Concentration in ICTs sector – cross country analysis.

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CONCENTRATION IN ICTs SECTOR
- CROSS COUNTRY ANALYSIS

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Abstract

In the chapter below, the author presents inequalities in sector of new information and communication technologies. Having in mind inequalities we can also discuss concentration issues, and the concentration itself is a problem to which the author refers on first place. The paper is organized as following: first basic measures of concentration are defined, after we can read a discussion referring to concentration in ICTs sector when R&D expenditures are considered. Consequently the author analyzes basic concentration where use and application of ICTs goods and services are taken into account. To analyze the inequalities and concentration, traditional measures are applied, like: Gini coefficient, Hirschman-Herfindahl Index, and Concentration Ratio.

***Key words**: market concentration, ICTs, monopolization, Hischman-Herfindahl Index.*

***JEL code classification**: monopolization (L41), industry studies (L6), information and internet services (L86), market concentration.*

1. Introduction

In today`s world economy, fast development and implementation of new information and communication technologies (ICTs) has become one of the crucial factor determining overall level of - both - social and economic development. At the same time, we can notice significant differences in level of ICTs implementation in difference regions and countries. Also, we can say that development of ICTs` industry is characterized by spatial differentiation.

The main target of the paper below is to learn about the magnitude of differences existing in level of ICTs` industry development but also about their implementation in different countries and regions. A statistical analysis is run to verify some hypothesis made in accordance to the subject.

2. Market concentration measurement - theoretical background

Before presenting some aspects of ways of measurement of concentration, we shall define the very term of "concentration" itself. In theory the "concentration" refers to four different kinds of situations. We can discuss market concentration - also called industry or sellers' concentration, buyers concentration, ownership concentration, or aggregate concentration. In this section we will refer strictly to the market concentration, which can be defined as a proxy of relative firm`s position on a market in relation to other

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companies. In some case we will also refer to aggregate concentration, to assess market power of huge companies that play crucial role on world markets. Sometimes it is also perceived as company`s strength of a given firm on the market. In here we will discus different aspects concentration in ICTs industry, but also in ICTs use and application.

In theory there are many different measures expressing market concentration. In here we will apply commonly used measures of concentration to learn about relative positions of some economies in the world map, but also to find out whether ICTs as industry has a "leading" position on markets in OECD countries.

Primary we will apply the following measures:

- Hirschman-Herfindahl Index (HHI)
- Gini coefficient (GINI)
- Concentration Ratio (CR)

The first measure, Hischman-Herfindahl Index[2] (a cumulative measure) is defined as:

$$H = \sum_i (S_i)^2$$

where S_i is the share of firm i in industry sales (turnover). In other words, HHI is defined as the sum of squared market shares of all the companies in the industry. The Herfindahl Index values range from 1/N (where N is the indicated number of firms taken into account) to 1 (alternatively to 10 000). If the HHI approaches 0, this indicates fully competitive market, while HHI value close to 1 means, that the market is fully monopolized (only one firm operating in the given sector). If HHI ranges from 0 to 0,01 it means highly competitive market, if HHI is between 0,01 - 0,18, the market to said to be moderately competitive, and HHI values above 0,18 indicate highly concentrated market (few dominant players operate on the market).

Another cumulative concentration measure is - widely recognized - Gini coefficient (Gini ratio). The GINI is not only applied when market concentration is discussed, but rather commonly used for income concentration proxies. The index constitutes a summary statistics of Lorenz curve, showing inequalities among individuals in a population. The values of Gini ratios vary from 0 to 1, when "0" score indicates perfect equality, while "1" indicates perfect inequality. Graphically the magnitude of inequality expressed by Gini index can be shown as the area between Lorenz curve and the line of the equity.

And finally, the concentration ratio, as discrete measure, which is a measure based on the concentration curve. Using concentration curve, on axis X we put attribute carriers, and on axis Y - cumulative part of attribute carrier value (in %). In such case, the concentration index[3] is defined as:

$$KI_m = \sum_{i=1}^{m} P_i ,$$

[2] Ginevicus R., Cirba S., (2007) Determining market concentration, Journal of Business Economics and Management, Vol VII, No 1.

[3] ibidem

where, KI_m stands for concentration index, m is defined as the m-th attribute carrier, P_i is the i-th attribute carrier`s relative part of sum of attributes (while $0 \leqslant P_i \leqslant 0$).

In the following sections of the work, the author will use all three presented measures to show inequalities (differences) existing in different aspects of ICTs industries and ICTs services distribution among countries.

3. New information and communication technologies and market concentration - selected aspects of R&D expenditure concentration

High levels of economic and social development are one of most important targets that many countries try to achieve. There are many different ways of achieving these objectives, and at the same time we recognize many factors determining socio-economic development. Some of them are rather obvious - like for example level of gross fixed capital formation - but some of them seem to have a great impact, but finding a "good proof" of that is quite impossible. New information and communication technologies (ICTs) are considered to be determinants of such kind. They are of great importance for social and economic development process, but at the same time it is hardly impossible to find any quantitative proof of their positive - or negative - direct impact.

From the other side, we observe a worldwide process of globalization. No matter how you define it, we now - by basic intuition - that the process of globalization has very strong impact on ways of running a business, it shapes the way world markets are working and many others. The very process - although a very "old one" - now is mainly driven by free flows of capital, human resources, information or knowledge. These "free flows" are enhanced by dynamic development and broad implementation of new information and communication technologies. But - at the same time - free markets make possible and quite easy for big companies to merge and make acquisitions. While the globalization process eases and fosters competition among companies - which should lead to higher competitiveness of markets and national economies - it also causes monopolization of markets in different ways. The process of monopolization - also named market concentration process - is widely recognized in world economy. On one hand many people say that big companies have a greater power and possibilities to invest, make expenditures on R&D, which lead to higher innovation and so on. One cannot deny that financial strength of big companies lets to invest in more broad sense, but a question arise if the process of monopolization does not affect free competition on market. From consumers' perspective, existence on highly monopolized markets in different sectors, denies their freedom to choose the most preferable and suitable product they wish to purchase.

