequate resources and equipment.

Long discussed but yet unsolved is the issue of position of **universities** in the national innovation system in the Czech Republic. Their role as innovation agents has still been quite weak, which is caused, among other things, by the survived dual system of academic research (undertaken in public institutes) and university education. Their reintegration (together with a fierce openness towards other innovating agents) is therefore a necessary precondition for increased productivity of the national innovation system.

Without any significant systematic change in this respect a more remarkable increase of innovation outputs cannot be expected. Even though the numbers of professional publications and patent applications have been increasing, the overall falling behind (in international comparison) is still quite remarkable. Publication activities show considerable difference between the individual science fields, especially in the citation impact. While the position of the technical fields is at least average, social sciences are nearly invisible in international scale.

Informatics in Czech practice has been undergoing very **dynamic development** both on technological and on application and managerial levels. One of the key requirements is revaluation and change of priorities in investment into IT development. While in the past there was the long-term preference for building ever stronger technological infrastructure and assurance of its security, today the main emphasis is laid on increased quality of information services on the basis of ICT applications. This will also reflect in increasing demand for the standards of management of IT services, measurement of their volume and quality, and for higher level of management regarding the relationships between customers and providers of these services.

A special and ever more important application area of ICT is represented by **small and medium-sized enterprises**. Not only the Czech Republic but also the whole EU understand this segment as a substantial factor of economic growth. However, informatics of these businesses is today still confined to the basic functionalities and support to common economic tasks. On the other hand, particularly in this segment, there is a strong potential for exploitation of services and applications that might lead to increased business performance and strengthening of competitiveness of SMEs. Such applications include electronic and mobile services, application of RFID technologies, complex of applications and technologies for increasing quality of management – business intelligence, instruments for document management, work flow management etc. There are still significant differences between the individual businesses of this size.

Another strong challenge for Czech informatics is represented by **electronisation of public administration** (e-government). As shown by EU statistics, the Czech Republic is one of the least developed countries in this aspect. It is not influenced by the quality of technological infrastructure itself but by its application in practice, by revaluation and change of administrative management procedures in relation to deployment of advanced ICT, by limited possibilities of database sharing in more offices etc. The nearest task therefore lies in valorization of investment incurred into computer and other technologies and their more rational exploitation in favour of businesses and citizens of the Czech Republic.

One of the basic issues faced by the Czech Republic is lack of **qualified ICT staff,** both on the part of suppliers and on the part of customers. Czech universities do not produce a sufficient number of graduates in ICT and the imaginary scissors between the supply and the demand keep opening apart. Very difficult for example is provision of the required workforce for global service centres, such as those established in Prague and in Brno by IBM and DHL companies etc. Provision of skills for ICT may also be considered one of the most substantial challenges not only for informatics as such but for Czech universities in general.

References

Adámek, P., Csank, P., Žížalová, P.: Regionální hospodářská konkurenceschopnost. Praha, Berman Group 2006.

Adámek, P., Vlasák, T.: Průzkum prostředí pro vědu, výzkum a spolupráci v podnicích Pardubického kraje. Praha, Berman Group 2006.

Adámek, P., Žížalová, P.: Průzkum prostředí pro konkurenceschopnost a inovace v podnicích Karlovarského kraje. Praha, Berman Group 2007.

Arundel, A., Hollanders, H.: EXIS: An Exploratory Approach to Innovation Scoreboards. Brussels, DG Enterprise 2005.

Arundel, A., Hollanders, H.: Innovation Strengths and Weaknesses. Brussels, DG Enterprise 2005.

Basl, J.: ERP pro malé a střední firmy. *Business World*, 2005, 10, pp. 34–43.

Basl, J.: Podnikové informační systémy. Praha, Grada 2002.

Basl, J.: Přehled podnikových informačních systémů na českém trhu, Praha, Businessworld 2006.

Bjorn Andersen, N.: The Never Ending story of IT Impact on the Organization. Berlin, Springer 2006.

