INFORMATION TECHNOLOGY AND COMMUNICATION (IT&C) AND RESEARCH AND DEVELOPMENT (R&D), OUTSTANDING FACTORS OF THE POST-CRISIS ECONOMIC RECOVERY

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Abstract

Regardless of the business cycle or of the crisis, the knowledge-based society continues to evolve based on two main pillars – IT&C and R&D – although the funding and investments in such areas are currently more or less shrinking. Under these circumstances, there are economic, social, technological and environmental reasons for which investments in the IT&C and R&D fields must be prioritized under the anti-crisis strategies in Romania.

The main argument in favour of is mainly based on the economic and social efficiency, on the technological progress on short, medium and long terms. At the same time, we are pointing out the main ways, instruments and mechanisms through which efficiency could be obtained for IT&C and R&D investments efforts in Romania during the post-crisis economic recovery.

Key-words: *Information Technologies & Communications (IT&C), Research & Development (R&D), economic crisis, economic efficiency; sustainable development, knowledge-based society (KBS), management*

JEL Classification: O_{32}, L_{86}

1. Introduction

Information Technology and Communication (IT&C) sector includes the totality of technologies implying the acquisition, storage, adaptation and distribution of the information through methods, techniques and electronic means (computers, radio, television, telephone etc.).

The Research and Development (R&D) includes[1] the creative work undertaken on a systemic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.

[1] OECD – *Glossar*, 2010, www.oecd.org.

Regardless of the business cycle or of the crisis, the knowledge-based society continues to evolve based on two main pillars – IT&C and R&D – although the funding and investments in such areas are currently more or less shrinking. Under these circumstances, there are economic, social, technological and environmental reasons for which investments in the IT&C and R&D fields must be prioritized under the anti-crisis strategies in Romania.

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2. The institutional framework at international level

The Organisation for Economic Cooperation and Development (OECD) founded in 1960, at first, comprised 20 states, among which the USA, Germany, France, Great Britain, Italy, Spain, Canada, Greece. Data collecting, analysis and synthesis, as well as decision-making have been on OECD work agenda as priority positions for urgent actions at the global level for improvement of the IT&C and R&D performances in close relation with protecting and preserving the environment, fighting global warming and developing the resource management.

The Committee on Information, Communications and Computer Policy of OECD is preparing its analysis and recommendations for the e-economy taking into consideration the following three interdependent pillars: connectivity (the convergence of integrated voice, video and data platforms on bases of the wideband networks, wireless and mobile communications); creativity (socio-economic and innovation activities allowed by IT&C); trust (the protection and authorization of online users and consumers). This committee provides: data sources for comparative analysis on the economic and social implications of IT&C and R&D; impact analysis of IT&C on the economy and environment, including the digital content, e-business, the IT&C competences; the personal data cross-border flows on the digital identity management, on the risks the children accessing the Internet encounter, as well as on information security strategies.

The basic elements of the digital economy are the IT&C infrastructure, the facilities of insuring the online transactions and the transmission means of the information from one subscriber to another (subscriber being either the person or the organisation).

Ever since Lisbon, in 2000, the European Union defined the **e-Europe objectives,** meaning that initiative to impel the IT&C application in the EU member states, with an accent on the digital economy, education and scientific research, the healthcare services development, also the development of the intelligent transport, of the e-Government etc. The European Commission's strategy *i2010 – an information-based society* refers to a integrated approach of the IT&C systems based especially on the multi-access platforms' progress, of the wideband communications (optic fibre, satellite), systems generating infrastructures and software applications at the base of the digital economy.

At the EU level, many Web-based information instruments are dedicated to the management of the research-development projects within the **European technological platforms,** in accordance with "smart and green" objectives of EU Strategy 2020 and other programs for current crisis exit.