New information and communication technologies can be treated and perceived in two different ways. Firstly - ICTs, broadly defined, they can be treated as a tool of achieving social and economic development targets. ICTs can be understood as set of tools, and only if they are regarded as such they can potentially become an enabler of social and economic development. But why are these ICTs assigned such importance in the development context? It is mainly because they facilitate - by electronic means - creation, storage, management

and dissemination of information and knowledge[4]. Mostly it is because of their unique characteristics, opportunities they offer and benefits they create. They are relatively cheap and can be implemented and used practically everywhere. ICTs have great impact on individual user's welfare, change the way business is run, transform societies, enable knowledge sharing and free from the so called "tyranny of physical distance". ICTs infrastructure creates economies of scale[5] and by stimulating building social and economic networks they spill over benefits. They enable overcoming distance, promote social inclusion, foster information and knowledge sharing, offer new services, health care information and learning opportunities. They also enhance job creating and local entrepreneurship. "ICTs reduce transactions costs, change the structure of markets and of public services and institutions, entrap human resources, and immediately increase potential values of human capital[6]". Much evidence from all around the world has shown that enormous benefits can be derived from ICTs, if they facilitate mainstreaming of information and knowledge. ICTs if deployed and used properly can solve many problems that many economies are struggling with.

Secondly - ICTs, can be defined is industry (as a sector of national economy), and as such we will analysis they in the chapter below. To continue our work, we must define the ICTs industry (sector) as such. By ICTs industry usually we mean all the industry that encompasses these companies which produce equipment, software, deliver services to process deliver and display all the available information and knowledge electronically. We can also say that companies classified as operating in ICTs industry they produce computers and their peripheral devices, all kind of computer software, communication assets and telecommunication services[7]. According to OECD classification, the definition of ICTs sector is well formulated. As stated in the year 1998, the "ICT sector" is a "combination of manufacturing and services industries that capture, transmit and display data and information electronically"[8]. Usually, there exists a "traditional" dichotomy between manufacturing and services activities. In case of information and communication technologies, treating separately these two aspects seems to be unjustified. The new information and communication technologies are set of tools of such characteristics, that breaking with this tradition is inevitable. The OECD definition of ICTs is of such kind that manufacturing and services sectors are not treated and - consequently - analyzed separately. There is no doubt that, both manufacturing and services sectors of ICTs, constitute an important part in an economy, and function "as one". Some authors - like for example Acconcia (2003), are to state that as ICTs sector can be treated all economic activities where

[4] Gester & Zimmermann, Information and communication Technologies for poverty reduction: discussion paper, Swiss Agency of Cooperation & Development, 2003 Fighting Climate Change. Human solidarity in a divided world. HDR 2007/2008, UNDP 2009; accessed: 5 May 2009

[5] Torero, M. and J.Von Braun (2006), ICTs for the poor, International Food Policy Research Institute, www.ifpri.org/, *accessed: 11 Oct 2008*

[6] Spence, R. (2005), ICTs, Internet, Development and poverty reduction, 2005, www.developmentgateway.org, accessed: 6 Jan 2007

[7] www.industry.gov.au, accessed: 17 Oct 2009

[8] Measuring the Information Economy 2002, OECD 2003.

information is perceived as a strategic factor. This notion of ICTs sector is closely related to the Porat`s (1977) point of view, while he distinguishes primary and secondary information sector. As the primary information sector he treats all kind of industries where information goods and market information services are produced as commodities. In such case, as secondary information sector he treats all kind of information that is produced by the government and non-informational companies. Few later studies have criticized such approach, for example Houghton (1999), and new kind of definition was proposed. One of them included creation of two-dimensional map of ICTs` industry, where these dimension would be: product-service, and transport-content dimensions.

The discussion considering proper ICTs sector defining is vital. However, in this paper we are going to treat ICTs sector in accordance to OECDs` definition.

In recent years, we can observe a massive development of firms operating in ICTs sector (both in manufacturing and services). Many of them they are huge, transnational companies, very often they possess a large part of market on the field they operate. At the same time they are often perceived as companies that expand at high pace – they diffuse on market very quickly we would say – and also their spending on R&D are accounted as very high and of great importance for industrial development. These companies also note high growth of revenues but at the same the growth of R&D expenditures is noticeable.

In Table 1, we have compiled R&D total expenditures of ten biggest companies operating ICTs sector.

Table 1. Top 10 ICT R&D spenders. Absolute values. Millions of USD. Years 2006 and 2007.

Company	Country	R&D total expenditures 2006	R&D total expenditures 2007	Growth of ICT R&D expenditures (%)
Microsoft	USA	6584	7121	8,16
Siemens	Germany	6312	n.a.	-
Samsung Electronics	Korea	6004	6451	7,45
IBM	USA	6107	6153	0,75
Intel	USA	5873	5700	-2,95
Nokia	Finland	4896	n.a.	-
Matsushita (Panasonic)	Japan	4854	4909	1,13
Sony	Japan	4675	4619	-1,20
Cisco Systems	USA	4067	4499	10,62
Motorola	USA	4106	4429	7,87

Source: Own compilation and calculation based on data from OECD Information Technology Outlook 2008

Although we see that in some companies the R&D spending have fallen, it is easy to notice that in general these expenditures grow. For example, looking at *Cisco Systems* where the growth rate is at 10,65% accounting just for two years, the increase seems to be significant.

In the next Table 2, we the author has presented R&D expenditures made by firms from ICTs industry in years 2000-2006. They are compiled according to sectors.

Table 2. Changes in R&D expenditures in ICTs industry. USD billions. Time period 2000-2006.

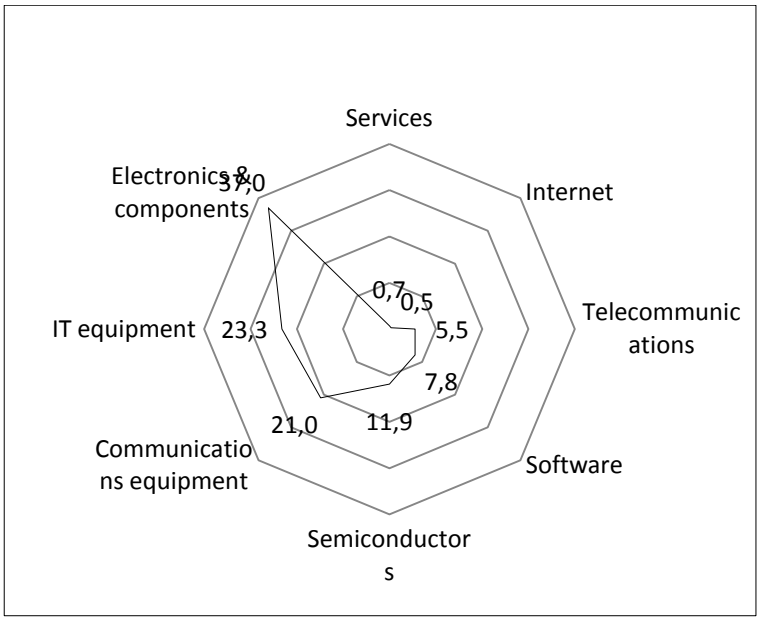
Sector	2000	2006	Growth rate of R&D expenditures (%), 2000-2006
Services	0,7	0,8	8,15
Internet	**0,5**	**3,1**	**559,66**
Telecommunications	5,5	7,2	30,03
Software	7,8	13,2	68,66
Semiconductors	11,9	19,6	65,54
Communications equipment	21,0	24,6	17,46
IT equipment	23,3	26,6	14,54
Electronics & components	37,0	48,0	29,81