Bloch, C.: Innovation Measurement: Present and Future Challenges. EUROSTAT conference: Knowledge Economy. Luxembourg, 8–9. 12. 2005.

Borbély, D.: Trade Specialization in the Enlarged European Union. New York, Physica-Verlag 2006.

ČNB: Statistika přímých zahraničních investic, 2000-2006: www.cnb.cz

ČSÚ: Databáze Ročních národních účtů: www.czso.cz

ČSÚ: Evropský systém účtů ESA 1995. Praha, ČSÚ 2000.

ČSÚ: Krajské ročenky 2005: www.czso.cz

ČSÚ: Regionální účty 2005: www.czso.cz

ČSÚ: Statistická ročenka vědy a technologie. Praha, Český statistický úřad 2005.

ČSÚ: Statistické šetření o technických inovacích. Praha, Český statistický úřad 2003, 2005, 2006.

ČSÚ: Ukazatele vědy a techniky v ČR za období 1995–2002. Praha, Český statistický úřad 2004.

ČSÚ: Ukazatele výzkumu a vývoje 1999–2005. Praha, Český statistický úřad 2000–2006.

ČSÚ: Ukazatele výzkumu a vývoje v ČR: www.czso.cz

Davis, G. B.: Information Systems as an Academic Discipline: Looking Back, Looking Forvard and Ensuring Future. Berlin, Springer 2006.

Dietzenbacher, E., Van Der Linden, Jan, A.: Sectoral and Spatial Linkages in the EC Production Structure. Journal of Regional Science, 1997, 2, pp. 235–257.

Dohnal, J.: *Řízení vztahů se zákazníky – procesy, pracovníci, technologie*. Praha, Grada 2002.

Doloreux, D., Parto, S.: Regional Innovation Systems: A Critical Review. Maastricht, MERIT 2004.

EC: A Year of Delivery: The European Commission´s 2006 Annual Progress Report on Growth and Jobs. Brussels, European Commission 2006.

EC: Adaption of Information & Communication Technologies (ICT) by Business. Brussels, European Commission 2006.

EC: Annual Information Society Report 2007, Brussels, European Commission 2005.

EC: Competitiveness and Innovation Framework Programme. Brussels, European Commission 2005.

EC: European Competitiveness Report 2006. Brussels, European Commission 2006.

EC: European Regional Innovation Scoreboard. Brussels, European Commission 2006.

EC: Towards a European Research Area, Key Figures 2003–2004. Luxembourg, European Commission 2005.

EIS: European Innovation Scoreboard. Brussels, European Commission 2003–2006.

English, L. P.: Improving Data Warehouse and Business Information Quality: Methods for reducing costs and increasing profits. John Wiley & Sons, New York 2003.

EUROSTAT: Databáze Regions and Cities: http:// ec. europa.eu/eurostat

EUROSTAT: Databáze Structural Indicators, Science and Technology. Luxembourg, EUROSTAT 2007.

EUROSTAT: R&D and Internationalisation. Statistics in Focus, 2005, 7.

EUROSTAT: The ESA 95 Input-Output Manual. Luxembourg, EUROSTAT 2002.

EXIS: An Exploratory Approach to Innovation Scoreboards. Brussels, European Commission 2005.

Falk, M.: What Drives Business R&D Intensity Across OECD Countries? Vienna, WIFO 2004.

Fať un, M.: TOP 100, Český trh. *Computer World*, 2005, speciální vydání, pp. 1–11.

Frantzen, S.: Silná poptávka, dobré vyhlídky. Computer World, 2005, speciální vydání, pp. 12–19.

Gála, L., Pour, J., Toman, P.: Podniková informatika. Praha, Grada 2005, 2006.

Gejdoš, V.: Vývoj konkurenční schopnosti výrobků zpracovatelského průmyslu před vstupem ČR do EU (1997–2003). *Statistika*, 2006, 6, pp. 463–475.

Godratt, E. M., Schragenheim, E., Ptak, C.A.: Jak vzniká zisk. Praha, Grada 2004.

