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The Hungarian ICT sector – a comparative CEE perspective with special emphasis on structural change

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Summary: This paper analyses the Hungarian ICT sector from a Central European and Estern European perspective. It outlines the position of the ICT sector in Central European and Eastern European states. Furthermore, it describes the impact of ICT on structural improvement in the regiuon. In conclusion, it gives an overview of the Hungarian ICT policy.

Zusammenfassung: Dieser Aufsatz analysiert den ungarischen IKT-Sektor aus einer vergleichenden mittel- und osteuropäischen Perspektive. Es wird der Stand der verschiedenen IKT-Branchen mittel- und osteuropäischer Länder herausgearbeitet. Zudem erfolgt eine Beschreibung der Auswirkungen von IKT auf strukturelle Verbesserungen in der Region. Abschließend wird ein Überblick über die ungarische IKT-Politik gegeben.

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1. Introduction

ICT is highly associated with technological development in organizations, companies, regions and countries (EC, 2009, EDQUIST, 1997, LUNDVALL, 1992). It contributes to economic and productivity growth with the following effects (OECD, 2004): evidence in Denmark, Ireland, Sweden, the US and UK shows that ICT investments raised labour productivity acting as capital goods; technological progress in the ICT sector contributes to more rapid multifactor productivity (MFP) growth in the ICT sector; the rapid diffusion of and increased use of ICT in the economy increases overall efficiency.

Regional development is also affected by ICT sector; the related investment can differ across regions within the same country; ICT take its effects through different channels (BARRIOS et al, 2008). Technical progress takes place mainly in high tech sectors; the higher the weight of ICT producing industries in total output, the higher the impact on economic growth via multifactor productivity improvements. ICT capital accumulation provides productivity gains in industries that use ICT and have the largest shares of ICT on total capital. ICT accelerate general technological progress by incorporating horizontal set of technologies. The latter particularly means that all sectors can potentially benefit through knowledge spillovers caused by the presence of ICT industries within the region.

The countries in Central and Eastern Europe (CEE) entered a transition period and faced the challenges of globalisation during the same period of time. During the 1990s, accession to the European Union, economic growth and modernization became increasingly crucial objectives for facing the challenges of both transition and globalization. Thus, one must consider two processes when analyzing the dynamics of ICT industry in CEE; foreign direct investment (FDI) and multinational enterprises (MNE) became decisive in shaping the national and regional innovation systems in outstanding industries (IZELT, 2003, RADOSEVIC, 2002). The concentration of industries brought new folds of regional differences related to the presence of ICT (JAKOBI, 2005).

This paper analyses the Hungarian ICT sector from a comparative CEE perspective. In the second section we introduce the status of the ICT industry of CEE countries. This is followed by a description of the effect of ICT on structural upgrading in the region. In the fourth section we give an overview of the Hungarian ICT policy. The conclusions will be drawn in the final section.

2. Current status and latest development of the ICT industry in CEE

The ICT sector, and in particular ICT services are highly concentrated spatially. This is due to the high knowledge-intensity of the sector that makes localization and urbanization economies and spatially given knowledge and technological spillovers prevail (JACOBS, 1969). The knowledge-related agglomeration economies are especially important in the case of ICT services; these can be provided at a large distance and therefore concentrate in large cities (LENGYEL, 2010). Thus, the ICT sector shares an important part in the specialisation of the richest regions of the EU15; while the ICT clusters in the EU10 still do not match this specialisation level (BARRIOS et al, 2008). Concentration in ICT prevails on a higher degree than in medium-tech industries such as the automotive industry (SZALAVETZ, 2010).

Here, we introduce the main country level trends of ICT industry in CEE according to the structure of the sector, the growth in production and foreign trade of ICT manufacturing. After these we show how big the major regional hubs in EU10 countries are compared to the ones in old member states. In the end of the section we illustrate the Hungarian ICT market in the European and CEE context.

2.1 ICT sectors in CEE from 1995 to 2004

There is a huge gap between EU15 and EU10 countries employment volumes of ICT sector. In the table below one can observe the employment structure at country and ICT subsector levels for the period from 1995 to 2004 (table 1). A substantial share of total ICT employment is located in the EU15 (88.3%); this has also increased slightly over the period 1995-2004. Meanwhile the share of ICT employment in the EU10 decreased slightly, going from 12.6% in 1995 to 11.7% in 2004.

Table 1: Share of employment in ICT in the CEE countries, 1995 and 2004 (%)

	NACE 30 Office, machinery, computing		NACE 32 Radio, Television & com. eq.		NACE 33 Medical precision & optical instr.		NACE 64 Post & Telecom		NACE 72 Computer Services		Total ICT		Total Economy	
	1995	2004	1995	2004	1995	2004	1995	2004	1995	2004	1995	2004	1995	2004
CZ	1,9	4,9	2,4	4,0	2,9	3,2	2,8	2,4	1,8	1,4	2,6	2,4	2,9	2,4
HUN	0,6	3,9	2,1	9,4	2,0	2,0	2,6	2,2	0,8	1,2	2,0	2,6	1,9	2,0
PL	1,9	2,9	5,9	3,4	4,8	4,3	6,4	5,9	1,5	2,0	4,8	4,0	6,6	5,5
SVK	0,9	1,8	1,4	1,5	1,2	0,9	1,3	1,1	0,7	0,5	1,1	0,9	1,3	1,1
EU15	93,8	85,4	85,1	78,7	87,3	87,9	84,6	86,2	94,3	94,1	87,4	88,3	84,9	86,9
EU10	6,2	14,6	14,9	21,3	12,7	12,1	15,4	13,8	5,7	5,9	12,6	11,7	15,1	13,1
EU25	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: author's edition after BARRIOS et al, 2008, at p. 13.

The decrease in the proportion of employment in the new member countries between 1995 and 2004 is probably a reflection of an overall decrease in the percentage of their share of employment in all sectors of the economy. This period is considered the late phase of transition during which time intense economic restructuring was experienced in the new member countries, and the ICT sector has been no exception to this process (HAVAS, 2006). The big state-owned companies went bankrupt or were privatized, which led to a general portfolio-cleaning in many sectors (LENGYEL and CADIL, 2009). Indeed, the decrease in the CEE employment share in total European employment is less pronounced in the ICT sector than in the rest of the economy (see table 1). There are even cases of increase on the share in certain countries and subsectors, where cost-efficiency and relatively well educated labour attracted foreign-owned firms (BARRIOS et al, 2008). Due to the investments of MNEs, EU10 countries tend to have gained employment shares in the manufacturing ICT sub-sectors, with the exception of the medical, precision and optical instruments sectors (NACE 33).

Thus, the CEE countries – and particularly the Czech Republic and Hungary – are somehow exceptions in the new member states; employment in ICT manufacturing saw a notable rise in the manufacturing of office machinery and telecommunication equipment (NACE 30 and NACE 32). The share of Hungary in the total EU employment in the manufacturing of radio, television and communication equipment rose from 2.1% in 1995 to 9.4% in 2004. The Czech Republic has almost 5% of total EU employment in the manufacturing of office, machinery and computing. Slovakian employment in ICT manufacturing increased slightly, while the change in the Polish employment share increased only in NACE 30, while decreasing in all other ICT manufacturing sub-sectors.

2.2 Development of ICT manufacturing in CEE countries, 2000-2008

In this part, we use the OECD STAN database to analyse growth in production volumes of the ICT manufacturing industry in CEE countries over the 2000-2008 period. The data are available at country level and include NACE 30, 32, 33 sectors. Euro values were calculated from national currency values at the exchange rate on the 1st of January for each year. Slovakia is an exception, because data were available directly in euro.

Table 2: Gross output at current prices, 2000-2008 (million EUR)

	2000	2002	2004	2006	2008	Growth 2000-2008
Czech Republic	10427	17447	21527	30974	44328	325 %
Hungary	20601	22025	30310	37487	n.a.	81 %
Poland	10546	13568	12434	19118	n.a.	81 %
Slovakia	3133	3824	5918	12066	15333	389 %

Source: author's calculation, OECD STAN database

Though data were not available for Hungary in 2008, the country has clearly stood out in CEE in terms of the gross output of ICT manufacturing over the decade. The Hungarian volume has been double the value in Poland. Hungary has also overperformed the Czech Republic in this sense, however the Czech output grew dynamically. ICT manufacturing performed at a much lower level but has grown quickly in the Slovak Republic.

Table 3: Export and Import of goods at current prices, 2000-2008 (million EUR)

		2000	2002	2004	2006	2008	Over production, (%) 2008
Czech Republic	export	7377	13360	18917	26878	37084	83
	import	10838	14942	18508	26153	34366	77
	balance	-3461	-1582	409	724	2719	
Hungary	export	141177	170174	237375	316127	n.a.	97 *
	import	134235	161212	203060	263410	n.a.	81 *
	balance	6942	8962	34315	52716	n.a.	
Poland	export	4830	7753	8353	15108	23893	79 *
	import	12874	14596	14684	23674	33006	125 *
	balance	-8044	-6842	-6330	-8566	-9112	
Slovak Republic	export	2300	3114	5660	13352	20273	132
	import	3873	5431	7159	13173	18721	122
	balance	-1573	-2317	-1499	179	1552	

Source: author’s calculation, OECD STAN database
Note: * - indicator for year 2006, respectively

Large differences are apparent across the CEE countries in terms of foreign trade. Similar to its gross output, Hungary stands out in the region in volume of export and also in the volume of import; these values are at least ten times larger than is the case in the Czech Republic and Poland. The trade balance was positive through the whole period only in Hungary and showed an upgrading trend. However, the high value of export is accompanied by high import values, thus the large share of export is probably import-related and is likely due to foreign-owned firms. Unfortunately, data on a company level for all CEE countries was unavailable, and we also found no statistics concerning ownership structure of ICT firms in all CEE countries. In another paper related to current research, however, it was shown that the cluster formation is highly associated with foreign-owned firms in Hungary (LENGYEL, 2010). We will illustrate cross-country differences with the help of value added and intermediate inputs in section 3.

The trade balance has become positive in the Czech Republic over the decade, and the same happened in the Slovak Republic to a lesser degree. We expect that the relatively high value of Czech ICT manufacturing export also depends on imports, as is that case in Hungary. The increasing Polish export of ICT manufacturing industry has not succeeded in outperforming the growing demand for import ICT goods, and the trade balance remained negative.

2.3 Regions

Employment in the ICT sector tends to be rather concentrated geographically around the so called blue banana of Europe (Southern UK, the Benelux and Denmark, Ile-de-France, the Western regions of Germany and the North of Italy). However, the ICT industry is also concentrated in some of the regions in the new member states. We show here the main ICT regions in terms of employment shares in total EU employment of the EU10, most of these are located in CEE countries. Malta, Kozep-Magyarorszag (HU), Mazowieckie (PL) and Praha (CZ) are the regions that emerged in the new member countries (BARRIOS et al, 2008).