Source: Own compilation and calculation based on data from OECD Information Technology Outlook 2008

As we can conclude from the data in the Table 2, growth rates in R&D expenditures in ICTs sectors are noticeably high. Especially high rates are achieved when Internet sector is considered. The growth rate, in years 2000-2006, at almost 560% seems to be astonishing. In other sectors the R&D expenditures growths rates are relatively lower, but - when considered in absolute terms - still very high. Growth rates noted for software and semiconductor are about 68% and 65% respectively. It seems to be quite justified as these expenditures grow so fast in the Internet sector. It is very probably that production of - for example - software is highly related to Internet diffusion in different countries. Also Internet usage requires new software as the "net" is widely applied for different use in business sector but also in everyday use. However, whatever said, in the world scale, we note very clearly that all kinds of new information and communication technologies constitute a very dynamically developing industry. It is highly possible that these broad use and application of ICTs is closely related - and at a time possible - thanks to their unique features. Among them we can mention the following: they are cheap and easy to acquire, they adjust perfectly to particular recipients` needs, they generate the so called positive scale effects, in many case they ease and foster social and economic development of nations.

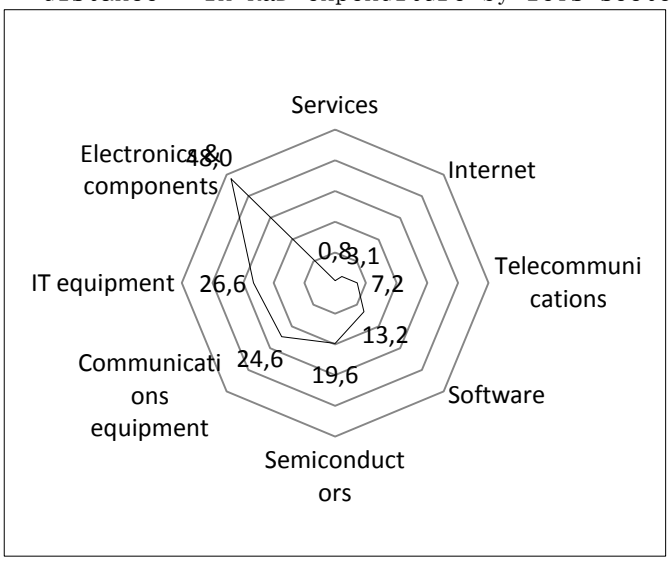
In Chart 1 and Chart 2, the author has presented distances among selected ICTs sectors when R&D expenditures are taken into account. The two following spider graphs should be interpreted as a graphic presentation of "how far objects are located from each other".

Chart 1. Relative ”distance” in R&D expenditure by ICTs sectors. Year 2000.



Source: own elaboration.

Chart 2. Relative ”distance” in R&D expenditure by ICTs sectors. Year 2006.



Source: own elaboration.

Although the R&D expenditures growth rate are the extremely high in Internet sector, still the “Electronics and components” sector it the one where R&D expenditures are at the highest level. In the year 2006, these expenditures constituted approximately 48% of total expenditures in ICTs sectors on R&D. High demand for all kinds of hardware and a constant need of improvement of some crucial elements in all kind of ICTs equipment, require high spending for doing research. In Charts 1 and 2, we see relative distances between sectors that constitute ICTs industry in high income countries. Having in mind the idea that mostly high income countries are creators of new

information technologies, and the "rest of the nations" are basically adopters, there is a constant need of new improvements and investments. As these companies note for high incomes, and market demand is high for their products they feel a pressure on making new improvements.

Let us now look, at total share of R&D expenditure in ICTs sectors in relation to other important industrial sectors in OECD countries. We take into account five sectors of great importance for nation economies in OECD countries. These are: motor vehicles, pharmaceuticals, chemicals, ICTs and research and development (as such). The analysis is run for time years 1993, 2000 and 2005. This kind of comparison will let us to have a general idea about the importance of ICTs sector in relation to other leading industries in OECD countries. In the next Table 3, we have put absolute values of general R&D spending in leading industrial sectors in OECD countries.

Table 3. R&D spending in leading industrial sectors in OECD countries. In billions of constant PPP dollars at 2000 prices. Years 1993-2005.

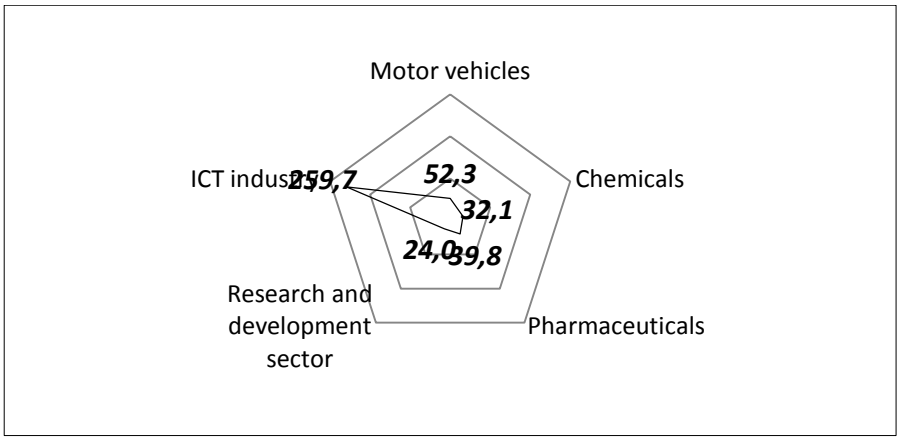
Sector	1993	2000	2005
Motor vehicles	32,0	48,6	52,3
Chemicals	32,5	31,6	32,1
Pharmaceuticals	24,0	32,3	39,8
Research and development sector	4,9	18,3	24,0
ICT industry	162,4	281,3	259,7
Total	**255,9**	**412,0**	**407,9**

