

On Romanian Experiences Related to ICT - R&D

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Romania is on the eve of EU accession, the accession date being now confirmed as 1 January 2007. Romania is the second largest in Central and East Europe and its presence in the European Union will have an important impact in South East Europe. Its rate of growth of GDP has been remarkable in the last 5 years, the economy showing healthy trends. IT in Romania has deep roots in the past. Now the Romanian ICT best assets are the human resources and a quickly developing market. Various reports appraise eReadiness of Romania, i.e. capacity of nations to participate in the Digital Economy from connectivity, information security, human capital, eBusiness climate and eLeadership. Despite the healthy trend and high dynamics of certain ICT indicators, reality shows that still the country is affected by digital divide, the Internet penetration is still low, ICT spending per capita is far not only from EU15 average, but less than EU25 average, there is a lack of major IT applications in public administration and in business sector. The R&D capacity of Romania has been decreasing gradually after 1989 from various reasons and Romania has a very weak position compared to other EU countries in terms of innovative capacity. Both public and business R&D expenditure are low. ICT R&D is in many respects a reflection of general R&D: low public & business funding, poor collaboration of the ICT SMEs but is distinctive in several areas: Innovation in software field is higher than statistics show. There are no marketing channels to make known the innovation capacity of Romanian ICT R&D in SMEs and its potential for EU ICT R&D, the level of education in ICT is high, many ICT multinationals have opened and the trend continues R&D centres in Romania, mostly in software & ICT applications, investments in ICT R&D centres are higher than in other fields. The main driving force for ICT R&D is the countries progress in developing ICT infrastructure, both public and business. On the other way, Lack of enough national ICT R&D lead to very high rate o imports of R&D, software and hardware. The only real drive was the growth of GDP, bringing a higher demand for ICT spending. ICT development is a must and it a condition for societal progress. To bridge the gap with advanced countries most of the countries have to build the four pillars: appropriate ICT Infrastructure, accessible and affordable Internet access, generalized ability to use ICT, availability of useful content. the regional cooperation in ICT R&D. The countries of the EE region experience the same problems; the transfer of experience is more natural. FP7 can become a starting point to approach regional cooperation in a more enhanced way, more practical and with less costly western consultancy. It is the moment to ask that the proposed European Institute of Technology to have regional branches. Such branches would have local knowledge and will push results more appropriate with our needs. IT STAR is a regional cooperation of professional associations from both developed and transition countries. It could play a role in bringing together experiences and knowledge to set up a pool of Regional ICT R&D

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CONTENT

| | |
|--|---|
| <i>General framework</i> | 1 |
| <i>Economy</i> | 2 |
| <i>ICT</i> | 2 |
| <i>ICT in Romania 1990-2006</i> | 2 |
| <i>Digital Divide & Regional Aspects</i> | 4 |
| <i>After EU Accession</i> | 4 |
| <i>R&D</i> | 4 |
| <i>ICT R&D</i> | 5 |
| <i>ICT R&D Infrastructure</i> | 6 |
| <i>International support to ICT R&D</i> | 7 |
| <i>Driving forces, problems, success stories and setbacks</i> | 8 |
| <i>The impact of ICT R&D on societal development: The Four Pillars</i> | 8 |
| <i>The role of research and international co-operation</i> | 8 |
| <i>References</i> | 9 |

General framework

Romania is now in November 2006 on the eve of EU accession, the accession date being now confirmed as 1 January 2007. With a population of 22 million and an area of 237.000 sq.

km., Romania is the second largest in Central and East Europe. Its presence in the European Union will have an important impact in South East Europe.

Economy

The GDP per capita of Romania is still rather small, 4,411 USD in 2005 at exchange rate parity and 8.400 USD in PPP (purchase power parity). However, the rate of growth of GDP has been remarkable in the last 5 years, the economy showing healthy trends (Chart 1).

GDP composition is industry 34%, agriculture 13%, services 53%, main industries being mining, timber, construction materials, metallurgy, chemistry, machine building, food processing, and petroleum production and refining. The agriculture main products are wheat, corn, sugar beets, sunflower seed, potatoes, grapes; milk, eggs and beef.