Table 4: Regions of ICT concentration in EU10 coutries

	ICT sector			All sectors			
egion	rank	share of EU ICT employment	Cumulated shares	rank	share of EU total employment	Cumulated shares	GDP per capita
Közép-Magyarország (HU)	12	1,29	1,29	40	0,65	0,65	97,5 (120)
Mazowieckie (PL)	14	1,24	2,52	13	1,04	1,68	73,7 (194)
Praha (CZ)	29	0,82	3,34	92	0,38	2,06	150,8 (12)
Slaskie (PL)	47	0,53	3,87	27	0,78	2,84	54,7 (227)
Lietuva (LT)	50	0,50	4,37	30	0,71	3,56	49,0 (235)
Slovenija (SI)	53	0,49	4,86	74	0,45	4,01	79,9 (179)
Severovychod (CZ)	50	0,46	5,32	106	0,35	4,36	61,1 (218)
ihovychod (CZ)	66	0,41	5,73	88	0,38	4,75	64,7 (210)
Wielkopolskie (PL)	71	0,38	6,11	45	0,61	5,36	52,3 ()231
Dolnoslaskie (PL)	74	0,37	6,48	75	0,45	5,31	49,6 (234)

Source: BARRIOS et al, 2008 at p. 17.

Table 4 above displays the share in total ICT employment of the top ten NUTS2 regions located in the EU10 in terms of share in EU ICT employment. Most notably Praha (CZ), Közép-Magyarország (HU), and Nyugat-Dunántúl (HU) appear to be relatively highly specialised in ICT activities among all member states. ICT industries can potentially play an important role in industrial specialisation and, thus, for regional development in those regions. The specialization indexes in these CEE regions are higher than in bigger hubs of ICT in EU15 countries (BARRIOS et al, 2008). It is worth noticing that despite the dominance of the Hungarian ICT manufacturing, only one region (Közép-Magyarország) is present in the EU10 countries. Nyugat-Dunántúl is also specialized in ICT, but this region is small according to the volume of employment and has not entered the list in table

4. The Czech and Polish ICT sector is more spread over their country: more regions are in the top ten.

The regional evolution of an industry prevails through different channels in which the location of MNEs and the establishment of SMEs play decisive role (BOSCHMA and FRENKEN, 2006). While MNEs act as gate-keepers between the global and local economy, the dynamics in SME creation is likely to report on the occurrence of knowledge spillover in a region. The following statements are based on maps in the appendix of the report on regional performance of European ICT industry (BARRIOS et al, 2008)

The location pattern of MNEs in ICT industry differs according to manufacturing ICT sub-sectors. The manufacturing of office machinery and computers sector has attracted a growing number of multinationals to Poland, Slovakia and the Czeck Republic since the early 2000s, although MNEs tended to favour locations in UK, Irish, Dutch and German regions before the 2000s. Hungary lingers behind in MNE attraction, which is probably due to the fact that these firms located their sites to the country in the 1990s. Central and North-West Hungary and West Poland seems to have been more attractive for MNEs in Television and Communication equipment; medical precision and optical instruments mostly went to Poland. The ICT service sub-sector is still attracting MNEs to invest in the core regions of EU, if these were going to new member states; they were likely to choose their locations in the capital regions.

The location of new SMEs is similar to the case of MNEs, but small companies tend to be much more dispersed geographically than multinationals (BARRIOS et al, 2008). New SMEs in ICT manufacturing subsectors have been numerous in the regions located in the EU10, in particular in Czech regions and to some extent in Poland. Hungary did not perform well in SME establishing in ICT manufacturing. Only 6 SMEs were formed in the 1995-2000 period and and even fewer, only 3 in the 2001-2004 period in Television and Communication equipment sub-sector. The number of new SMEs in medical, precision and optical instruments was 7 from 1995 to 2000, and new SMEs have not been registered later. The SME creation in ICT services is much more dynamic in the Czech Republic and Poland than in Hungary. Only few companies were established in post and telecommunications, but a higher number in computing services in Budapest. However, this growth does not come anywhere near the Czech and Polish dynamics.

2.4 The Hungarian ICT market and market-related indicators in EU countries

One might find the domestic Hungarian ICT market much smaller than the value of foreign trade. This is due to the activity of multinational firms that have located their sites there because of the relatively cheap and well educated labour. These companies are not embedded in the local economy; they produce for the global market and are the main drivers of the Hungarian ICT export.

Table 5: The domestic Hungarian ICT market by product categories, 2006 and 2007 (million EUR)

Product categories	**2006**	**2007**
IT hardware	871	914
IT software	345	376
IT services	924	1044
Consolidated IT market	**2140**	**2334**
Transmitted IT hardver	663	704
Transmitted IT softver	117	150
Transmitted IT services	254	300
Cumulated IT market	**3174**	**3488**
Telecommunication services	3417	3501
Total	**6598**	**6988**

Source: NFGM, 2008, at p. 7.

The consolidated IT market includes transactions only between comsumers and suppliers, while cumulated IT market also involves transactions among IT firms. Consequently, the cumulated IT market is a wider category. Euro values in the following tables were calculated from average HUF/EUR exchange rates in 2006 (264 HUF= 1 EUR) and 2007 (253 HUF= 1 EUR).

IT services present the biggest field of consolidated IT market followed by hardware and software products. Transmitted IT hardware – transaction among IT firms – also has a big share in the cumulated IT market. All these fields grew from 2006 to 2007. The domestic market of telecommunication services exceeded the whole IT market in terms of turnover. However, this sector stagnated from 2006 to 2007; the growth one can observe in euro values in table 5 is due to the strengthening HUF.

Table 6: Structure of the consolidated ICT market by company size categories

Number of employees	Million EUR	Share (%)	Annual growth (%)
1-2	61	2,6	-3,5
3-9	305	13,1	1,0
10-49	737	31,6	4,2
50-249	648	27,8	7,2
250-	583	25,0	4,3
Alltogether	2334	100,0	4,4

Source: NFGM, 2008, at p. 10.

Micro companies twith 1-9 employees accounted for 15.7 % of the total turnover (table 6). The turnover volume decreased in companies with 1 or 2 employees and grew slightly in firms with 3-9 employees. Small-sized IT firms had the biggest share of the market (31.6 %) and managed to grow at an average pace. Medium-sized companies came in for a smaller share (27.8 %), but they were on a shifting wave. Big companies shared 25% of the market and performed at an average speed of growth.

Other indexes connected to the market, like favourable demand for innovation and product competition, reflect cross-country differences in CEE, just as policy oriented indexes do (the effectiveness of IPR system and the existence of industry related policies). In table 7 we give an overview of selected EU countries in order to compare CEE countries with the ICT sector in leading economies.

The favourable demand for innovation in CEE countries is in the second range in Europe; the share of firms for which demand is not important to innovate is higher in leading countries, but the gap between old and new member states is small. 81% of firms are not affected by demand in their intention to innovate in Hungary; the share of these firms is similar in the Czech Republic and a bit lower in Poland and Slovakia. Similarly, product competition varies on a wide spectrum across EU countries, and CEE does not lag behind except in the case of Poland.

Table 7: Market indexes related to innovation in selected European countries

	Favourable demand (1)	Product competition (2)	Effectiveness of IPR system (3)	Existence of industry related policies (4)
Finland	0.83	0.61	3.4	2.49
Netherland	0.89	0.74	4.4	0.41
France	0.86	0.71	3.7	0.83
UK	0.91	0.86	3.9	2.07
Belgium	0.77	0.71	3.8	0.41
Germany	0.89	0.77	4.0	0.00
Austria	0.94	0.66	4.1	0.83
Sweden	0.79	0.21	3.8	0.41
Denmark	0.93	0.75	3.8	3.32
Spain	0.70	0.64	3.5	1.66
Portugal	0.45	0.71	2.5	0.00
Italy	0.86	0.60	3.7	0.00
Hungary	0.81	0.60	3.3	0.00
Poland	0.78	0.41	2.7	0.41
Czech Republic	0.82	0.61	3.0	0.24
Slovakia	0.79	0.66	2.4	0.00

Source: WINTJES and DUNNEWIJK, 2009, at p. 116.
Note: (1) Proportion of firms for which uncertain or lack of demand are not a problem for innovate; (2) index of product market competition; (3) IPR protection index taken from GWARTNEY et al, 2006

The effectiveness of IPR system is significantly lower in CEE countries than in the old member states (table 7). This factor has a huge effect on the level and growth of the innovation in ICT (WINTJES and DUNNEWIJK, 2009). The existence of industry specific policies oriented to give support to firms in the ICT industry is also significantly associated with the index of innovation performance. Thus, the lack of policy in Hungary and Slovakia may cause the low level of innovation in ICT; this will be elaborated in section 3. On the other hand, one might argue that the dynamics in the Czech Republic and Poland in MNE and SME location was the result of their effective ICT policy.

2.5 Conclusion

The output of the Hungarian ICT sector stood out in the Central European region over the 2000s. We showed in this section that this is due to the intense export activity of multinational firms of which production is heavily built on imported goods. The domestic market is on a lower level than foreign trade. The Hungarian ICT sector concentrates in Central Hungary, as regions were not able to attract MNEs to a similar degree as the Czech and Polish regions did. Neither was SME formation effective in the Hungarian regions; consequently, knowledge spillover is not likely to occur from MNEs to the local economy.

The Hungarian index of level of competition in the ICT market is below the European average but has a similar degree as in other CEE countries. The IPR protection in Hungary is also below the level of leading economies but exceeds its neighbours in the region. We observed that Hungary is loosing the advantages it had in the beginning of the decade, with the ICT sector growing more dynamically in the Czech Republic and in some aspects in Poland as well. The argument on this will be further elaborated in the next section.

3. Contribution of ICT industry to structural upgrading in CEE

The previous section described the state of the industry in CEE countries in general. We intend to show the contribution of ICT to structural upgrading in this section. Thus we analyse the volumes and changes of value added and labour costs, R&D and patent activity and the ICT-related socio-cultural characteristics of CEE countries.

3.1 Value added and labour cost per capita in the ICT manufacturing of CEE countries, 2000-2008

We continue our argument from section 2 discussing how foreign-owned firms determine production in the Hungarian ICT sector and what follows from this for the local economy. First we analyse cross-country differences concerning the share of value added in the output and labour cost in the CEE region.

Table 8: Volumes of value added and intermediate inputs at current prices and share over production in ICT manufacturing of CEE countries, 2000-2008 (MN EUR, %)

		2000		2002		2004		2006		2008	
		volume	%	volume	%	volume	%	volume	%	volume	%
Czech Republic	inputs	8141	78	15094	87	18556	86	27009	87	39592	89
	val. add	2286	22	2353	13	2970	14	3965	13	4736	11
Hungary	inputs	17813	86	18868	86	25205	83	31565	84	n.a.	n.a.
	val. add	2788	14	3157	14	5106	17	5922	16	n.a.	n.a.
Poland	inputs	7379	70	10083	74	9546	77	14977	78	n.a.	n.a.
	val. add	3167	30	3485	26	2887	23	4141	22	n.a.	n.a.
Slovak Republic	inputs	2331	74	2949	77	4795	81	10044	83	12911	84
	val. add	802	26	875	23	1123	19	2022	17	2421	16

Source: author's calculation on OECD STAN database

The volume and share of value added in the production varies on a small scale across the four CEE countries we analyse (table 8). The Hungarian value added in absolute terms has been the highest in the region; Hungary has taken Poland over in this sense. Value added over production has been stable in Hungary: it was only 14% in 2000 and has grown to 16% by 2006. The Czech ICT manufacturing has also evolved to this structure after the volume of intermediated inputs almost doubled from 2000 to 2002. ICT in Poland seems to have had a higher share of value added in the production due to a lower level of inputs. The output of Slovakian ICT depends more and more on the inputs, while output and its factors are on a lower level in absolute terms.