Source: Own compilation based on data from OECD Information Technology Outlook 2008

As it can be easily read from the numbers below, R&D spending in ICTs sector are relatively high and seem to be of a great importance. In year 1993 the absolute amount of total R&D spending in ICTs sector was at 162 billions of US dollars (at 2000 constant prices), while in 2005 it was at 259 billions of US dollars, so it grew at about 60%. In other sectors relative changes are positive but it none of them it is noted at such high level. Solely in "Research and development sector" the R&D spending have changed from 4,9 billions of US dollars in 1993, up till 24,0 billions of US dollars in the year 2005. It stands for approximately 389% growth rate. The percentage change in absolute level of these kind of spending is extremely high, but we must note the last 20 year are the years when the meaning of creation "something new" and doing different kind of research has grown extraordinary.

In Chart 3 (presented also as spider graph) we present relative distance among leaning industries in OECD economies. The spider charts are a good presentation method to show how far different object are located from one another. It give you a general idea about the relations between objects. You can point out very clearly the objects which are lagging behind, and those which are performing best in given category.

Chart 3. Relative distance of R&D spending in leading industries in OECD countries. Year 2005.



Source: own elaboration.

From the Chart 3 above we can deduct that when total amount of R&D spending is taken into account, the ICTs sector is an undoubted leader. As such sectors like "Motor vehicle", "Chemicals", "Pharmaceuticals" and "Research and development" sectors are rather "close" to one another - there is no extreme differences in R&D spending levels in these industries. The R&D spending in ICTs sector are so high, that the sector as an "object" is located far away from the rest of the objects (sectors).

Table 4. Concentration statistics. R&D spending in leading industrial sectors in OECD countries, year 1993.

	Ungrouped data		Lorenz curve		
	Elements (Absolute)	Elements (Relative)	Cumulative % of population	Cumulative % of variable	
				Expected	Observed
Motor vehicles	32,00	0,12	0%	0,00	0,000010
Chemicals	32,50	0,12	20%	0,20	0,019156
Pharmaceuticals	24,00	0,09	40%	0,40	0,112979
Research and development sector	4,90	0,02	60%	0,60	0,238077
ICT industry	162,40	0,63	80%	0,80	0,365129

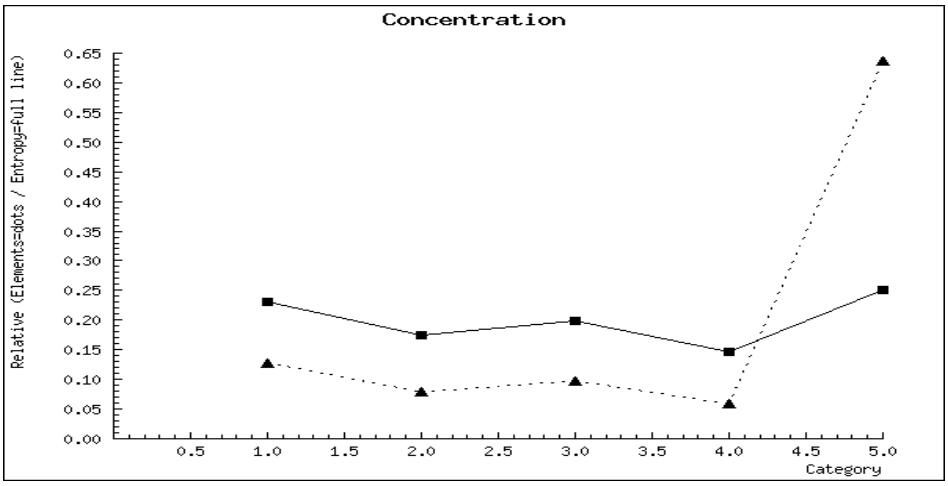
Source: own calculation using WESSA.NET software

Table 5. Concentration statistics. R&D spending in leading industrial sectors in OECD countries, year 2005.

	Ungrouped data		Lorenz curve		
	Elements (Absolute)	Elements (Relative)	Cumulative % of population	Cumulative % of variable	
				Expected	Observed
Motor vehicles	52,30	0,128	0%	0,00	0,000010
Chemicals	32,10	0,078	20%	0,20	0,058838
Pharmaceuticals	39,80	0,097	40%	0,40	0,137534
Research and development sector	24,00	0,058	60%	0,60	0,235107
ICT industry	259,70	0,636	80%	0,80	0,363324

Source: own calculation using WESSA.NET software

Chart 4. R&D spending in leading industrial sectors in OECD countries, year 2005.



Source: own elaboration using WESSA.NET software

From the concentration statistics presented on Table 4 and Table 5, we can see that when taking into account only selected industrial sectors in OECD countries, the R&D spending are highly concentrated in ICTs sector. Probably it is strictly associated with dynamic development of ICTs sector, and a great need for constant improvements. It is obvious that these improvements require high expenses in order to be innovative and highly competitive. When two years - 1993 and 2005 - are compared, the share of R&D expenditures in ICTs sector in relation to other mentioned, it has hardly changed. It proofs a great demand for investment and innovation in the sector itself.
Finally, in Table 6, the author has presented basic concentration measures, calculated for the statistics analyzed above. It shows differences in Hirschman-Herfindahl Index, Gini coefficient (as inequality measure) and Concentration ratio.

Table 6. R&D spending in leading industrial sectors in OECD countries. Selected concentration measures. Years 1993 and 2005

	1993	2005
Hirschman-Herfindahl Index (HHI)	0,444	0,440
Gini coefficient (GINI)	0,505	0,482
Concentration ratio (CR)	0,632	0,602

Source: own calculation using WESSA.NET software

If we treat selected sectors as companies, and total R&D expenditures (in these sectors all together) as market production, while R&D expenditures in selected sectors as their market shares, we can calculate the Hirschman-Herfindahl Index. Also we calculated the GINI and Concentration Ratio, to assess the magnitude of inequalities when applied data is considered. The HHI is extremely high, which indicated that if it was a real market and sectors companies, the market would be highly monopolized. Also the GINI is high, which indicated rather high inequalities on the market. Considering the two years - 1993 and 2005, we see that all three indicators have hardly changed. The GINI and CR are slightly lower, but still high indicating high level of

concentration and inequalities. However the absolute values have changed significantly - we have studied it before, the selected indices did not change, which proofs that no radical changes on the market did not take place. The relations among these industries stay the same. In the time period 1993-2005 no other industry has become a leading one. The ICTs sector still occupies a leading position.