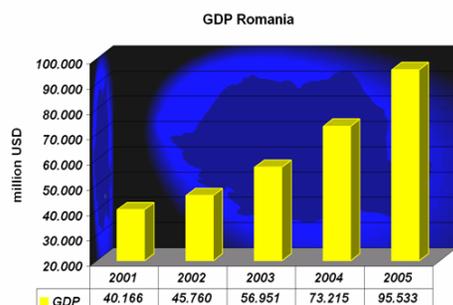


Chart 1 GDP Romania 2001-2006

The labour force of 9.3 million is not hit by unemployment (5.5%) as an estimate of 2.5 million people work now abroad. The average salary is slowly rising.

The productivity is still low, but local investments and FDI start showing their fruits. Companies like Mittal Steel, Renault, OMV, Lafarge, Orange, Vodafone, Alcatel, Erste Bank, EDF, Metro Cash & Carry, Carrefour have modernized old state owned companies or they made greenfield-type hundred million dollars each investments. These are only a few examples. Except some utilities companies there is no major economy sector still state-owned.

| | | 2003 | 2006 | Rate |
|--------------------|--------------|--------|--------|--------|
| Population | millions | 22.4 | 21.44 | -4.3% |
| GDP | billion USD | 57.2 | 90.8 | 58.7% |
| ICT /GDP | % | 7.00% | 8.00% | 14.3% |
| ICT Spending/GDP | % | 2.33% | 2.66% | 14.0% |
| ICT Spending | billions USD | 1.333 | 2.412 | 80.9% |
| IT Spending/GDP | % | 0.8 | 0.5 | -37.5% |
| Computer Users | % | 24% | 35% | 45.8% |
| Cards Issued | millions | 5 | 8.5 | 70.0% |
| Card Penetration | % | 22.40% | 38.50% | 71.9% |
| Mobile Phone Users | % | 25% | 60% | 140.0% |

Table 1 Main ICT Indicators 2006 vs. 2003
Sources MCTI, IDG, INS RO, Eurostat

ICT

IT in Romania has deep roots in the past. Romania was the first country in Easter Europe to build first generation computers: CIFA-1957, MECIPT-1961, and DACICC-1962. An industrial base was built in the 1970s with licenses from CII-France, Friden-Holland, Ampex, Memorex, Control Data-USA, etc. with research, manufacturing, service, trade and data processing organizations reaching in 1980s a 40.000 people workforce. Minicomputers "Made in Romania" were exported to Czechoslovakia, East Germany, China, Middle East countries and other markets. But technologies became obsolete in the period 1980-1989 due to lack of investments in hard currencies.

ICT in Romania 1990-2006

After 1989 almost all world major ICT companies have arrived in Romania in a sector now practically 100% private or privatized. They discovered the Romanian ICT best assets, human resources and a quickly developing market.

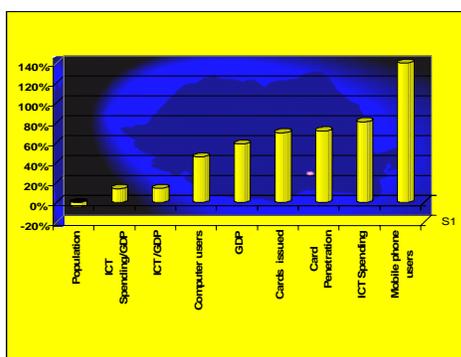


Chart 2 Main ICT indicators Romania

Romanian education system is largely recognized as on of the best in the world of ICT. Over 5.000 new graduates enter the labour market every year. If 10 year ago most of them left Romania to find jobs in the West, now the ratio is much smaller and even some people return. Brainbench puts Romania first based on the number of skilled programmers in Europe.

There are more than 8.000 software and IT services companies in Romania. Most of them are small, but a process of acquisitions has started and

the entry in EU will probably accelerate this process. Instead of only hiring Romanian experts in their research and production facilities in USA and Western Europe many multinationals have started create rather large R&D, production or service centres in Romania,

Various reports appraise eReadiness of Romania, i.e. capacity of nations to participate in the Digital Economy from connectivity, information security, human capital, eBusiness climate and eLeadership.

But as most of neighbouring countries in Romania the IT accessibility, affordability, digital literacy and content availability are being yet inadequate (Chart 2 and Table 1).