Wages over labour costs inform us about the share of wages that the employees earn in overall labour expenses. The remaining part contains the incremental expenses the companies must pay for social security purposes (table 9).

Table 9: Wages over labour cost (%) and labour cost over total employment at current prices (EUR) in ICT manufacturing in CEE countries, 2000-2008

		2000	2002	2004	2006	2008
Czech Republic	wages / labour cost	75	75	75	74	75
	labour cost / employment	5174	6838	7856	9934	12250
Hungary	wages / labour cost	71	74	76	76	n.a.
	labour cost / employment	7370	7653	8553	10191	n.a.
Poland	wages / labour cost	86	87	87	n.a.	n.a.
	labour cost / employment	8864	10742	7569	10218	n.a.
Slovak Republic	wages / labour cost	76	76	78	79	n.a
	labour cost / employment	6392	7003	7845	9047	10198

Source: author's calculation on OECD STAN database

Cross-country differences prevail first of all in wage/labour cost rates. In the overall ICT manufacturing, the wage of Polish employees accounts for 86-87% of total labour costs, while this share in the Czech Republic and Hungary was only 75-76%, respectively, and 79% in Slovakia for 2006. However, the differences in absolute volume of labour cost per employee seem to equalize in the region. The labour cost per employee has grown dynamically in the Czech Republic over this period, while the the strong Zloty made the Polish employees relatively expensive in 2002.

We interpret the case of Hungary as revealing that ICT employees have become relatively expensive over the decade; this trend is even more strengthened by the big share of social welfare costs. One might expect that these differences result in a relatively competitive Polish ICT sector. Actually, this was underlined by R&D managers of multinational ICT companies located in Budapest (Nokia-Siemens Networks) as a huge disadvantage of the Hungarian ICT sector (Barta et al, 2007). According to them, it is much easier to recruit software engineers in Poland where the employees can take almost the double salaries as in Hungary (reduced by income taxes).

3.2 ICT innovation in CEE: R&D and patenting

The state of innovation in the ICT sector reports on the future dynamics the industry might follow (LINDMARK et al, 2008). Thus, we describe cross-country differences in the level of innovation performance and business expenditure on R&D (BERD) and government expenditure on R&D (GOVERD) in the ICT sector. The benchmarking of competitiveness and innovation performance in the ICT sector usually relies on indicators of patenting, total factor productivity, and market advantage (WINTJES and DUNNEWIJK, 2009):

- **Index of Patenting Advantage** has been constituted from the number of EPO patent applications per employee in the ICT industry as the proportion of the total number of EPO patent application in this industry across all countries per employee.
- **Index of Market Advantage** means a total export volume per employee in the ICT industry divided by total exports in the whole industry per employee.
- **Total Factor Productivity** has been calculated from value-added data at constant prices, number of hours worked and value of capital stock at constant prices (CRESPI and PATEL, 2006).

Built on these indicators, two composite indexes of innovation performance were established in the report. The first captured the static performance calculating the average levels of the 3 indicators between 2000 and 2003. The second index reflects the dynamics and includes changes in these variables between 1990 and 2003 for each country. These indexes are presented in the table as they were reported in the report (WINTJES and DUNNEWIJK, 2009).

Table 10: Country level benchmarking of innovative performance in the ICT industry, 1990-2003

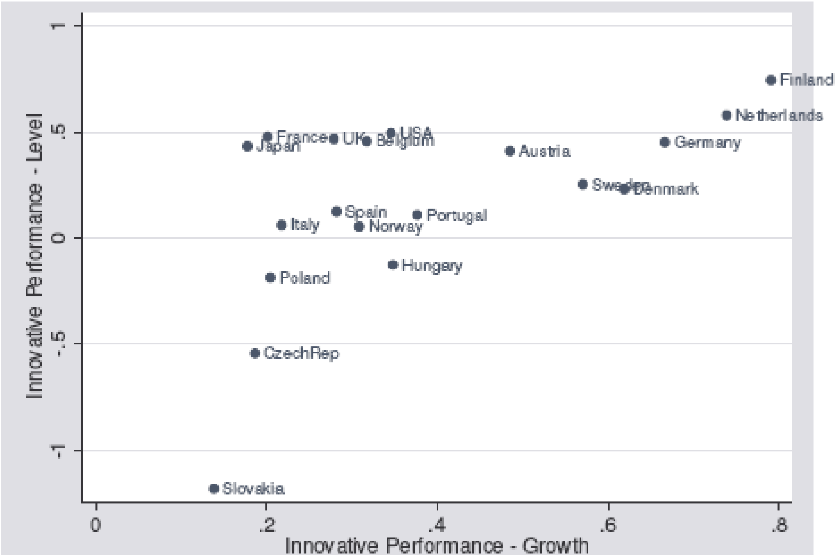
	Index level of innovation	Patenting advantage	Market advantage	Total factor productivity	Index of growth in innovation performance
Finland	0.75	2.33	2.94	3.66	0.79
The Netherlands	0.58	1.93	4.50	1.50	0.74
France	0.48	0.91	0.82	3.97	0.20
UK	0.47	0.66	1.11	4.15	0.28
Belgium	0.46	0.72	2.26	3.29	0.32
Germany	0.45	1.75	1.11	1.94	0.67
Austria	0.41	0.99	1.49	2.61	0.49
Sweden	0.25	1.55	1.66	-0.46	0.57
Denmark	0.23	1.04	1.30	0.37	0.62
Spain	0.13	0.27	0.50	0.84	0.28
Portugal	0.11	0.05	0.66	0.96	0.38
Italy	0.06	0.49	0.39	-0.30	0.22
Hungary	-0.13	0.12	1.69	-2.66	0.35
Poland	-0.19	0.04	0.19	-2.53	0.20
Czech Republic	-0.54	0.05	0.60	-7.24	0.19
Slovakia	-1.18	0.03	0.20	-15.08	0.14
Ireland		0.45	7.68		
Greece		0.18	0.22		
USA	0.50	0.97	0.56	4.19	0.35
Japan	0.43	1.45	1.24	2.20	0.18
Average	0.17	0.76	1.83	0.02	0.38

Source: WINTJES and Dunnewijk, 2009, at p. 63.

The leading countries in ICT innovation level in the period 2000-2003 were Finland and the Netherlands followed by France, UK, Belgium, Germany and Austria. Individual indicators of innovative performance are included in the main index that was used for listing the countries. For example, the overall leadership of Finland in the ICT sector is based on a strong performance with respect to all three indicators (patent advantage, market advantage and total factor productivity).

CEE countries are at the other end of the spectrum, with low levels of innovation performance: Slovakia, Czech Republic, Poland, and Hungary (table 10). These countries perform on a much lower level of EPO patent applications; the negative level of the index concerning total factor productivity even made the innovation index negative. Hungary stands out in terms of market advantage, the export from the country is highly specialized in ICT products. The index (total exports per employee in ICT sector divided by total export per employee in the whole industry) had the fourth highest level in Europe. However, this export is mostly due to MNEs, as we argued earlier (Lengyel, 2010). The fact that total factor productivity is low, lead us to the statement that MNEs have located their low value added activities to the country.

Figure 1: Level and dynamics of innovation performance

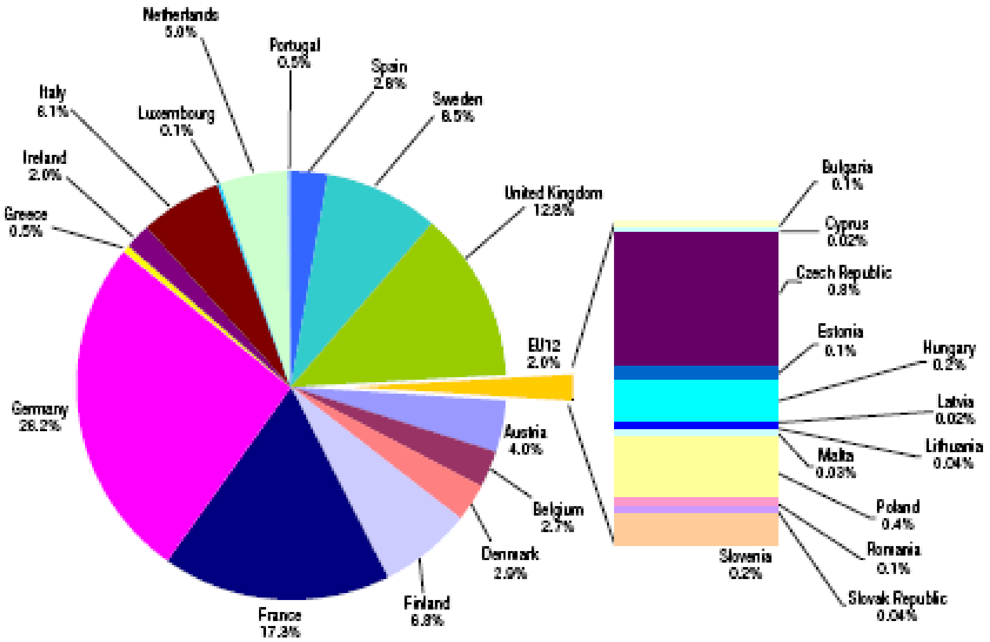


Source: WINTJES and DUNNEWIJK, 2009, at p. 64.

Figure 1 was constituted from the first and last column of table 10 and shows that growth of ICT innovation and innovation performance correlate to a high degree, but some of the countries of high innovation performance (France, Japan, UK, USA) have been growing at rates well below the median. Clustering of countries according to the two axes show that Hungary and Poland belonged to average European level of performance and growth in ICT innovation in the 1990-2003 period. Slovakia and Czech Republic had low values for both innovation indexes at this time.