As we have assumed in the very beginning of the chapter, greater concentration enhances and betters companies` ability to finance research and development expenses from their own resources. As we can distinguish some sectors in OECD countries that are characterized by high shares of R&D expenditures, they are these sectors that are highly competitive and have a great potential to benefit from market competition. They are also companies where relatively high revenues are noted. As we can see from the pre-analysis above, the R&D expenditures are highly concentrated in ICTs sector. New information and communication technologies are commonly perceived as drivers of economic growth and development. Their implementation and use is broad both in high and low income economies. The author thinks that it is fully justified to assume that in high income countries the production of ICTs equipment, hardware or software is at very high level. Also these countries are treated as main exporters of ICTs goods and services. Main, big multinationals operating in ICTs industry are firms originating from high income countries. In the following section we will analyze the export values in OECD countries, production of electronic goods, level of spending on ICTs` goods and services. Also we will present best performing companies of ICTs sectors in OECD and assess the concentration on the market they operate. And finally the author analyses the inequalities in ICTs use and application in all countries of the world where required data were available.

4. Differences in level of ICTs sectors development and ICTs use - cross country analysis

In the last section of the paper, we will study concentration of ICTs` industry - as market concentration, and at the same time we will learn about the magnitude of existing divides among countries in ICTs` utilization and everyday application.

As ICTs industry is developing at high speed rates, we continue to investigate whether these new information and communication technologies contribute positively or negatively to economic growth and development. Intuitively we know that ICTs use and production shall have strong positive impact on it. Thanks to detailed studies of - for example - Oliner and Sichel (2000), or Gordon (1999 and 2000), we know that ICTs` production sectors they do contribute positively to economic growth - namely gross domestic output. The effect of using ICTs` does not seem to be so spectacular, however many evidence have shown that the impact is positive. In case of analyzing impact of ICTs` in terms of their use and application, the effects are long-term one, and are visible only in long-term perspective.

The question of concentration of ICTs industries is vital, mainly when discussing possible ways of fostering social and economic development of some

regions (countries). It is widely recognized that rich regions (countries) are these where we note high concentration of ICTs industries. Of course there is no direct link between existing of ICTs sectors in a given region (country) and its wealth, but it noticeable that presence of ICTs – both in industrial and "use and application" sense – creates some kind of externalities. These externalities arise mainly in labour market. Usually in regions (countries) where ICTs are well developed we can benefit from huge market of well-skilled and experienced people, which constitutes an obvious advantage. On the other hand, employment in ICTs sectors requires high qualifications, which generates relatively high earnings at a time. Another kind of possible externality identified in regions where ICTs industry is well developed, is a great facilitation of information and knowledge transmission. ICTs industries are both horizontally and vertically linked which enables to share a great deal of common knowledge and information. At the same time the exchange of information and knowledge is facilitated a lot.

Another fact, broadly observed in regions where ICTs is highly concentrated, is relatively high labour productivity – in accordance to Acconcia (2003). That enables creation of wealth and effective use of innovative potential.

The benefits which can be drawn from ICTs industry presence in a region are rather obvious and unquestioned. However it is not an objective of the paper, and will not be analyzed deeper – it is highly probable that when analyzing the assumed set of data, we will conclude that general welfare – both on social and economic ground – are strictly linked to presence of ICTs sectors in a region, and widespread use of ICTs equipment and services.

As it was assumed before, the author will assess the concentration of ICTs industry – mostly referring to value of ICTs goods export, ICTs trade on global market, etc. in here additionally we will analyze "traditional" market concentration referring to the few largest ICTs companies. In this part – for technical reasons – we will concentrate exclusively on high income countries.

After, ICTs concentration will be analyzed from a different perspective. ICTs use and application concentration in different region – and world economy as one entity – will be analyzed. In this part, we will not consider ICTs as an industry, but we will try to learn about the magnitude of spatial differentiation in ICTs` use all over the world.

Firstly, main ICTs equipment exporters (countries) will be analyzed. We take into consideration, gross values of exported equipment in time period 1997-2006. All statistics are drawn from OECD Factbook 2008. List of countries that produce and export ICTs equipment is presented below in Table

Table 7. Value of ICTs export, million USD, absolute values. Selected countries, years 1997-2006.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Australia	2282	1873	1830	2068	1983	1762	1948	2128	2262	2238
Austria	3568	4074	4111	5018	5237	5846	6627	7861	8134	8465
Belgium	8344	9373	9548	11434	11814	10561	12488	13581	14620	13655
Canada	14913	14573	15728	22626	15011	12018	12016	14222	16615	18047
Czech Republic	962	1513	1339	2128	3201	4790	5922	9104	9778	13498
Denmark	3805	3862	4016	4177	4060	5435	5136	5823	7102	6778
Finland	6920	8656	9343	11555	9414	9789	11085	11563	14557	14640
France	28155	32257	32084	35689	30455	27827	28209	32328	33182	38120
Germany	43700	47517	50793	57452	59083	61433	70349	91452	99127	107388
Greece	219	257	315	481	381	397	456	585	525	700
Hungary	3294	4761	5943	7776	7510	8938	11967	16983	17277	19353
Iceland	3	4	5	12	9	13	17	18	25	16
Ireland	16224	18637	23644	26349	29732	27260	22565	23673	24933	24521
Italy	11711	11890	11777	12842	12825	11435	12549	14659	15162	15386
Japan	104239	93612	101473	123548	94696	95015	106655	124242	121474	125089
Korea	36248	33906	45061	61525	46793	55021	66545	86099	87163	88544
Mexico	20369	24678	30432	38267	38058	36324	35906	41336	43870	53462
Netherlands	31926	31584	35396	41218	34543	31593	45505	58305	64748	70049
New Zealand	290	299	280	286	273	314	365	464	494	509
Norway	1432	1513	1502	1430	1525	1345	1471	1670	1858	2173
Poland	917	1295	1242	1424	1738	2154	2652	3341	4123	6124
Portugal	1357	1465	1781	1893	2065	2012	2716	2899	3184	3907
Slovak Republic	310	386	409	464	574	624	1032	1896	3200	5518
Spain	5115	5683	6055	6137	6161	5897	7615	8218	8280	8547
Sweden	12513	13224	13720	16579	9353	10251	11374	14807	15818	16475
Switzerland	3919	4090	4337	4712	4301	3730	4237	4947	5690	5512
Turkey	647	1043	924	1103	1188	1714	2125	3096	3395	1718
United Kingdom	47039	48019	48964	55865	53396	51657	43052	43848	59755	91282
United States	140814	135108	148465	182262	152150	132614	136631	149273	154917	169027
Brazil	1176	1190	1479	2513	2640	2420	2332	2290	4038	4396
China	23194	27419	32663	46996	55305	79377	123303	180422	235167	298993
India	545	317	444	714	880	939	1262	1205	1424	1742
Israel	4189	4726	5109	8214	7308	6006	5862	7199	8214	7199
Russian Federation	917	609	755	799	1009	942	896	1137	1157	1519
Slovenia	332	350	314	396	415	436	536	619	565	629