Havlik, P.: Structural Change, Produktivity and Employment in the New EU Members. Vienna, WIIW 2005.

Hoffman, T., Mandík, P.: Znají ty správné odpovědi na záludné otázky financování IT. *Computer World*, 2004, 39, pp. 11.

Chen, D., Dahlman, C.: The Knowledge Economy, the KAM Methodology and World Bank Operations. Washington, World Bank Institute 2005. WP No. 37256.

IMD: The World Competitiveness Yearbook. Lausanne, International Institute for Management and Development 2004-2007.

ISI: ISI Web of Science. Institute for Scientific Information: www.isinet.com.

Jasinski, A. (ed.): Transition Economies in the European Research and Innovation Area. New Challenges for their Science and Technology. Warsaw, Warsaw University 2004.

Jaumotte, F., Pain, N.: An Overview of Public Policies to Support Innovation. Paris, OECD 2005.

Jaumotte, F., Pain, N.: Innovation in the Business Sector. Paris, OECD 2005.

Jen čtvrtina lidí v Česku je počítačově gramotných. Computer World, 2005, 21, pp. 10–12.

Kadeřábková, A. a kol.: Proces konvergence v nových členských zemích EU. Praha, CES VŠEM 2007.

Kadeřábková, A., Müller, K.: Národní inovační systémy: výzkumné a vývojové zdroje, infrastrukturní předpoklady. Praha, CES VŠEM 2005.

Kadeřábková, A., Rojíček, M.: Internationalization of production, trade and innovation. In: K. Piech (ed.), Knowledge and innovation processes in Central and East European economies. Cracow, EIKON Plus 2007, pp. 293–312.

Kadeřábková, A.: Inovační výkonnost v učící se ekonomice. In: A. Kadeřábková a kol., *Růst, stabilita a konkurenceschopnost III*. Praha, Linde 2007, pp. 327-344.

Kadeřábková, A.: Kvalitativně založená konkurenční výhoda ČR v globalizované ekonomice. Praha, CES VŠEM 2007.

Kadeřábková, A.: Strukturální charakteristiky konkurence-schopnosti české ekonomiky. Praha, CES VŠEM 2007.

Kadeřábková, A.: Výzvy pro podnikání – inovace a vzdělání, Česká republika na cestě ke znalostně založené ekonomice. Praha, Linde 2004.

Kahoun, J.: Ukazatele regionální konkurenceschopnosti v České republice. Praha, CES VŠEM 2007.

Kaplan R. S., Norton D. P.: The Balanced Scorecard. Boston, HBS Press 1996.

Kleinknecht, A., van Montfort, K., Brouwer, E.: The Non-trivial Choice between Innovation Indicators. *Economics of Innovation and New Technology*, 2002, 11, pp. 109–121.

Landesmann, M. et al.: Structural Developments in Central and Eastern Europe. Vienna, WIIW 2000–2007. Research Report.

Landesmann, M., Worz, J.: CEEC's Competitiveness in the Global Context. Vienna, WIIW 2006.

Laube, D. R., Zammuto, R. F.: Business Driven Information Technology. Denver, Stanford Business Books 2003.

Laudon, K. C., Laudon, J. P.: Management Information Systems – Managing the Digital Firm. New York, Pearson Prentice Hall 2006.

Lehvo, A., Nuutinen, A.: Finnish Science in International Comparison: A Bibliometric Analysis. Helsinki, Academy of Finland 2006.

Lundvall, B. A.: National Innovation Systems – Analytical Concept and Development Tool. Kopenhagen, Business School 2005.

Malerba, F.: Sectoral Systems of Innovation and Production. *Research Policy*, 2002, 2, pp. 247–264.

Matějka, M.: Management by ROI – Nový univerzální řídící princip, metodologie, informační systém a aplikace. Praha, Oeconomia 2005.

McFarlan, F. W.: Information Technology Changes the Way you Compete. Boston, Harward Business Publishing 1984.