Business R&D expenditure is a widely accepted measure of level of maturity in a given industry and country (Malerba, 2002, Török et al, 2005). ICT BERD is heavily dominated by some of the largest economies in the EU, while the new member states (EU12) contribute only 2% (figure 2). Note that due to the use of purchasing-power parities the Scandinavian countries Sweden, Finland and Denmark, which have high price levels, have a lower share than they would have under current exchange rates (18.1% together instead of 20.1%). Of greater importance, however, the share of new member states has been doubled using PPP because of their generally lower price levels. (Turlea et al, 2009)

Figure 2: Distribution of ICT business R&D expenditure in EU27 countries in PPP, 2005 (%)



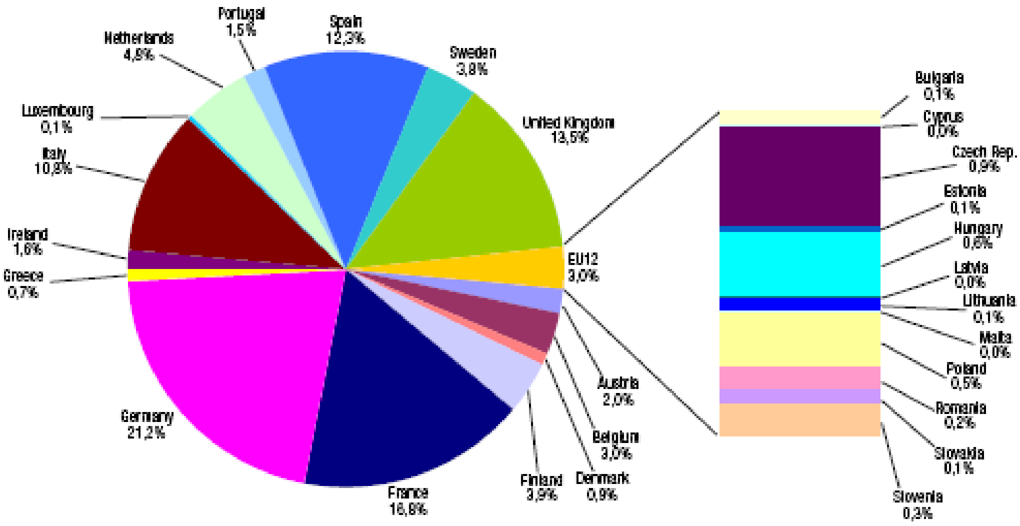
Source: TURLEA et al, 2009, at p. 41.

It was pointed out several times that ICT was one of the leading areas of economic development and was concentrated in the most developed regions (reference). Consequently and not surprisingly, the ICT BERD is marginal in new member states compared to the whole EU. However, CEE country shares are interesting in our case. Czech Republic (0.8%) stood out according to the indicator and was followed by Hungary and Poland (0.4%). There was hardly any business R&D in the Slovakian ICT sector in 2005.

R&D employment (measured in full-time employment) follows a similar pattern as in the BERD distribution; Germany, Finland, France, Sweden and the UK made up 69 % of the total EU volume (Turlea et al, 2009). The share of new member states is limited to 3-4%, however large differences prevail among R&D personnel in ICT manufacturing and ICT services. Czech Republic is relatively strong in ICT services and was the 11th on the country list with a share around 2.5%. Czech Republic gained the second largest number of units in business ICT R&D employment (3200 new jobs), which almost tripled the volume of the sectoral R&D base of the country.

Just like ICT BERD, ICT GOVERD is heavily dominated by the largest economies in the EU; Germany, France, the UK, Spain and Italy represent together 75% of European ICT GOVERD (Turlea et al, 2009). The new member states contribute only 3% to the total EU27 ICT GOVERD. This share is far below their economic weight but higher than their 2% share in ICT BERD. As with the share of new member states in the EU27 GOVERD, single CEE countries have a slightly higher share than in BERD. The Czech Republic accounts for 0.9%, which is higher than the share of Denmark or Greece. Hungary is the second in the region with 0.6%; Poland has a 0.5% share, and Slovakia made up 0.1% of the total EU27 ICT GOVERD (see figure 3).

Figure 3: Distribution of ICT GOVERD in EU27 countries in PPP values, 2005 (%)



Source: TURLEA et al, 2009, at p. 48.

These shares include ICT research performed by government establishments or universities and government financial support to ICT R&D that is performed in the business sector. Therefore, it provides a total picture of government participation in ICT R&D.

3.3 ICT-related socio-cultural environment, e-business readiness and interaction of ICT companies in CEE countries

The level of maturity of ICT sector in a given country is a dependent variable of several factors: the demand for ICT products and services, the international openness of the sector, human capital, etc. Foreign participation affects the ICT sector in CEE countries in terms of production and export volumes. However, according to our interviews with leading R&D centres of multinational companies in Hungary, foreign-owned companies are isolated from the local environment (BARTA et al, 2007). These companies have very few local connections; the global network in which they take part requires in depth preparedness from suppliers that local SMEs cannot fulfil. Consequently, foreign-owned firms and local SMEs might form separate spheres, and we expect that this symptom is stronger in CEE countries than in old member states. The fact that most of the MNE decisions are made in the company headquarters that are far from CEE countries strengthens the relevance of our assumptions.

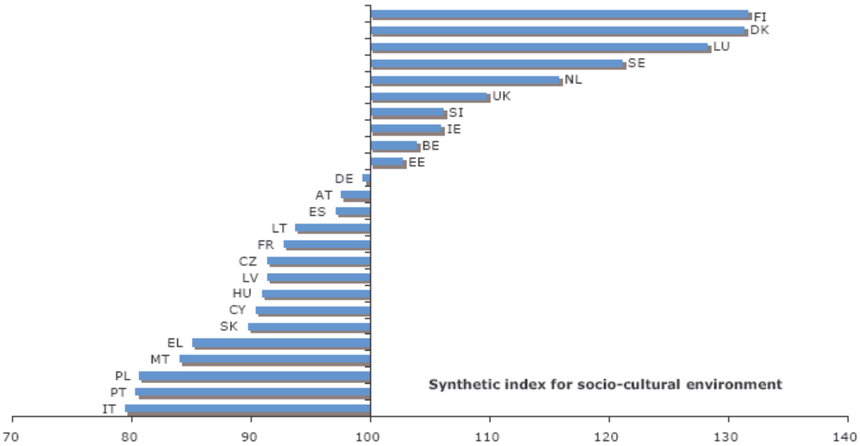
However, knowledge spillovers occur not only along supply chains but also through the mobility of experts and new spin-off firms. The socio-cultural environment is important in the investigated countries, because the more mature the ICT culture, the higher demand one can expect for new ICT services. Similarly, the cultural environment favours new firm formation through the quality of human capital and the level of co-operation among agents. Consequently, the quality of socio-cultural environment helps the value added grow.

Cultural capital, human capital, social capital and organizational capital have to be distinguished in order to measure the specific elements of the environment related to innovation and structural change. Cultural capital encompasses basic attitudes towards science and technology, other cultures, the level of risk taking, etc. The concept of human capital is used in many aspects and means human resources in science and technology and knowledge-intensive services, the provision of higher educated people, and job-to-job mobility. The social capital index includes the cooperation behavior of firms, the main information sources for innovation, level of trust, etc. The index of organisational capital reflects to the company's culture, routines, structure, morality and management styles.

According to these measures, CEE countries lag behind compared to the mean of EU25 countries (WINTJES and DUNNEWIJK, 2009). The Czech Republic exceeds the mean only in terms of social capital, which is very similar in Slovakia, for which the social capital index seems to stand out in new member states. All the four indexes in Poland are far below the EU25 mean. The cultural capital is above the EU mean in Hungary, and the same occurs in social capital to a lower extent. However, human capital and organizational capital are under the EU25 mean.

The synthetized index for socio-cultural environment (figure 4) and also the cluster analysis prepared shows that Czech Republic, Slovakia and Hungary constitutes one block with Cyprus and Latvia, and follows France and Lithuania at close quarters. Poland differs from these three CEE countries, because social networks are closed in the ICT industry. Thus, Poland relates much more to countries like Malta, Italy, Spain and Greece in terms of socio-cultural environment in ICT sector.

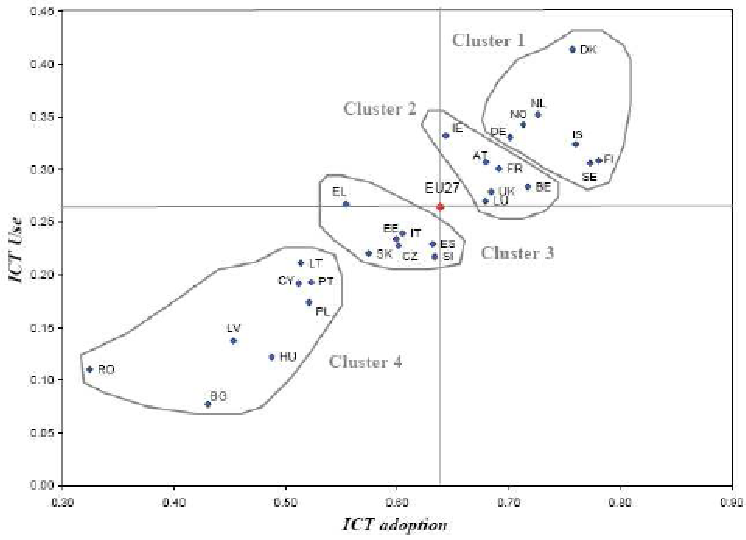
Figure 4: Socio-cultural environment across EU25 countries



Source: WINTJES and DUNNEWIJK, 2009, at p. 69.

The e-business readiness appears to divide CEE countries differently than socio-cultural environment (figure 5). This index has been constituted from ICT adoption (% of companies that use internet opportunities) and ICT use (% of internet penetration in the population) indexes; it reflects on the state of general ICT demand and special internet-related ICT service supply. Most countries with high scores on the e-business readiness index are countries that have a strong socio-cultural environment. Hungary and Poland belong to the last cluster, share of internet users among citizens and companies is far beneath the EU27 mean, while these rated higher in the Czech Republic and Slovakia.

Figure 5: ICT adoption and ICT use in EU25 countries by budget allocation weighting scheme



Source: WINTJES and DUNNEWIJK, 2009, at p. 70.

In our interpretation, both socio-cultural environment and e-business readiness indicators describe the opportunities that enable ICT innovations to prevail. Similar socio-cultural environment provides a similar ground for ICT innovation. As social networks are more closed in Poland, we expect that ICT innovations come off at a lower degree. However, Hungary legs behind according to e-business readiness that signs the low innovation expectations on ICT services. Another index shows the proportion of companies that interact with universities to innovate in ICT. Hungary has a medium value compared to other CEE countries (table 11). Thus, different aspects of agent interactions are embraced by the indicators described above.

The average size of ICT firms is the largest in Hungary among the selected EU countries just like the foreign participation in these sectors (Sweden and the Czech Republic have a similar rate in the latter index). 18% of Hungarian ICT firms are active in export or co-operate with firms outside Europe. This rate is low in EU comparison but is outstanding in CEE at the same time. Interestingly, the comparison of university-firm co-operation shows adverse contiguity; Hungary has a medium value in the region but exceeds most of the old member states.

Table 11: Interactions among agents in ICT industry in selected EU countries

	Average size (1)	Foreign participation (2)	International orientation (3)	Co-operation universities (4)
Finland	4.04	0.01		0.55
Netherland	0.97	0.01	0.20	0.12
France	1.26	0.01	0.31	0.14
UK				0.12
Belgium	1.05	0,01	0.26	0.36
Germany	1.21	0.01	0.28	0.23
Austria				0.29
Sweden	0.95	0.03	0.28	0.13
Denmark		0.02	0.35	0.12
Spain	1.48	0.01	0.19	0.12
Portugal	0.83	0.01	0.41	0.17
Italy	2,25	0.01	0.09	0.11
Hungary	0.45	0.03	0.18	0.16
Poland	0.95	0.01	0.13	0.12
Czech Republic	0.74	0.03	0.07	0.21
Slovakia	0.50	0.01	0.10	0.24

Source: WINTJES and DUNNEWIJK, 2009, at p. 66.