The encouraging sign is the response of the market. Romania is placed by Digital Planet, an WITSA/Global Insight, Inc. yearly report [DP]

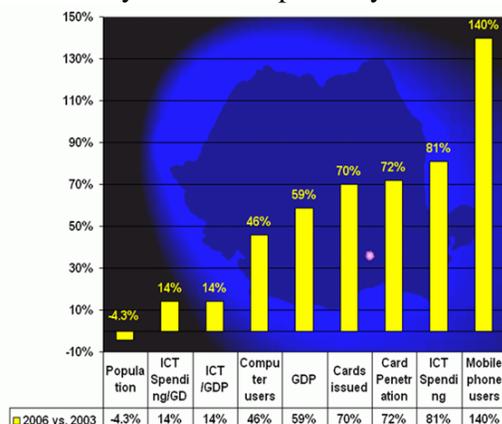


Chart 3 Main ICT Indicators Dynamics 2006 vs. 2003

among the top 10 countries as dynamics of market growth.

A look at the IT market in Romania (chart 3 and 4) reveals a very high rate of all IT sectors in the period 2003-2005 and while computer hardware looks a little bit saturated,

computer software and computer services continue their high rate of growth for still many years. Hardware spending will grow 10% in 2007 vs. 2005, while software will mark a substantial 31.5% and IT services 21.5% grow in the same period. Biggest increases of 32-42% will be marked by services, financial and banking, trade and communications.

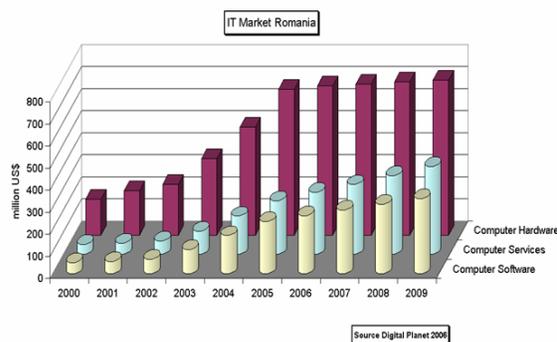


Chart 4 Romanian IT Industry 2000 - 2009

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The communication market (Chart 5) has experienced a similar evolution. If in 1989 Romania had a 10% telephone penetration, mostly with obsolete lines, now fixed and mobile lines are abundant, Romania being one of the first European countries to fully

liberalize communications market. Latest data show a 20% penetration of fixed line telephony with one big operator Romtelecom and 74 alternative operators. The mobile market has 4 big operators Orange, Vodafone, Cosmote and Zapp (CDMA) with a penetration rate of more than 55%.

The Internet penetration is explosive. There are 980 Internet Service Providers and they reported for 2005 a number of 1,8 million accesses, dial-up access being in regress. Broadband access accounted for 41% of the total a rate of 96% increase over 2004. Based on the number of people using these accesses a rate of penetration of Internet of 28% is reported by the Ministry of Communications and Information Technology.

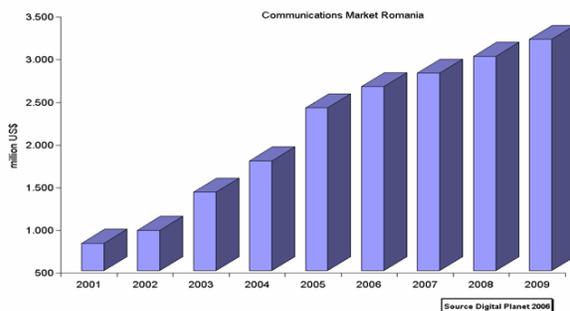


Chart 5 Romanian Communications 2001-2009

Large nation- wide IT projects have started, like Ministry of Finance - Customs Office and Global Income Taxation System, Ministry of Interior - ID & Car Registration, Border Police, National Health Insurance Office, IS of major banks with branches all over the country, Educational & Research Networks.

The legal framework is completed, communications, intellectual property, electronic signature, eCommerce being covered by laws in-line with EU recommendations.

The country is able to participate to the Digital Economy; the market is increasingly big, human resources are still abundant; the education system is very performing, eBusiness offers a chance to leapfrog stages; foreign languages skills are largely available, protection of intellectual property is enforced.

Digital Divide & Regional Aspects

However, despite the healthy trend and high dynamics of certain ICT indicators, reality shows that still the country is affected by digital divide, the Internet penetration is still low, ICT spending per capita is far not only from EU15 average, but less than EU25 average, there is a lack of major IT applications in public administration.

Various studies link ICT diffusion to GDP and rank countries according to ICT basic indicators. A UNCTAD study [UN] places Romania at rank 66 from 180 countries surveyed, a middle position among the Eastern European countries (Chart 6). Most important is that this rank evolved from 77 in 1998 to 66 showing a positive trend. Most of the other countries of the region listed show the same trend (Chart 7).