Source: own compilation based on data from OECD Factbook 2008.

In following analysis each country is treated as a "company". World market of ICTs equipment is treated as a market where these companies operate. All these economies are main exporters and creators of ICTs goods and services. The "rest of the world" are countries that import and adopt what is produced in OECD economies. But as we can see from the statistics in Table 7, also among these countries ("companies") exist significant differences. Some countries - like United States, China, Germany, Japan, United Kingdom, France or Korea (South) - have dominant position on the exporting market of ICTs goods and services.

In Table 8, below, we have basic concentration statistics. They are: Gini coefficient, Hirschman-Herfindahl Index and Concentration Ratio which give us a general idea about the magnitude of inequalities existing on the exporting market.

Table 8. Concentration statistics for export of ICTs equipment, selected economies. Years 1997, 2000 and 2006.

	1997	2000	2006
Gini coefficient	0,715	0,699	0,707
Hirschman-Herfindahl Index	0,117	0,106	0,111
Concentration Ratio	0,736	0,719	0,728

Source: own calculation using WESSA.NET software

Both Gini coefficients and Concentration Ratio are at significantly high level. That suggests that among OECD countries exporting ICTs goods and services exist great differences when the overall value of the export is taken into account. It proofs that on the market there are few great players which play a dominant role. The value of HHI states for fairly competitive market. What is even more interesting no significant changes can be observed among three analyzed years. The values of all three measures are slightly lower in 2006 than in 1997, but still very high.

In addition to the statistics above the author presents also differences among countries that produce electronics. All data is put in the following Table 9.

Table 9. Electronic production in selected economies (in billions of US dollars), absolute values. Years 2005 and 2008.

	2005	2008	Growth rate in period 2005-2008 (%)
China	**265641**	**413114**	**55,52**
United States	267943	282376	5,39
Japan	191569	184137	-3,88
Korea	97641	94355	-3,37
Germany	70859	81477	14,98
Malaysia	**49516**	**63383**	**28,01**
Singapore	50175	52500	4,63
Chinese Taipei	**41331**	**51171**	**23,81**
Mexico	**34980**	**46995**	**34,35**
Brazil	**21184**	**37753**	**78,21**
United Kingdom	34068	32716	-3,97
France	32751	32396	-1,08
Thailand	**21134**	**31371**	**48,44**
Ireland	18356	21882	19,21
Italy	17484	18633	6,57
India	**10712**	**18476**	**72,48**
Hungary	**13419**	**18046**	**34,48**
Philippines	13890	15329	10,36
Canada	12258	14101	15,04
Switzerland	10879	12184	12,00
Netherlands	10485	11048	5,37
Czech Republic	**7539**	**10808**	**43,36**
Indonesia	10728	10789	0,57
Finland	11069	10347	-6,52
Sweden	10294	10311	0,17
Israel	7880	8661	9,91

Source: own compilation based on data from OECD Factbook 2008.

Statistics explaining gross electronic production proof that this kind of production is mainly concentrated in developing economies. Countries where the growth of value of electronic production is the highest are: Brazil, India, China Thailand. Growth rates are at: 78%, 72%, 55% and 48% respectively. In Europe, Czech Republic, Hungary, Ireland and Germany are definite leaders in growth of value of electronic production. However, in European countries the absolute values of electronic production - also in United States and Japan - are relatively very high, these countries do not experience high growth rates of the production. It is clearly seen that most of companies move their production to developing nations to benefit from cheap labour force, low taxes etc. Although in Table 9, we have presented these countries that are treated as leading economies in terms of gross value of electronic production, in the group also some leader can be observed. The inequalities in the group seem to be significant.

To assess the magnitude of inequalities among main producers of electronics (countries not companies), the author has calculated standard inequality measures. In the case, we also treat countries as companies, so that we could the HHI calculate. The results are presented in the following Table 10.

Table 10. Concentration statistics for electronic production (values), selected economies. Years 2005 and 2008.

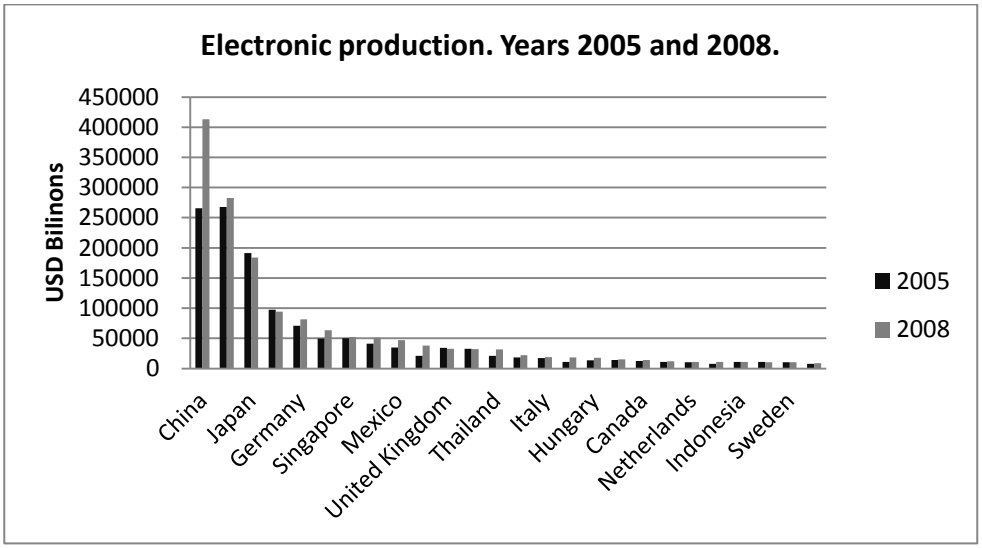
	2005	2008
Gini coefficient	0,600	0,608
Hirschman-Herfindahl Index	0,116	0,126
Concentration Ratio	0,624	0,632