Note: (1)average size - the larger the index the smaller the average size of firms in the industry; (2)proportion of companies that have a foreign office; (3)proportion of firms that sell products to international markets and co-operate with firms outside Europe; (4)proportion of ICT firms that co-operate with universities to innovate

To sum up, different aspects of innovation and R&D show slightly different results for our comparative study. For example, R&D expenditure is low in Slovakia, but they perform well in the e-business readiness indicator. However, the ICT dynamics in the Czech Republic prevail on a higher level, which is proved by almost every indicator.

3.4 Conclusion

The Hungarian value added in ICT sector has been the highest among CEE countries over the decade, though its share in output was low. However, indicators reporting on the dynamics and opportunities for further growth reflect that the ICT sector in other CEE countries might be more competitive. ICT labour costs are lower in the Czech Republic and Slovakia, and the wages are still low due to high social welfare expenses and income taxes in Hungary.

ICT R&D values are also higher in the Czech Republic both in the private and the public sectors. Though, Hungary had performed well and grew dynamically in the 1990s, the Czech innovation system is likely to overcome It. In particular, ICT service innovations are expected to prevail on a higher level in the Czech Republic because a higher share of people have access to the internet as do Czech companies. The university-industry relations in the Czech Republic are also stronger than in Hungary.

4. Policy measures to promote expansion and quality upgrading in the Hungarian ICT industry

In this section we look through the parallels in the Czech and Hungarian innovation policies and the Hungarian ICT policy, respectively.

4.1 Innovation policies and FDI attraction in the Czech Republic and Hungary

Innovation policies have followed similar paths in the Czech Republic and Hungary (HAVAS, 2006, SZANYI, 2010). R&D expenditures of foreign-owned firms have become an important factor of innovation systems since the beginning of the 1990s. However, the Czech policy reacted faster than the Hungarian one (LENGYEL and CADIL, 2009). The first Czech policy was launched in 2000, while the innovation strategy was accepted only in 2007 in Hungary. The Czech system concentrated on the economical perspectives of R&D: FDI attraction had a major role in innovation policy. Universities were in the focus of Hungarian innovation policy. We argue that the main institutions of innovation systems had a decisive impact in the late 1990s on the development of the innovation system: the Ministry of Industry and Trade in the Czech Republic and the Ministry of Education in Hungary (table 12).

There is a broad international challenge for the European countries and the global community, respectively. The energy sector has two particular traits that make it important in both an economic and a political perspective:

- Investment in the energy-producing sector is characterized by a high capital intensity and long amortization periods, so adequate long-term planning in the private and the public sectors is required. Such long term planning – including financing – is not available in the whole world economy; and the Transatlantic Banking Crisis has clearly undermined the stability of the international financial system and created serious problems for long term financing. Thus, the banking crisis is directly undermining the prospects of sustainability policies across many countries.
- Investments of energy users are also mostly long-term. Therefore, it takes time to switch to new, more energy-efficient consumption patterns. As energy generation and traffic account for almost half of global SO_2 emissions, it would be wise to not only focus on innovation in the energy sector and in energy-intensive products, but to also reconsider the topic of spatial organization of production. As long as transportation is not fully integrated into CO_2 emission certificate trading, the price of transportation is too low – negative external global warming effects are not included in market prices. This also implies that international trading patterns are often too extended. Import taxes on the weight of imported products might be a remedy to be considered by policymakers, since emissions in the transportation of goods are proportionate to the weight of the goods (actually to tonkilometers).

One key problem for the general public as well as for policymakers is the inability of simple indicators to convey a clear message about the status of the quality of environmental and economic dynamics. The traditional Systems of National Accounts does not provide a comprehensive approach which includes crucial green aspects of sustainability. The UN has considered several green satellite systems, but in reality the standard system of national accounts has effectively remained in place so that new impulses for global sustainability could almost be derived from standard macroeconomic figures. The global sustainability indicators presented are a fresh approach to move towards a better understanding of the international position of countries, and hence, for the appropriate policy options to be considered in the field of sustainability policies. International organizations, governments, the general public as well as firms could be interested in a rather simple consistent set of indicators, that convey consistent signals for achieving a higher degree of global sustainability. The proposed indicators are a modest contribution to the international debate, and they could certainly be refined in several ways. For instance, more dimensions of green economic development might be considered, and the future path of economic and ecological dynamics might be assessed by including revealed comparative advantages (or relative world patent shares) in the field of "green patenting". The new proposed indicators could be important elements of an environmental and economic compass, that suggest optimum ways for intelligent green development.

The Global Sustainability Indicator (GSI) provides broad information to firms and consumers in the respective countries and thus could encourage green innovations and new environmental friendly consumption patterns.

The GSI also encourages governments in countries eager to catch up with leading countries to provide adequate innovation incentives for firms and households, respectively. This in turn could encourage international diffusion of best practice and thereby contribute to enhanced global sustainability in the world economy.

The Copenhagen process will show to what extent policymakers and actors in the business community are able to find new international solutions and to set the right incentives for more innovations in the climate policy arena. There is no reason to be pessimistic, on the contrary, with a world-wide common interest to control global warming there is a new field that might trigger more useful international cooperation among policymakers in general, and among environmental policies, in particular. From an innovation policy perspective there is, however, some reason for pessimism in the sense that the Old Economy industries – most of them are highly energy intense – are well established and have strong links to the political system while small and medium sized innovative firms with relevant R&D activities in global climate control typically find it very difficult to get political support. Thus one should consider to impose specific taxes on non-renewable energy producers and use the proceeds to largely stimulate green innovative firms and sectors, respectively. Competition, free trade and foreign direct investment all have their role in technology diffusion, but without a critical minimum effort by the EU, Switzerland, Norway, the US, China, India, the Asian countries and many other countries it is not realistic to assume that a radical reduction of CO_2 emissions can be achieved by 2050. Emphasis should also be put on restoring stability in the financial sector and encouraging banks and other financial institutions to take a more long term view. Here it would be useful to adopt a volatility tax which would be imposed on the variance (or the coefficient of variation) of the rate of return on equity of banks (WELFENS, 2009).

It is still to be seen whether or not the Copenhagen process can deliver meaningful results in the medium-term and in the long-run. If the financial sector in OECD countries and elsewhere remains in a shaky condition, long-term financing for investment and innovation will be difficult to obtain in the marketplace. This brings us back to the initial conjecture that we need a double sustainability – in the banking sector and in the overall economy. The challenges are tough and the waters on the way to a sustainable global economic-environmental equilibrium might be rough, but the necessary instruments are known: to achieve a critical minimum of green innovation dynamics will require careful watching of standard environmental and economic statistics, but it will also be quite useful to study the results and implications of the EIIW-vita Global Sustainability Indicator.

Appendix 1: Eigenvalues and Components

Figure 6: Eigenvalues and Components

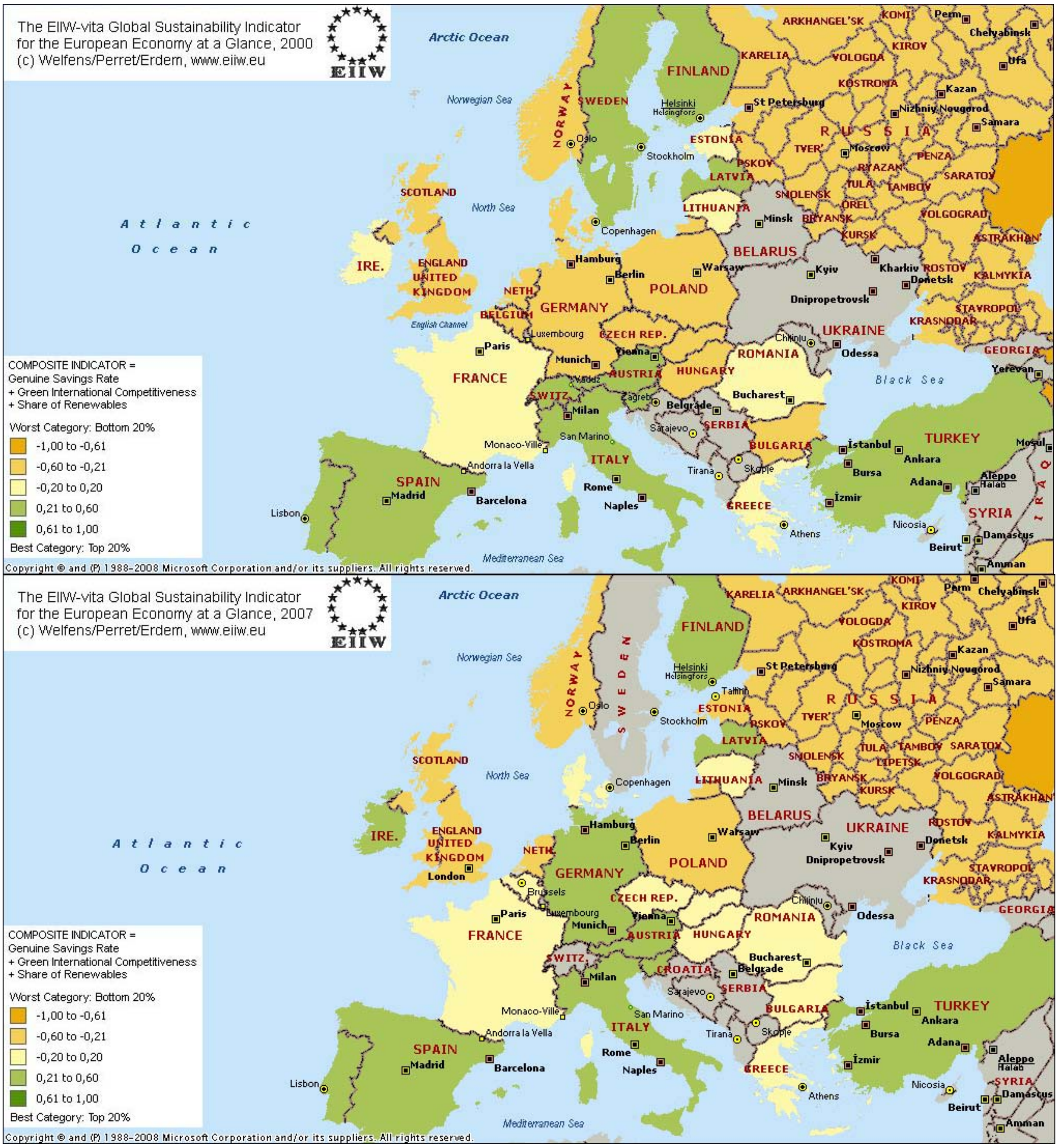
	2000											
	RCA normal						MOD RCAVOL					
	with CO2			without CO2			with CO2			without CO2		
	without SoR	with SoR	with SoRRCA	without SoR	with SoR	with SoRRCA	without SoR	with SoR	with SoRRCA	without SoR	with SoR	with SoRRCA
EV1	2.151	2.252	2.427	1.516	1.602	1.786	1.682	1.856	2.033	1.014	1.283	1.432
EV2	0.520	0.969	0.796	0.484	0.969	0.792	0.996	1.044	1.008	0.986	1.006	1.000
EV3	0.328	0.451	0.449		0.429	0.422	0.323	0.777	0.636		0.711	0.568
EV4		0.328	0.328					0.323	0.323			
VolRCA	0.796	0.746	0.731	0.871	0.784	0.754	0.163	0.081	0.097	0.712	-0.148	0.015
SavingsRate	0.867	0.869	0.863	0.871	0.882	0.869	0.904	0.872	0.867	0.712	0.783	0.846
SoRRCA		0.412	0.628		0.457	0.681		0.564	0.719		0.805	0.846
CO2emissions	-0.876	-0.878	-0.868				-0.915	-0.878	-0.869			