Meske, W. (ed.): From System Transformation to European Integration. Science and Technology in Central and Eastern Europe at the Beginning of the 21st Century. Münster, LIT Verlag 2004.

MPSV – Zaměstnanost. (Integrovaný portál MPSV): http://portal.mpsv.cz/s

Müller, K.: *Industriální zdroje, ekonomický růst a sociální změna*. Praha, SLON 2002.

Novotný, O., Pour, J., Slánský, D.: Business Intelligence. Praha, Grada 2005.

Nunnenkamp, P., Spatz, J.: Intellectual Property Rights and Foreign Direct Investment: The Role of Industry and Host-Country Characteristics. Kiel, Institute for World Economics 2003.

OECD: AFA Database. Paris, OECD 2005.

OECD: ANBERD Database. Paris, OECD 2005.

OECD: Communications Outlook. Paris, OECD 2005.

OECD: Economic Policy Reforms: Going for Growth 2006. Paris, OECD 2006, 2007.

OECD: Frascati Manual. Paris, OECD 2002.

OECD: ICT Key Indicators. Paris, OECD 2005.

OECD: Information Technology Outlook, Paris, OECD 2006, 2007.

OECD: National Accounts of OECD Countries. Paris, OECD 2005

OECD: Oslo Manual. Paris, OECD 2005.

OECD: Potential Impacts of International Sourcing on Different Occupations (Working Party on the Information Economy). Paris, OECD 2006.

OECD: Regions at a Glance, Paris, OECD 2007.

OECD: Science, Technology and Industry Outlook 2006. Paris, OECD 2006.

OECD: Science, Technology and Industry Scoreboard 2005. Paris, OECD 2005.

OECD: Venture Capital Database. Paris, OECD 2006.

Pazour, M.: Inovace ve službách – koncepční rámec. Praha, CES VŠEM 2007.

Policejní prezídium ČR – statistické přehledy kriminality členěné do VÚSC: www.mvcr.cz/statistiky/index.html.

Porter, M.: Building the Microeconomic Foundations of Prosperity: Findings from the Business Competitiveness Index. In: Global Competitiveness Report 2003–2004. Oxford, Oxford University Press 2003, pp. 29–56.

Pour, J.: Co lze očekávať od Business Intelligence? *Systémová integrácia*, 2006, pp. 47-59.

Remr, J.: Jak se láme chléb v IT? *Computer World*, 2005, speciální vydání, pp. 46–48.

Rojíček, M.: Strukturální analýza české ekonomiky. Praha, CES VŠEM 2007.

Rojíček, M.: Strukturální charakteristika nabídkové strany české ekonomiky. Politická ekonomie, 2007, 4, pp. 435-457.

Řepa, V.: Podnikové procesy. Praha, Grada 2006.

Sala-i-Martin, X., Artadi, E.: The Global Competitiveness Index. In: Global Competitiveness Report 2004–2005. New York, Palgrave Macmillan 2004, pp. 51–70.

Smith, K.: Measuring Innovation. In: Fagerberg, J., Mowery, D. C, Nelson, R. (eds.): The Oxford Handbook of Innovation. Oxford, Oxford University Press 2004.

SPIS: Manifest znalostní společnosti 2005 – Cesta k úspěchu, Praha, Sdružení pro informační společnost 2005.

Srholec, M.: Teoreticko-metodologická východiska hodnocení inovační výkonnosti na alternativních analy tických úrovních. Praha, CES VŠEM 2005.

Vavrla, L., Rojíček, M.: Sestavování symetrických input-output tabulek a jejich aplikace. *Statistika*, 2006, 1, pp. 28–43.

WEF: Global Competitiveness Report 2004–2007. New York, Palgrave Macmillan 2003-2006.

WEF: Global Information Technology Report 2004–2007. New York, Palgrave Macmillan 2003-2006.

WEF: The Lisbon Review 2004, 2006: www.weforum.org

World Bank: Knowledge Assessment Matrix 2006–2007: www.worldbank.org/kam.

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