The high rate of growth in Romania is real, but it is mainly a result of high investments made in telecommunications by foreign companies and the modernization of information systems by companies in services, banking, trade and manufacturing.

The cost of the growth is high, as it was in the past, as most of the development is based on R&D from abroad and by foreign or foreign-owned suppliers.

The positive trend is thus due to a complex of actions by the government and the private ICT industry.

The legal framework has encouraged competition and ruled different aspects of ICT and large investments by telecom operators and banks increased access and affordability (Chart 2).

A project based on a World Bank Loan of 80 million US\$ is now being implemented creating Knowledge and Internet Centres in 200 rural locations. This will further enhance the trend of using IT in office and at home.

But as access and affordability are not enough, ATIC – ICT Association of Romania as CEPIS member started to promote ECDL, with accent to Public Administration, high schools and universities. Mid-2006, ECDL Romania reported a network of 350 test centres with already over 28.000 certificates issued and 60.000 skill cards.

After EU Accession

Access to EU will certainly affect ICT industry in Romania. Fiercer competition will mean closing many small companies, problems with scarcity of IT labour force, as demand for IT experts will increase and experts will be more tempted to emigrate for a better paid job.

However, all forecasts show trends of growth of ICT spending with favourable effects on the industry and possible on ICT R&D.

High technology exports (3-4% of total exports in 2002-2004 [WB]) should go up for reasons outlined below.

R&D

The R&D capacity of Romania has been decreasing gradually after 1989. The main reasons are:

- Dismantling of old state owned research institutes; partly by decreasing orders; partly by outflow of researchers to new private companies or to better positions abroad
- An continuously diminishing workforce; from cca 0,6% of population in early 1990s to 0.14% in 2002
- An aging workforce; researchers 50-60 years old and more counted in 2002 for 30% of total, compared with 26% in 1995.
- Low salaries and unsuitable research environment favoured brain drain

- Dispersion in many small R&D units; Romania had in 2003 a number of 607 R&D units, respectively 34 National R&D Institutes in 15 research fields co-ordinated by eight ministries; 227 public research institutions, subordinated to Ministry of Education and Research, other ministries, the Romanian Academy; 15 R&D institutes operating on the basis of the Government Decision 100/1991 which are in a re-organising process according to the legal norms in force; 310 joint-stock public or private companies having R&D as main object of activity [ETI] This gives a little over 50 people per R&D unit.
- Lack of orders and research grants from the industry

It is not surprising that Romania has a very weak position compared to other EU countries in terms of innovative capacity.

Despite the success of economic development, the business R&D is weak. There is a

strong demand for imported foreign technology and equipment and a low demand for domestic R&D.

The European Innovation Scoreboard 2005 ranks Romania second to last on the SII out of 33 countries. It performs poorly on public & business R&D, SME collaboration on innovation, ICT expenditure, hi-tech exports and better for the supply of new S&E graduates that has doubled between 1998 and 2003, youth education, university R&D financed by business, new to market product

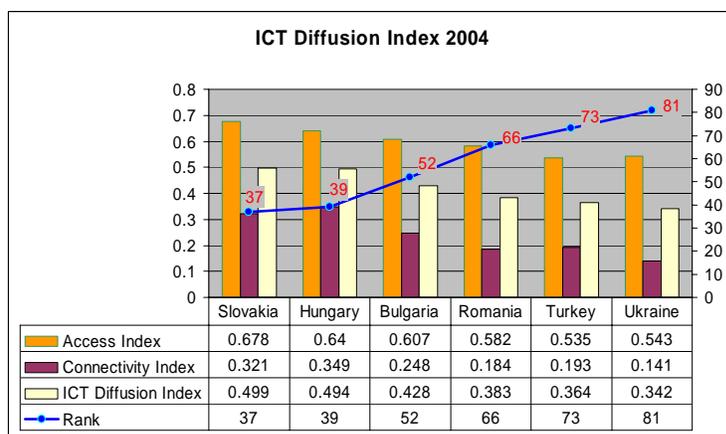


Chart 6 ICT Diffusion Index 2004

Source: UNCTAD

sales [EIU] (Chart 8).