	2006											
	RCA normal						MOD RCAVOL					
	with CO2			without CO2			with CO2			without CO2		
	without SoR	with SoR	with SoRRCA	without SoR	with SoR	with SoRRCA	without SoR	with SoR	with SoRRCA	without SoR	with SoR	with SoRRCA
EV1	1.701	1.791	2.004	1.378	1.441	1.621	1.621	1.519	1.730	1.236	1.243	1.387
EV2	0.693	0.942	0.794	0.622	0.939	0.759	0.759	1.112	0.998	0.764	1.071	0.937
EV3	0.605	0.677	0.629		0.620	0.620	0.620	0.708	0.682		0.686	0.676
EV4		0.590	0.573					0.662	0.590			
VolRCA	0.782	0.738	0.721	0.830	0.785	0.771	0.771	0.434	0.407	0.786	0.726	0.590
SavingsRate	0.743	0.715	0.679	0.830	0.803	0.756	0.756	0.757	0.704	0.786	0.821	0.795
SoRRCA		-0.430	0.684		0.425	0.675	0.675	0.454	0.708		0.207	0.638
CO2emission	-0.733	-0.742	-0.745					-0.743	-0.753			

	2007											
	RCA normal						MOD RCAVOL					
	with CO2			without CO2			with CO2			without CO2		
	without SoR	with SoR	with SoRRCA	without SoR	with SoR	with SoRRCA	without SoR	with SoR	with SoRRCA	without SoR	with SoR	with SoRRCA
EV1	1.635	1.743	1.974	1.386	1.468	1.667	1.439	1.502	1733.000	1.279	1.288	1.458
EV2	0.760	0.927	0.808	0.614	0.918	0.722	0.883	1.109	0.987	0.721	1.053	0.897
EV3	0.605	0.727	0.621		0.614	0.611	0.678	0.732	0.679		0.658	0.645
EV4		0.603	0.598					0.658	0.601			
VolRCA	0.785	0.742	0.725	0.832	0.792	0.776	0.664	0.521	0.482	0.800	0.750	0.633
SavingsRate	0.746	0.705	0.679	0.832	0.789	0.755	0.780	0.753	0.707	0.800	0.826	0.798
SoRRCA		0.472	0.716		0.467	0.703		0.434	0.717		0.211	0.649
CO2emission	-0.679	-0.687	-0.690				-0.624	-0.689	-0.698			

Appendix 2: Europe 2000 and 2007

Figure 7: EIIW-vita Indicator for Europe



Appendix 3: List of Environmental Products

Description	HS
Vacuum pumps	841410
Compressors of a kind used in refrigerating equipment	841430
Air compressors mounted on a wheeled chassis for towing	841440
Other air or gas compressors or hoods	841480
Parts for air or gas compressors, fans or hoods	841490
Filtering or purifying machinery and apparatus for gases	842139
Parts for filtering or purifying machinery	842199
Limestone flux	252100
Slaked (hydrated) lime	252220
Magnesium hydroxide and peroxide Activated earths	281610
Filtering or purifying machinery and apparatus for gases	842139
Parts for filtering or purifying machinery	842199
Filtering or purifying machinery and apparatus for gases	842139
Parts for filtering or purifying machinery	842199
Other glass fibre products	701990
Machinery for liquefying air or other gases	841960
Other machinery, for treatment of materials by change of Temperature	841989
Filtering or purifying machinery and apparatus for gases	842139
Parts for filtering or purifying machinery	842199
Other furnaces, ovens, incinerators, non-electric	841780
Filtering or purifying machinery and apparatus for gases	842139
Parts for filtering or purifying machinery	842199
Industrial or laboratory electric resistance furnaces	851410
Industrial or laboratory induction or dielectric furnaces	851420
Other industrial or laboratory electric furnaces and ovens	851430
Parts, industrial or laboratory electric furnaces	851490
Parts for sprayers for powders or liquids	842490
Compressors of a kind used in refrigerating equipment	841430
Air compressors mounted on a wheeled chassis for towing	841440
Other air or gas compressors or hoods	841480
Parts for air or gas compressors, fans or hoods	841490
Limestone flux	252100
Slaked (hydrated) lime	252220
Chlorine	280110
Sodium hydroxide solid	281511
Sodium hydroxide in aqueous solution	281512
Magnesium hydroxide and peroxide	281610
Aluminium hydroxide	281830
Manganese dioxide	282010

Manganese oxides (other)	282090
Lead monoxide	282410
Sodium sulphites	283210
Other sulphites	283220
Phosphinates or phosphonates	283510
Phosphates of mono or disodium	283522
Phosphates of trisodium	283523
Phosphates of potassium	283524
Calcium hydrogenOrthophosphate	283525
Other phosphates of calcium	283526
Other phosphates (excl. polyphosphates)	283529
Activated carbon	380210
Water filtering or purifying machinery and apparatus	842121
Other machinery for purifying liquids	842129
Parts for filtering or purifying machinery	842199
Other centrifuges	842119
Parts of centrifuges	842191
Water filtering or purifying machinery and apparatus	842121
Other machinery for purifying liquids	842129
Parts for filtering or purifying machinery	842199
Other articles of plastic	392690
Water filtering or purifying machinery and apparatus	842121
Other machinery for purifying liquids	842129
Parts for filtering or purifying machinery	842199
Woven pile and chenille fabrics of other textile materials	580190
Tanks, vats, etc. > 300 1	730900
Tanks, drums, etc. > 50 1 < 300 1	731010
Cans < 50 1, closed by soldering or crimping	731021
Other cans < 50 1	731029
Hydraulic turbines	841011
	841012
	841013
Parts for hydraulic turbines	841090
Other furnaces, ovens, incinerators, non-electric	841780
Weighing machines capacity < 30 kg	842381
Weighing machines capacity > 30 kg < 5 000 kg	842382
Parts for sprayers for powders or liquids	842490
Industrial or laboratory electric resistance furnaces	851410
Industrial or laboratory induction or dielectric furnaces	851420
Other industrial or laboratory electric furnaces and ovens	851430
Parts, industrial or laboratory electric furnaces	851430
Cast articles of cast iron	732510
Positive displacement pumps, hand operated	841320
Other reciprocating positive displacement pumps	841350
Other rotary positive displacement pumps	841360
Other centrifugal pumps	841370

Other pumps	841381
Valves, pressure reducing	848110
Valves, check	848130
Valves, safety	848140
Other taps, cocks, valves, etc.	848180
Instruments for measuring the flow or level of liquids	902610
Instruments for measuring or checking pressure	902620
Other articles of cement, concrete	681099
Other articles of lead	780600
Other electric space heating and soil heating apparatus	851629
Lasers Vitrification equipment	901320
Household or toilet articles of plastic	392490
Brooms, hand	960310
Brushes as parts of machines, appliances	960350
Mechanical floor sweepers Trash bin liners (plastic)	960390
Polypropylene sheeting, etc.	392020
Machinery to clean, dry bottles, etc.	842220
Other mixing or kneading machines for earth, stone, sand, etc.	847439
Other machines for mixing/grinding, etc.	847982
Other machines, nes, having individual functions	847989
Other furnaces, ovens, incinerators, non-electric	841780
Parts of furnaces, non-electric	841790
Industrial or laboratory electric resistance furnaces	851410
Industrial or laboratory induction or dielectric furnaces	851420
Other industrial or laboratory electric furnaces and ovens	851430
Parts, industrial or laboratory electric furnaces	851490
Cleaning~up	851629
Other electric space heating and soil heating apparatus	901320
Other electrical machines and apparatus with one function	854389
Parts for spark-ignition internal combustion piston engines	840991
Parts for diesel or semi-diesel engines	840999
Silencers and exhaust pipes, motor vehicles	870892
Thermometers, pyrometers, liquid filled	902511
Other thermometers, pyrometers	902519
Hydrometers, barometers, hygrometers, etc.	902580
Other instruments for measuring liquids or gases	902680
Parts of instruments for measuring, checking liquids or gases	902690
Instruments for analysing gas or smoke	902710
Chromatographs, etc.	902720
Spectrometers, etc.	902730
Exposure meters	902740
Other instruments using optical radiation	902750
Other instruments for physical or chemical analysis	902780
Parts for instruments, incl. microtomes	902790
Ionising radiation measuring or detecting instruments	903010
Other optical instruments	903149

Other measuring or checking instruments	903180
Manostats	903220
Hydraulic/pneumatic automatic regulating, controlling instruments	903281
Other automatic regulating, controlling instruments Auto emissions testers Noise measuring equipment	903289
Thermostats	903210
Peat replacements {e.g. bark)	284700
Paints and varnishes, in aqueous medium, acrylic or vinyl	320910
Other paints and varnishes, in aqueous medium	320990
Chlorine	280110
Waters, including natural or artificial mineral water	220100
Distilled and conductivity water	285100
Ion exchangers (polymer)	391400
Instantaneous gas water heaters	841911
Other instantaneous or storage water heaters, non-electric	841919
Photosensitive semiconductor devices, including solar cells	854140
Methanol	290511
Multiple walled insulating units of glass	700800
Other glass fibre products*	701990
Heat exchange units	841950
Parts for heat exchange equipment	841990
Fluorescent lamps, hot cathode	853931
Gas supply, production and calibrating meters	902810
Liquid supply, production and calibrating meters	902820
Thermostats*	903210

Appendix 4: List of Data Sources

Table 12: List of Data Sources

Source:	**Data:**
WITS Databank (of UN Comtrade and World Bank)	International Trade Data
World Development Indicators Online Database	National Data for GS and GDS
International Energy Agency Online Data Base	CO_2 emissions data and Share of renewables
OECD Manual for Environment Goods	List of environmental products