The USA competent institutions and International Development Agency (USAID) elaborated in 2009 a series of programs and minimum standard guide for the post-crisis economic recovery. These guide include common standards for all sectors and analysis and evaluation standards, grouped in four distinct fields: financial services; assets access; new workplaces; the development of the company. The "core" measures of these programs are focused on the efficiency "panaceum" potential and outstanding role of IT&C and R&D sectors.

3. The IT&C and R&D impact on the post-crisis economic recovery

Although delayed, the prospects of post-crisis economic recovery determines the characteristics of the governmental analysis, measures, programmes and initiatives concerning the business environment taking into account the special impact that science and technology are able to exert on the total factor productivity, using in this context the new endogenous models generation.

OECD has analysed a total of 92 Governmental programmes and industrial initiatives in the IT&C and R&D and environment fields, in 22 OECD and EU states pointing at the necessity of non-reducing investments in these fields. The direct effects of IT&C are closely related by OECD to the term **Green IT&C strategies** according to the requirement **"doing more with less"**.

A conceptual model for the analysis of the influence of the IT&C and R&D factors on the post-crisis performance level of the company is presented in Figure 1 (according to Grewal).

Figure no. 1 shows the main factors of influence for the performances after crisis from the viewpoint of socio-economic environment, company flexibility and instrumental variables. All such factors are essentially changed under the crisis and post-crisis circumstances. For example, the R&D in the field of green technologies is becoming one of the most relevant priorities for achieving the sustainable development objective for the future.

It is worth mentioning that the R&D expenditures for the "green" technologies have become a priority in the economic stimulation package of many governments. For example, in 2008 the USA spent 59 billion dollars on "green" technologies, Germany - 5.8 billion dollars, Australia – 5.7 billions and Canada – 2.8 billion dollars. Special attention is given to the technologies providing new ways of energy efficiency increasing through IT&C devices and the most recent results of R&D in the field.

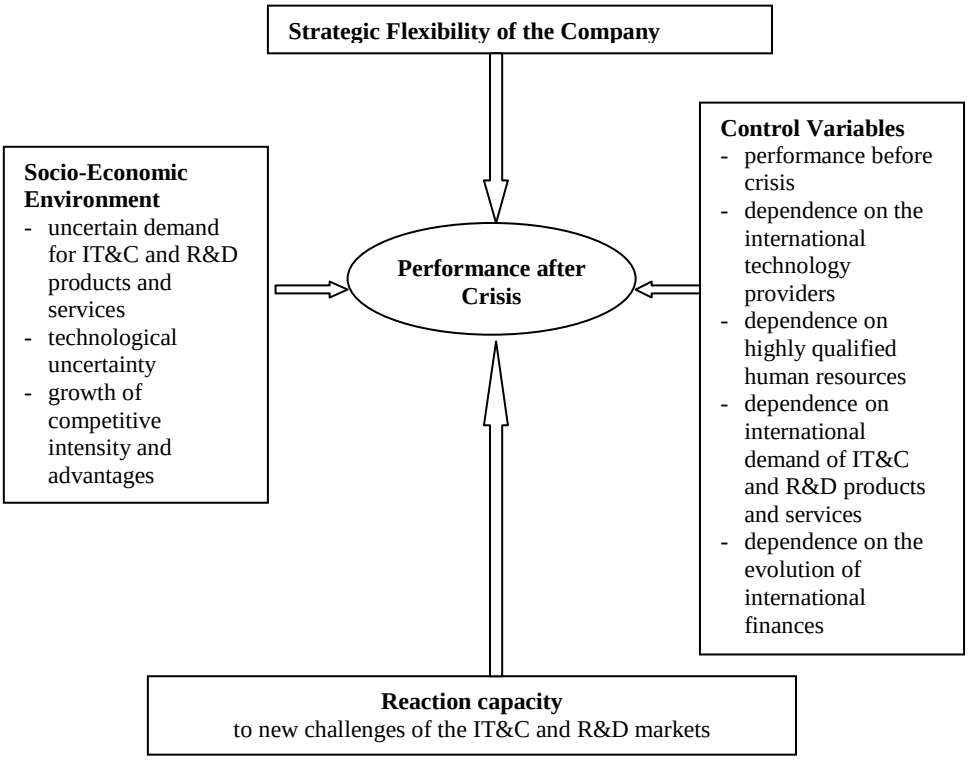

Fig. 1. *Conceptual model for the analysis of the influence of the IT&C and R&D factors on the post-crisis performance level of the company*