Public R&D expenditures have increased from 0.11% of GDP in 1998 to 0.16% of GDP in 2003, but conversely business R&D has more than wiped out any gains, declining from 0.38% of GDP in 1998 to 0.24% in 2003. Although 1% from GDP was promised for 2007, only 0.5% is mentioned in the draft of the budget.

The European Innovation Scoreboard 2005 states some challenges for Romania: to substantially increase ICT expenditures, which only accounted for 1.5% of GDP in 2004 (in

fact other statistical data [DP] accounts for 2.7%). Other requirements include improving the share of SMEs that cooperate on innovation projects and the percentage of firms that receive support for innovation projects.

Indeed, EIU reveals a majority of non-innovator firms (over 80%) and only about 3% strategic innovator firms, probably most in hi-tech areas.

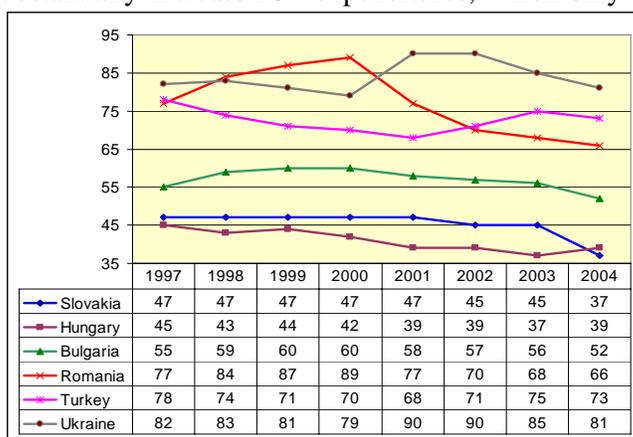


Chart 7 ICT Diffusion Rank 1998 – 2004

Source: UNCTAD

However, the lower investment needed for ICT R&D research compared with other science & technology fields make Romanian ICT R&D distinctive in several areas:

ICT R&D

ICT R&D is in many respects a reflection of general R&D: low public & business funding, poor collaboration of the ICT SMEs.

- Innovation in software field is higher than statistics show. There are over 8,000 SMEs many of them very creative and even sometimes “the wheel is recreated” a lot of creative solutions are proposed.
- There are no marketing channels to make known the innovation capacity of Romanian ICT R&D in SMEs and its potential for EU ICT R&D. It is well known that Microsoft bought few years ago, in an over 15 million US\$ deal, a Romanian anti-virus technology from an SME and made it the nucleus of one of its most recent products. I wonder if any considered that company GECAD an R&D unit before.
- The level of education in ICT is high and every year 5,000 new educated graduates join the market. 10 years ago 90% emigrated to West Europe and North America, now somewhat less.
- Many ICT multinationals have opened and the trend continues R&D centres in Romania, mostly in software & ICT applications. Among them Alcatel, Siemens, Solectron, Oracle, HP, IBM, Infineon, Huawei, Adobe Systems, Microsoft, SAP and many other smaller companies
- Investments in ICT R&D centres are higher than in other fields
- The highest concentration of ICT innovating firms is in the Bucharest Region (80%+).

ICT R&D Infrastructure

ICT R&D is done by business sector, specialized institutions, universities. The coordinators are the Ministry of Education and Research, Ministry of Communications and Information Technology, Romanian Academy, other ministries and agencies. A special role was played by the National Institute for R&D in Informatics (ICI) that in a consortium with several universities supervised a national research programme called INFOSOC.

A particular promising programme was the creation Industrial & Software Parks, Technology Transfer Centres, Technology & Business Incubators, Technology Information centres. Although, they are created in the framework of encouraging innovation, most of them have the specifics of ICT (Software Park Galati, Softex Braila, CyberLAB Slobozia, Software Park Brasov, Minatech-Ro Bucharest, CTT-Baneasa, IPA SA - CIFATT Craiova, etc.).

A very promising step was also the creation in 2001 of the ICT Task Force in support of the implementation of Information Society in Romania in March 2001. Among this body’s main tasks are ICT strategy-making and approval of all major projects (worth over €100,000) initiated by public institutions, initiated by or benefiting to national companies or by companies with the state as a major shareholder. The ICT Task Force includes: the Prime Minister of Romania (as chairman), Minister of Education and Research, Minister of Public Administration, Minister Coordinating the General Secretariat of the Government, Minister of Communication and Information Technology, Minister of Public Finance, Minister Delegate for the Ministry of Education and Research. Except approval of several large projects little is known about the role of this high ranking body that after the 2004 elections entered in a phase of no public awareness.