Appendix 5: Indicators showing the Influence the SoRRCA

Figure 8: Indicators showing the Influence the SoRRCA, respectively 2000

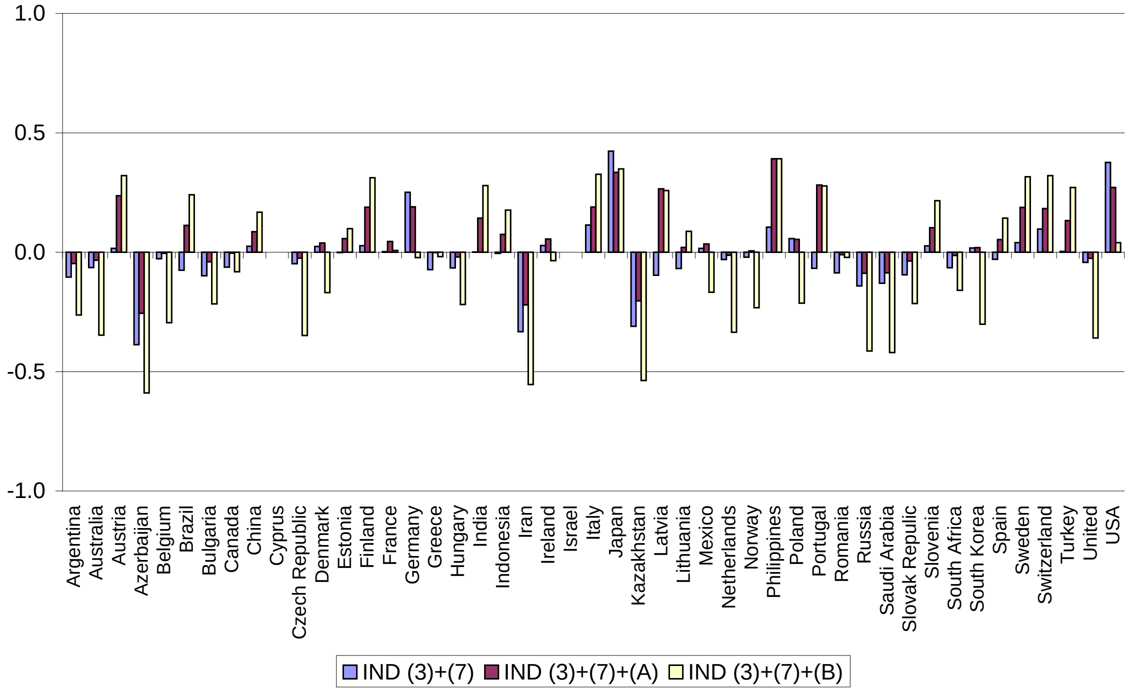


Figure 9: Indicators showing the Influence the SoRRCA, respectively 2006

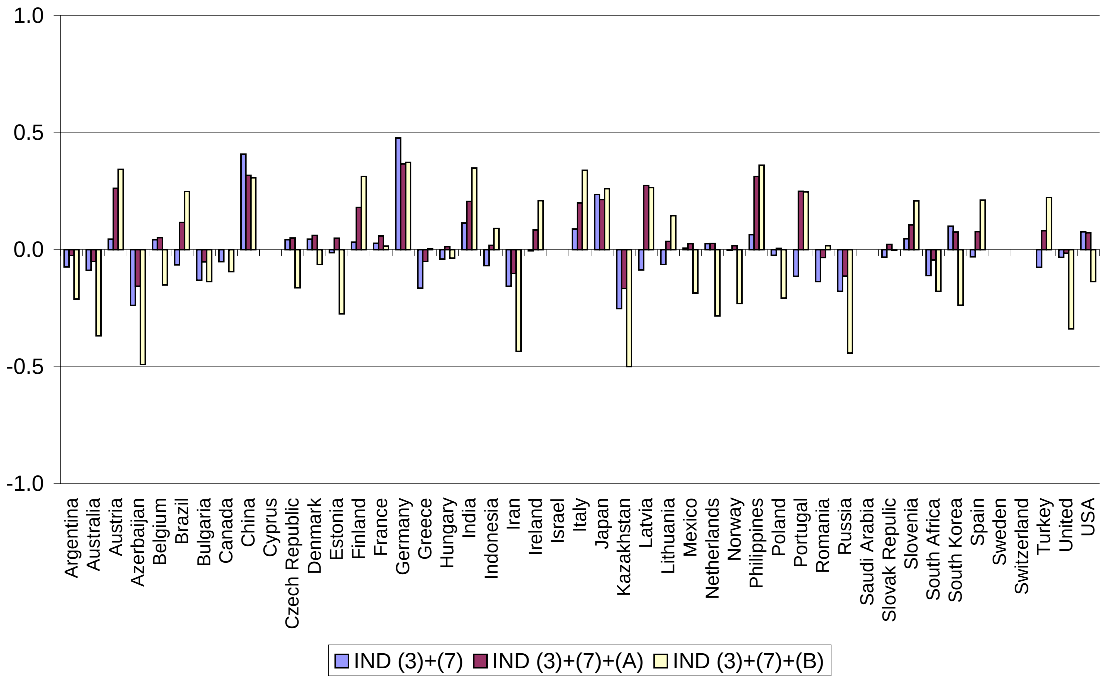
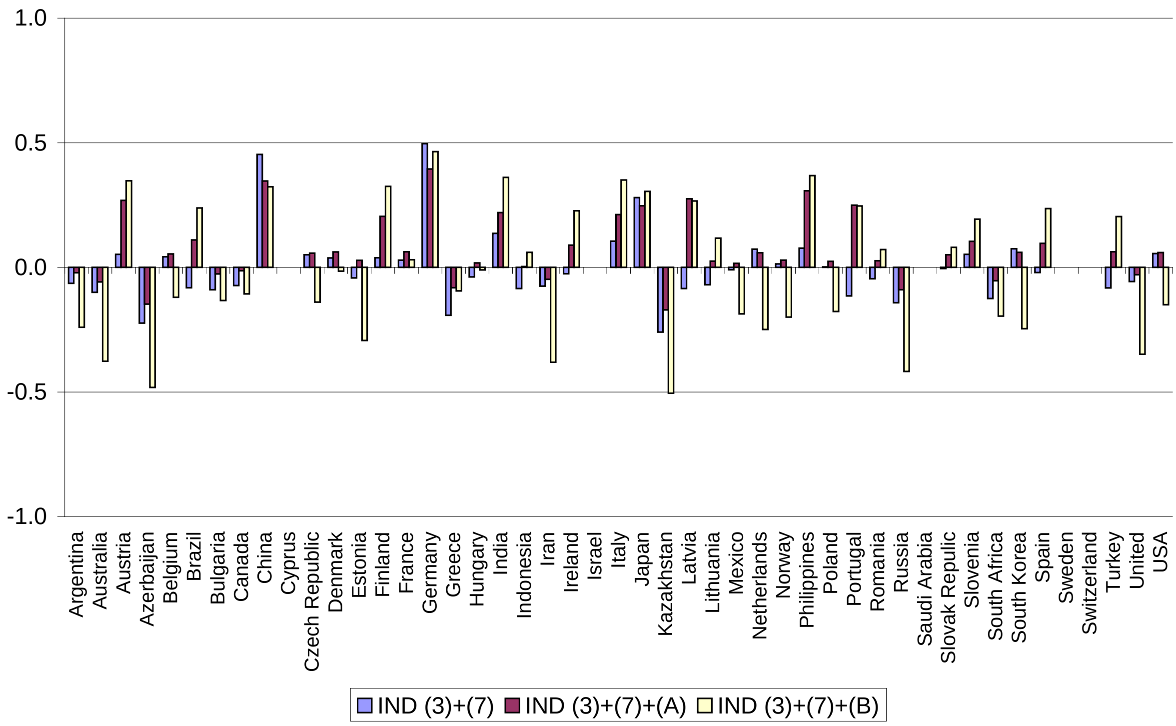


Figure 10: Indicators showing the Influence the SoRRCA, respectively 2007



In contrast to the first two parts, the composite indicators in this part differ rather strongly from each other. While they are still temporarily stable, in many cases it occurs that two indicators point in opposite directions or that one indicator shows neither an advantage nor a disadvantage, while the others clearly favour one of the two. It is not possible to state which indicator is more positive and which is more negatively biased.

As neither indicator shows any distinct advantage over the others, results from the tests in the case of variable weights are included. It can be seen, that only the case of either no inclusion of the share of renewable energy or the inclusion of the SoRRCA leads to consistent reliable estimates of weights. Furthermore, when the share of renewable energy is excluded from the indicator, the results for the case of flexible weights coincide with the results for the case of fixed identical weights.

Therefore, the composite indicator constructed from the VolRCA and the genuine savings rate is seen as a simple first indicator, whereas for the remainder, the case of introducing the SoRRCA is considered.

Appendix 6: Absolute CO_2 Emissions (thousand tons of carbon)

Table 13: Absolute CO2 Emissions (thousand tons of carbon)

	2006	**2007**	**2008**
China	1664589	1801658,587	1922687,476
US	1568806	1594884,811	1547460,438
India	411914	445878,1672	479038,944
Russian Fed.	426729	427144,5605	435125,8403
Japan	352748	357240,8894	357534,0763
Germany	219571	212171,6012	210479,6756
Canada	148548	151776,8117	153658,9514
United Kingdom	155051	150619,0791	148818,148
South Korea	129613	137572,3905	142230,2275
Iran	127358	130348,1795	133960,6503
Italy	129314	127598,6512	125015,2981
Mexico	118950	122043,1985	124449,8597
South Africa	113085	115025,352	120520,3484
Saudi Arabia	104063	111563,2196	119373,6681
Brazil	96142	103621,3529	110832,6373
France	104495	102784,8514	103844,9818
Indonesia	90951	95007,44721	99647,71769
Other Africa	96479	97345,8269	99556,99587
Australia	101459	101086,201	96168,2528
Spain	96063	99286,1414	94468,12711
Poland	86787	87551,21704	90072,49236
Ukraine	87044	86081,10724	84447,67133
Turkey	73487	79253,20398	80207,40321
Thailand	74324	75882,95419	76817,32172
Taiwan	74371	77404,68497	75066,00612
Kazakhstan	52775	55936,18333	59015,84402
Argentina	47328	52074,73596	53821,55158
Venezuela	46799	49835,53765	52528,73085
Egypt	45491	49254,5702	52335,91825
Malaysia	51236	51554,11959	50514,61284
UAE	38060	41850,59887	47871,21725
Netherlands	45958	44901,98523	46201,51866
Pakistan	38906	42234,93692	45093,19005
Algeria	36195	39216,8782	42382,4107
Uzbekistan	31548	34473,18478	36323,15563
Belgium&Lux.	32321	31773,67704	31350,56141
Czech Rep.	31324	31523,24548	30787,66433
Greece	26287	27007,59946	27065,08835
Kuwait	23617	23464,896	25804,76189

Romania	26861	24619,85167	24403,54671
Austria	19590	19144,40926	19579,02327
Philippines	18636	19477,77719	19061,3672
Belarus	18777	18264,18022	18233,65551
Colombia	17397	17790,13996	17882,15294
Singapore	15278	16160,76728	17080,07292
Chile	16391	17278,40615	16552,5955
Portugal	16364	15991,16751	15585,04691
Finland	18189	17205,02817	15387,44049
Hungary	15721	15375,2762	15339,83635
Qatar	12598	13126,40053	13642,11905
Bulgaria	13114	13842,42338	13581,63363
Sweden	13875	13364,35734	12962,06195
Peru	10539	11694,11655	12899,94342
Denmark	14712	13479,05799	12671,7483
Turkmenistan	12028	13370,96296	12541,71536
Bangladesh	11349	11836,50792	12388,0501
Rep. of Ireland	11948	11959,47289	11624,59388
Switzerland	11407	10495,27648	11131,97475
Norway	10969	11081,45638	10906,9165
Hong Kong	10647	11049,05438	10387,50994
Slovakia	10216	10149,07825	10380,67315
Ecuador	8544	9031,029724	9392,326957
Azerbaijan	9559	8631,203791	8609,326302
New Zealand	8316	8135,067217	8338,59829
Lithuania	3870	4027,568156	4031,305761
Iceland	604	662,7754019	606,3737287
Sum of above	**7557285**	**7823175,449**	**7987781,044**
TOTAL WORLD	**8229000**	**8504526,83**	**8670866,36**

Note that the sum of all countries is less than the total world emissions for 4 reasons: 1.) fuels used in international commerce are not counted with any country but are included in the world total, 2, 3.) fossil fuels used for non-fuel purposes and the change in stocks of fossil fuels are treated slightly differently for countries than for the global average, 4.) statistical uncertainty

Source: http://cdiac.ornl.gov/

References

AGHION, P. ET AL. (2009), No Green Growth without Innovation, *Bruegel Policy Brief* November 2009, Brussels.