Source: own calculation using WESSA.NET software

In years 2005 and 2008 the value Gini coefficient indicates rather high inequalities in the group of countries. The same conclusion can be drawn when concentration ratio is taken into account. The level of Hirschman-Herfindahl Index proofs that the market (if countries as treated as companies) in year 2005 was moderately monopolized. But looking at the value in 2008, we see that HHI=0,126, which shows that the market is highly monopolized. The shows some significant changes when relations among countries producing electronics are considered. Such change shows that big companies producing electronics tend to concentrate their production in few developing economies, which seem to bring them the maximum of benefit and comparative advantage. Not surprisingly among these countries are China, India, Thailand, which are widely thought to be countries where locating production seems to bring high profits. Of course it does not mean that new information and communication technologies are created in there. These countries only give the final product of what is invented in high income economies. The process of transferring production to cheaper markets is a common procedure especially when production in ICTs sectors is considered. The procedure is not negative itself, although we observe some main direction of such transfers. The level of selected inequalities measures also proof that electronic production is mainly concentrated in few developing nations. To complete the general view of the problem we present values of

electronic production in Chart 5 for selected countries, where you can clearly see great differences among economies.

Chart 5. Electronic production in selected advanced economies. Years 2005 and 2008.



Source: own elaboration based on data from OECD Information Technology Outlook 2008.

As following the author presents 50 Top ICTs companies that operate worldwide in ICTs sector. Changes in revenues in between years 2000 and 2007 are presented. In the last column the growth rate of revenue in each company is calculated. In here the author treats revenues as proxies of turnover which is traditionally applied for HHI calculation.

Table 11. Revenues in Top 50 ICTs companies in ICTs sector. Years 2000 and 2007.

Company`s name	Country	2000	2007	Growth rate of revenue (%)
Siemens	Germany	64 405	99 108	53,9
Hewlett-Packard	United States	48 870	104 286	113,4
IBM	United States	85 089	98 785	16,1
NTT	Japan	92 679	91 191	-1,6
Verizon Communications	United States	64 707	93 469	44,4
Hitachi	Japan	72 725	86 059	18,3
Deutsche Telekom	Germany	37 559	85 580	127,9
Matsushita (Panasonic)	Japan	68 711	76 488	11,3
Telefonica SA	Spain	27 306	77 264	183,0
France Telecom	France	30 894	72 497	134,7
Sony	Japan	62 046	69 665	12,3
Samsung Electronics	Korea	34 573	67 970	96,6
AT&T	United States	46 850	118 928	153,8
Dell Computer	United States	25 265	57 420	127,3
Toshiba	Japan	53 349	59 761	12,0
Nokia	Finland	27 868	69 895	150,8
Microsoft	United States	22 956	51 122	122,7
Vodafone	**United Kingdom**	**11 929**	**51 199**	**329,2**
Motorola	United States	32 107	36 622	14,1

NEC	Japan	48 343	39 072	-19,2
Fujitsu	Japan	48 484	42 830	-11,7
Sprint Nextel	United States	17 220	40 146	133,1
Telecom Italia	Italy	27 516	43 399	57,7
China Mobile	**Hong Kong**	**15 249**	**46 922**	**207,7**
BT	United Kingdom	28 356	40 830	44,0
Canon	Japan	25 020	38 055	52,1
Intel	United States	33 726	38 334	13,7
Philips Electronics	Netherlands	34 736	36 678	5,6
Mitsubishi Electric	Japan	35 021	32 379	-7,5
Cisco Systems	United States	18 928	34 922	84,5
Hon Hai Precision	**Chinese Taipei**	**2 900**	**51 828**	**1687,2**
KDDI	Japan	14 159	28 009	97,8
LG Electronics	Korea	20 085	25 286	25,9
Ericsson	Sweden	29 866	27 788	-7,0
Sharp	Japan	17 210	26 266	52,6
3M	United States	16 699	24 462	46,5
China Telecom	China	15 663	23 484	49,9
America Movil	**Mexico**	**3 181**	**28 511**	**796,3**
Sanyo Electric	Japan	18 005	19 387	7,7
EDS	United States	18 856	22 134	17,4
Tech Data	United States	16 992	21 440	26,2
Emerson Electric	United States	15 545	22 572	45,2
Apple Inc	**United States**	**7 983**	**24 006**	**200,7**
Korea Telecom	Korea	10 686	20 076	87,9
Accenture	Bermuda	11 331	21 453	89,3
Telstra	Australia	11 246	20 544	82,7
Sumitomo Electric	Japan	12 142	20 198	66,3
Schneider Electric	France	8 894	23 695	166,4
ASUSTeK Computer	**Chinese Taipei**	**2 146**	**17 931**	**735,6**
Ricoh	Japan	12 870	17 374	35,0

Source: own compilation based on data from OECD Information Technology Outlook 2008

The statistics, especially in some cases seem to be astonishing. Growth rate of revenues are extremely high, which proofs great demand for the goods and services these companies are offering, but at the same time such changes proof that the market for such goods and services is growing rapidly. Additionally basic concentration statistics are calculated. As seen from the Table 12, the GINI are relatively low, which indicates that among these companies there are no great disparities when revenues levels are considered. However there are no significant inequalities in levels of revenues in Top 50 ICTs companies (concentration ratios indicate the same), the growth rates of revenues are large and highly surprising. When HHI is analyzed, its levels show that market is moderately concentrated, and the situation – considering market concentration – did not change significantly over the analyzed time period.

Table 12. Concentration statistics for Top 50 ICTs companies. Years 2000, 2006 and 2007

	2000	2006	2007
Gini coefficient	0,381	0,310	0,313
Hirschman-Herfindahl Index	0,030	0,026	0,026
Concentration Ratio	0,389	0,316	0,319

Source: own estimation based on data from OECD Information Technology Outlook 2008, using WESSA.NET

As final analysis, the author shows worldwide inequalities in access and use basic ICTs tools. The author checks the diffusion of ICTs tools among all economies for which necessary data was available. All statistics are drawn from Information Telecommunication Union database. Three basic ICTs use indicators are applied, these are: number of fixed telephone lines (per 100 inhab.), number of cellular phones (per 100 inhab.), and number of Internet users (per 100 inhab.).