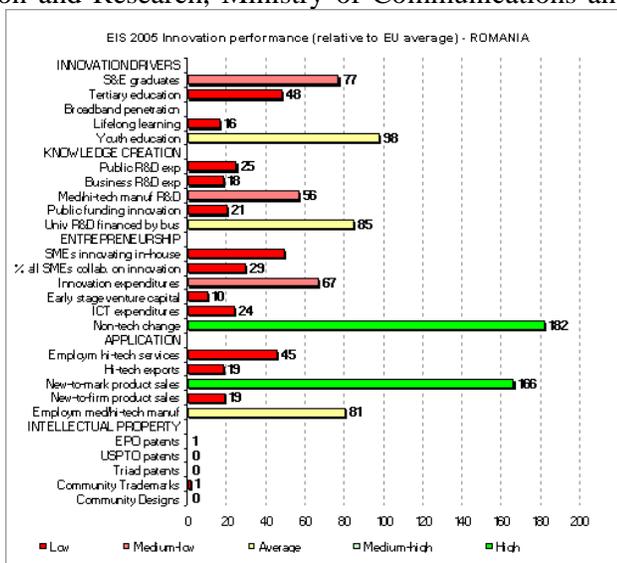


Chart 1 EIS Innovation Performance 2005 relative to EU average

Source: The European Innovation Scoreboard 2005

The Ministry of Communications and Information Technology has launched since 2001 a number of IT projects:

- The "Knowledge-Based Economy" – developed and implemented on the basis of a 80 million US\$ loan by the World Bank and aiming to foster innovation and ICT access in rural areas of Romania through Local Community Electronic Networks (RECL).
- The National Electronic System (www.e-guvernare.ro), a government’s one-stop-shop portal that provides forms for download and on-line services
- The Electronic System for Public Acquisitions (www.e-licitatie.ro) targeting reductions in public spending, as well as increased transparency of public acquisitions and discouraging corruption.
- The Electronic System for Allocating International Transport Authorisations,
- (www.autorizatiiauto.ro) to manage transport authorisations granted by the state
- Electronic Systems for the Payment of Local Taxes, aiming at improve the efficiency of the local taxpaying

All these projects and other that are currently in the phase of implementation stimulated ICT R&D as they were developed by Romanian companies.

There are a lot of agencies involved in stimulating growth in ICT R&D. One example is "Partners for Excellence", a programme initiated by the National Agency for Partnership between Universities and the Socio-Economic Environment (APART) in 2004, with the purpose to foster university-industry linkages in Romania. The Programme aims at organising different events to facilitate contacts and joint projects between university and business representatives and to create thus the premises for long-term partnerships between academia and business. ATIC and APART cooperate in the frame of a sector committee for ICT.

Business ICT R&D is counted by statistical data. But very probably the statistics do not always cover all the R&D. ICT multinationals employ now in R&D in Romania over 2,000 people. The output of theses R&D centres is normally in the range of 150 MUS\$. It is notable that its antivirus technology is based on Romanian RAV bought by Microsoft in 2004 in a deal estimated by market analysts at 15 MUS\$. No R&D statistics took that and other deals into account.

International support to ICT R&D

FP5, FP6 and forthcoming FP7 are the main international drivers. Romania has participation in all these programs.

In FP6 compared with FP5 Romania had 3 times less proposals, but with a budget 5 times bigger that in FP5[StI].

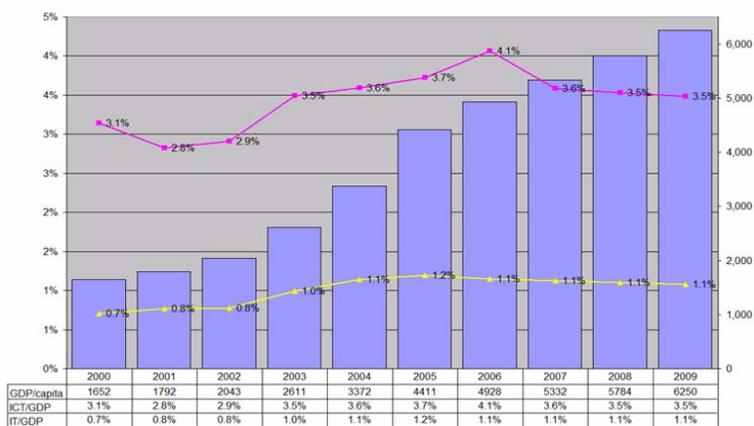


Chart 8 ICT Spending and GDP per capita 2000-2009

The main Romanian participation referred to software technologies, mobile communications, wideband communications, microsystems, etc.