ANTWEILER W.; COPELAND B.R.; TAYLOR, M.S. (2001), Is Free Trade Good for the Environment?, *American Economic Review*, Vol. 91(4), pp.877-908.

Available: http://sedac.ciesin.columbia.edu/es/esi/

BALASSA, B. (1965), Trade Liberalization and Revealed Comparative Advantage, *Manchester School*, 33, 99-123.

BARTELMUS, P., ed. (2001), Wohlstand entschleiern. Über Geld, Lebensqualität und Zukunftsfähigkeit, Stuttgart: Hirzel.

BORBÈLY, D. (2006), Trade Specialization in the Enlarged European Union, Physica, Heidelberg .

BRETSCHGER, L. (2009), Sustainability Economics, Resource Efficiency, and the Green New Deal, in BLEISCHWITZ, R.; WELFENS, P.J.J.; ZHANG, Z. (eds., 2010); Sustainable Growth and Resource Productivity – Economic and Global Policy Issues, Greenleaf, Sheffield, forthcoming.

BP (2007), Statistical Review of World Energy, London.

BP (2009), Statistical Review of World Energy, London.

BRINGEZU, S. (2000), Ressourcennutzung in Wirtschaftsräumen. Stoffstromanalysen für eine nachhaltige Raumentwicklung. Springer, Berlin, New York.

COBB, C.W. (1989), The Index for Sustainable Economic Welfare. In DALY, J.; COBB, C.W., eds: For the common good – Redirecting the Economy towards community, the Environment, and a Sustainable Future, Boston: Beacon Press.

COPELAND B.R.; TAYLOR, M.S. (2004), Trade, Growth, and the Environment, *Journal of Economic Literature*, Vol. 42(1), pp. 7-71.

DASGUPTA P.; HEAL, G. (1979), Economic Theory and Exhaustible Resources, Cambridge University Press: Cambridge, London, New York etc.

DEAN, J.M. (2002), Does trade liberalization harm the environment? A new test, *Canadian Journal of Economics* Vol. 35, pp. 819–842.

DIMARANAN, B.; IANCHOVICHINA, E.; MARTIN, W. (2009), How Will Growth in China and India Affect the World Economy, *World Economics*, 145, 551-571.

ENOS, J. L. (1962), Invention and Innovation in the Petroleum Refining Industry, in: Rate and Direction of Inventive Activity, 299-321, Princeton University Press.

EUROPEAN COMMISSION (2009), GDP and beyond. Measuring progress in a changing world COM(2009) 433 final, Brussels.

EUROPEAN ENVIRONMENTAL AGENCY (2008), Energy and environment report 2008, http://www.eea.europa.eu/publications/eea_report_2008_6

FARMER, K.; STADLER, I. (2005), Marktdynamik und Umweltpolitik, LIT Verlag, Wien.

FURTADO, A. (1997), The French system of innovation in the oil industry: some lessons about the role of public policies and sectoral patterns of technological change in innovation networking, *Research Policy*, 25, Number 8, January 1997, 1243-1259.

GLOBAL FOOTPRINT NETWORK, http://www.footprintnetwork.org/en/index.php /GFN/page/ecological_debtors_and_creditors/

GROSSMAN, G. M.; KRUEGER, A. (1995), Economic Growth and the Environment, *The Quarterly Journal of Economics*, 110(2), pp. 353-77.

GROSSMAN, G.; HELPMAN, E. (1995), Technology and Trade, in: G. Grossman, K. Rogoff, eds., *Handbook of International Economics*, Vol. III, Amsterdam: Elevier, pp. 1279-1337.

GRUBB, M. (2004), Technology Innovation and Climate Change Policy, *Keio Economic Studies* 41(2), 2004, pp. 103-132 in: HIERL, J., PALINKAS, P., (2007).

GRUPP, H. (1999), Environment-friendly innovation by price signals or regulation? An empirical investigation for Germany, *Jahrbücher für Nationalökonomie und Statistik*, Vol. 219, Issue: 5-6, 611-631.

HATAKENAKA, S.; WESTNES, P.; GJELSVIK, M.; LESTER, R.K. (2006), The Regional Dynamics of Innovation: A comparative study of oil and gas industry development in Stavanger and Aberdeen, Paper presented at the SPRU 40th Anniversary Conference University of Sussex.

HENSING, I.; PFAFFENBERGER, W.; STRÖBELE, W. (1998), Energiewirtschaft, Verlag Oldenbourg, München, Wien.

HIERL, J.; PALINKAS, P. (2007), Energy Technology Policy in Europe, Technology Dynamics, Growth and Reform Policies in the US and Europe, EIIW, Springer Verlag, Berlin, im Erscheinen.

HOTELLING, H. (1931), The economics of exhaustible resources, *Journal of Political Economy*, 39, pp. 137-175.

KELLER, W. (2004), International *Technology Diffusion*, *Journal of Economic Literature*, vol. 42(3), pp.752-782.

KELLER, W.; LEVINSON, A. (2002), Pollution abatement costs and foreign direct investment inflows to US, *Review of Economics and Statistics*, 84, pp. 691–703.

KEMFERT, C. (2002), Induced technological change in a multi- regional, multi- sectoral integrated assessment model (WIAGEM); Impact assessment of climate policies, Dept. of Economics, University of Oldenburg.

KHALATBARI, F. (1977), Market Imperfections and the Optimum Rate of Depletion of Natural Resources," *Economica, Vol.* 44, 409-414.

KLEPPER, G.; PETERSON, S. (2006), Emission Trading, CDM, JI, and More – The Climate Strategy of the EU, *Energy Journal*, Vol. 27.

LATIF, M. (2009), Klimawandel: Hintergründe und Zukunftsszenarien, Paper presented on 09.09.09 at the Conference Climate Change - Status and Perspectives of Verein für Sozialpolitik, Magdeburg.

LEVY, A. (2000), From Hotelling to Backstop Technology, *University of Wollongong Department of Economics Working Paper Series* 2000 WP 00-04.

MALTHUS, R. (1798), An Essay on the principle of population.

NORDHAUS, W.D. (1974), Resources as a constraint on growth, *American Economic Association*, Vol. 64/2, pp. 22-27.

NORDHAUS, W.D. (2006), The Stern Review on the Economics of Climate Change," *NBER Working Paper* No. W12741.

OECD (2008), Handbook on Constructing Composite Indicators, Paris.

PEARCE, E. (1999), Economics and Environment, Northampton.

PETERSON, S. (2008). Greenhouse Gas Mitigation in Developing Countries Through Technology Transfer? - A Survey of Empirical Evidence. Mitigation and Adaptation Strategies for Global Change, 13(3), 283-305.

POPP, D. (2002), Induced Innovation and Energy Prices. *American Economic Review* 92(1), 160 – 180.

RENNINGS, K. (1999), Hrsg. Innovation durch Umweltpolitik, ZEW Wirtschaftsanalysen, Bd. 36, Baden-Baden.

SCHMIDT-BLEEK, F. (1992), MIPS - A Universal Ecological Measure. Fresenius Environmental Bulletin 2, 407-412.

SCHMIDT-BLEEK, F. (1994), Wie viel Umwelt braucht der Mensch ? MIPS – das Maß für ökologisches Wirtschaften. Birkhauser, Berlin, Basel.

SINN, H.-W. (1981), Stock Dependent Extraction Costs and the Technological Efficiency of Resource Depletion, *Zeitschrift für Wirtschafts- und Sozialwissenschaften* 101, pp. 507- 517.

SPRENGER, R.U (1999), Economic Globalization, FDI, Environment and Employment in WELFENS P.J.J., ed., Internationalization of the Economy and Environmental Policy Options, Springer, New York.

STERN, N. et. al. (2006), The Economics of Climate Change (Stern Review), HM Treasury, London.

STEVENSON, B.; WOLFERS, J. (2008), Economic Growth and Subjective Well-Being: Reassessing the Easterlin Paradox, *NBER Paper No*. 14282, Cambridge: Ma.

STIGLITZ, J.E. (1974), Growth with Exhaustible Natural Resources: Efficient and Optimal Growth Paths," *Review of Economics Studies* 41, Symposium on the Economics of Exhaustible Resources, 123-137.

WACKER, H., BLANK, J. (1999), Ressourcenökonomik Band II: Einführung in die Theorie erschöpfbarer natürlicher Ressourcen, Verlag Oldenbourg, München.

WACKERNAGEL, M. (1994), Ecological Footprint and Appropriated Carrying Capacity: A Tool for Planning Toward Sustainability, PhD Thesis, School of Community and Regional Planning, The University of British Columbia.

WACKERNAGEL, M.; REES, R. (1996), Our Ecological Footprint: Reducing Human Impact on the Earth, New Society Publishers: Gabriola Island, BC.

WALKER, W. (1986), Information technology and energy supply", *Energy Policy*, 23, 466-488.

WARD, F.A. (2006), Environmental and Natural Resource Economics, Upper Saddle River.

WDI (2008), World Development Indicators 2008, World Bank Online Database.

WEIMANN, J. (2009), Klimapolitik im Zeitalter des Emissionshandel, *Wirtschaftswissenschaftliches Studium*, Bd. 38.2009, 2, S. 86-90.

WELFENS, P.J.J. (2008), Explaining the oil price dynamics, *EIIW Discussion Paper* Nr.169.

WIEDMANN, T.; MINX, J. (2007), ISAUK Research Report 07-01, A definition of carbon footprint. Available: http://www.isa-research.co.uk/docs/ISA-UK_Report_07-01_carbon_footprint.pdf

WORLD BANK (2006), Where Is the Wealth of Nations? Measuring Capital for the XXI Century, Washington DC.

WTO (1999), Trade and Environment at the WTO, Special Issues 4, Geneva.

XU, B. (2000), Multinational enterprises, technology diffusion, and host country productivity growth, *Journal of Development Economics*, Jg. 62, H. 2, pp. 477–493.

YALE (2005), Environmental Sustainability Index, Yale Center for Environmental Law and Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) of Columbia University, Columbia.

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