Table 13. Summary concentration statistics for access and use of ICTs tools. All countries. Years 1998 and 2008.

	1998		2008	
	Gini coefficient	*Concentration ratio*	*Gini coefficient*	*Concentration ratio*
Fixed telephone lines (per 100 inhabitants)	0,601	0,604	0,514	0,516
Cellular telephones (per 100 inhabitants)	0,729	0,733	0,366	0,368
Internet users (per 100 inhabitants)	0,781	0,785	0,527	0,529

Source: own calculation using data from International Telecommunication Union 2009

Considering all three ICTs indicators, in 1998, the measures indicating inequalities were relatively high. The GINI and CR we - when use of cellular phones and number of Internet users are taken into account - have fallen radically. In case of number of people using fixed telephone line the decline is fair but noticeable. Such changes in GINI and CR values - in case of cellular phones and number of Internet users, is mainly due to rapid spread of ICTs technologies all over the world. These changes are especially noted in low income countries. If taking account the rapid changes in revenues of Top 50 ICTs companies, high growth rates of electronic production, and after identifying main countries where ICTs goods and services are produced, the result seen in Table 13 are not very surprising. It is quite obvious that low income countries there are huge markets where ICTs implementation is common and diffusing at high pace. As it was already mentioned at the beginning, ICTs poses a few unique features that let them to diffuse fast and their use is effective and broadly demanded. Putting together statistics of electronic production, ICTs companies revenues and changes in ICTs use in all countries, it is fully justified to state that despite relatively high concentration of

ICTs production the use of these technologies is becoming more and more common regardless the average income in a country.

Summary

The main target of the chapter presented, was to analyze general inequalities (concentration) of new information and communication technologies worldwide. As the author assumed at the very beginning, huge companies that experience high incomes and poses great shares of market, at the same time have great possibilities to invest and finance research and development from their own resources. High monopolization – in some cases – can lead to higher innovative power. After analyzing R&D spending in realized by companies in ICTs sector are high and grow dynamically. Especially spending doing research in Internet sector are very high. Just to remind – in years 1993-2005 – total amount of money spend on R&D in Internet sector, grew at 60%. The extraordinary growth is partly a consequence of great need to improve basic and advanced ICTs goods and services. In most of countries these ICTs are highly desired, mainly because there are many proofs that they have a great potential of fostering economic growth and development. The positive impact of ICTs influence on overall socio-economic welfare is hard to quantify, however many advocates that the impact is long run and new technologies can do much better in improving people's living conditions.

As we can conclude generally, the concentration in ICTs sector is rather high, however it seems that the concentration let many companies to finance research and development expenses. We can also draw the conclusion that thanks to high investment in ICTs sectors and high R&D spending, the diffusion of ICTs tools is common in many economies. As inequalities statistics proof, in years 1998-2008 the disparities in using Internet and other ICTs goods and services fell significantly, which is perceived very positively.

We can hopefully state that despite rather significant concentration is ICTs sector, the use and application of goods and services offered by companies operating in the sector has a tendency to fall.

Bibliography:

1. Acconcia A., Del Monte A., ICT Spatial Concentration and Growth among European Regions, www. is2.lse.ac.uk/asp/aspecis/20030041.pdf, accessed: 20 Oct 2009
2. EU KLEMS Database, (2008), University of Groningen and University of Birmingham; downloadable at www.euklems.net
3. Gester & Zimmermann, Information and communication Technologies for poverty reduction: discussion paper, Swiss Agency of Cooperation & Development, 2003 Fighting Climate Change. Human solidarity in a divided world. HDR 2007/2008, UNDP 2009; accessed: 5 May 2009
4. Ginevicius R., Cirba S., (2007), Determining market concentration, Journal of Business Economics and Management, vol. VIII, No1, pp.3-10
5. Gordon R. (2000), "Does the "New Economy" measure up to the Great Inventions of the Journal of Economic Perspectives, vol. 14, n.4, pp. 49-74.
6. Gotz G., Gugler K., (2006), Market concentration and product variety under spatial competition, J Ind Compet Trade 6, pp.225-234

7. Houben A.,Kakes J.(2002) “ICT Innovation and Economic Performance:The Role of
Financial Iintermediation”, KyKlos.Vol.55-2002 Fadc.4,543-562.
8. International Telecommunication Union Database 2009, www.itu.int 2009
9. Lyon B., Matraves C., Moffatt P., (2001), Industrial concentration and market integration in the European Union, Economica 68, pp. 1-26
10. Measuring the Information Economy 2002, OECD 2003.
11. Medvedev A., Zemplinerova A., (2005) Does Competition Improve Performance? Evidence from the Czech Manufacturing Industries", Prague Economic Papers, 14, 4:317-3
12. Nickell, S., (1996), Competition and Corporate Performance, Journal of Political Economy, 104(4), pp. 724-746.
13. OECD Factbook 2008, OECD, 2008
14. OECD Information Technology Outlook 2008
15. Oliner S. D., Sichel D. E. (2000), “The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?”, Journal of Economic Perspectives, vol. 14, n.4, Fall, pp.3-22.
16. Porat, M.U. (1977), “The Information Economy: Sources and Methods for Measuring the US Department of Commerce,Office of Telecommunication, (2), 7-12, Washington
17. Spence, R. (2005), ICTs, Internet, Development and poverty reduction, 2005, www.developmentgateway.org, accessed: 6 Jan 2007
18. Symeonidis G., (1996) Innovation, firm size and market structure: Schumpeterian hypotheses and some new themes, OCDE/GD(96)58, OECD
19. Torero, M. and J.Von Braun (2006), ICTs for the poor, International Food Policy Research Institute, www.ifpri.org/, accessed: 11 Oct 2008
20. Tremblay V.J., Iwasaki N., Tremblay C.H. (2005), The dynamics of industry concentration for U.S. micro and macro brewers, Review of Industrial Organization 26, pp.307-324
21. Tsekouras K., Daskalopoulou I.F., (2006), Market concentration and multifaceted productive efficiency, J Prod Anal 25, pp. 79-91
22. Vossen R.W., (1999) Market power, industrial concentration and innovative activity, Review of Industrial Organization 15, pp.367-378