FP7 is presumed to amplify public private partnerships and its main ICT chapters are ICT Technology Pillars, Integration of Technologies and Applications Research.

There are voices that ICT related FP5 and FP6 possibilities were not best exploited by Romania and even that grants received were less than Romania’s contribution.

Driving forces, problems, success stories and setbacks

The main driving force is the country's progress in developing ICT infrastructure, both public and business. The above mentioned high rate of growth of ICT spending is based more on GDP growth and less on intrinsic causes. It is well known the relation between GDP/capita and ICT spending [UNCTAD].

Chart 8 shows a rapid increase of GDP/capita in the period 2000-2005 and further increase till 2009 [DP]. ICT spending shows no sign of increase being more or less flat, with exception of some years of telecom higher growth due to mobile proliferation.

Lack of enough national ICT R&D lead to very high rate of imports of R&D, software and hardware. The only real drive was the growth of GDP, bringing a higher demand for ICT spending.

Over 90% of turnover of ICT companies is produced by branches of ICT multinationals or joint ventures with foreign main shareholder. Some of them organized Romanian R&D centres, but the result is exported with a small margin and often re-imported with commercial margin. We may expect quick increase of absolute value of ICT business R&D in Romania, but with less effect on the general performance of ICT industry.

Like in other R&D areas, although significant progress has been made in order to foster the weak ICT innovation in the country, further measures are needed to increase application of R&D results by business and to turn innovation into a driver of national competitiveness.

The impact of ICT R&D on societal development: The Four Pillars

ICT development is a must and it a condition for societal progress. To bridge the gap with advanced countries most of the countries have to build the four pillars [VB]:

- Appropriate ICT Infrastructure
- Accessible and Affordable Internet Access
- Generalized Ability to Use ICT
- Availability of Useful Content

The enterprise is facilitated by technology: hardware continues to become cheaper as the Moore's Law will be valid for another 10 years, new cheaper and powerful devices appear, new telecom technologies offer cheaper access, there are wireless expectations: Wi-Fi, WiMAX, GSM/CDMA, free (Open Source) software is more and more available, etc.

The question is to be asked: Spending for ICT Reduces DD? The answer is YES and NO. Developing countries present success stories. In Malaysia, Turkey, South Africa and others ICT spending is 7-8% of GDP similar with UK, Japan but the result is in the range of \$300 per capita comparative with \$1,600-\$3,600 in developed countries. The spending of those countries, and Eastern Europe is not far from being in the same situation is equivalent to 1 PC per capita vs. 5-12 PCs in developed countries.

In most developing or transition countries ICT spending per capita is less than \$100 due to limited resources, poverty or other reasons and there is waste of domestic and international funds: expensive consultancy, inappropriate acquisitions, etc. ICT spending for infrastructure in most cases is not enough to really narrow Digital Divide. In addition the lack of own ICT R&D makes infrastructure even more expensive by a mechanism explained above.

As regards the content it is true that what was developed for the rich is now available for the poor and Internet sites with terabytes of data of precious knowledge are available. But content has to be mostly local or localized. This is also an important role of local innovation, of local ICT R&D.

In fact, ICT R&D is to play in the future a priority role in consolidation of the four pillars in each country.

The role of research and international co-operation

The necessity of international cooperation in ICT and in ICT R&D in particular is wide accepted and it is one of basic activities in EU.

Less understood and less practiced is the regional cooperation in ICT R&D. The countries of a region experience the same problems; the transfer of experience is more natural.

FP7 can become a starting point to approach regional cooperation in a more enhanced way, more practical and with less costly western consultancy.

The proposed European Institute of Technology (EIT) by the European Commission is based on the assumption that the economic relevance of research has increased substantially, while the EU's share in worldwide knowledge creation has gone down. It is the moment to ask that such an institute has to have regional branches. Such branches would have local knowledge and will push results more appropriate with our needs.

IT STAR is a regional cooperation of professional associations from both developed and transition countries. It could play a role in bringing together experiences and knowledge to set up a pool of Regional ICT R&D.

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