As a consequence, the governmental IT&C policies concentrate on: a) stimulation of the R&D for the "green" and applied IT&C technologies; b) the growth pf public-private partnership role in distributing the "green" and "applied" technologies on a complementary basis; c) the development of competences and level of education in the IT&C field.

In 2008, Japan spent about 3 billion USD for R&D and IT&C technologies with high energetic efficiency. Another focus is on IT&C projects with intelligent application. At the same time, Denmark allocated a research fund of 36 million DKK for applications where intelligent technologies develop tele-work and virtual meetings, as well as for research capable to contribute to the conservation of the global energy.

A greater emphasis is put on the initiatives of the business environment related to: 1) encouraging the R&D companies (start-ups, spill-overs and spin-offs); 2) IT&C diffusion for "green" and "applied" research projects devoted to product and process technology improvements; 3) optimisation of energy efficiency within value chains.

Table 1

The analytic matrix, used by OECD for the classification of governmental programmes and industrial initiatives analysed in the IT&C field

		Life cycle phases				
Impact categories	**Direct and permissive effects of the IT&C**	**R&D and design**	**Production**	**Distribution**	**Use**	**Cassation**
	Global warming					
	Energy use					
	Toxicity					
	The exhaustion on non-energetic resources					
	Soil usage					
	Water usage					
	Ozone layer exhaustion					
	The bio-diversity					

The analytic matrix used by OECD for the classification of governmental programmes and industrial initiatives analysed in the IT&C field (table 1) takes into consideration *the direct effects, the environment impact and the life cycle phases.* Each cell of the matrix represents a potential target and indicates the focus of the policies, programmes and proposed initiatives.

We can therefore conclude that the main factors of reducing crisis aftermaths and re-launching sustainable economic development at the macro level are concentrated on general efficiency factors as well as on science and technology contribution, enhanced by IT&C infrastructure and oriented in accordance with multidisciplinary approach required by sustainability and complexity, as well as by the triple objective of EU Strategy 2020 concerning "the smarter, cleaner and more cohesive society".

4. **The innovative factors at the company level and the possibilities to recover from the crisis**

Taking into consideration the new trends of the economic and social development today, it is clear that IT&C and R&D have become autonomous sectors of the economy, in the input-output terms, distributing their outputs to practically all the other branches of the economy. This means the increasing role of innovation and IT&C at micro level and intangible assets as the main source of generating profit and income. In view of this situation, a new twofold pattern of R&D and IT&C activities can be observed for their intra- and extra-muros deployment in the public and private sectors. At the same time, the size of firms has a very great importance to the recovery from crisis. In this respect, large-size enterprises seem to be less affected by the crisis consequences as far as the R&D funding and investments are concerned.

According to specialists and researchers[2], about half of the innovative European companies do not develop in-house R&D activities. However, they become innovative mainly using information received from the suppliers and competitors in their non R&D-related daily business. For this type of companies, this could be a potential way to overcome the crisis. On the other hand, the companies with in-house R&D divisions must also use clients, universities and other research institutions, buy patents as important information sources for enhancing their innovations. In both cases, one conclusion is of overall significance in the sense that IT&C and R&D are a promising way for re-launching business.

In parallel with a greater importance given to R&D funding, they have to pay more attention to improved commercialisation of products, services and new or modernised (improved) technologies (processes), as a prerequisite for being successful and competitive.

Besides innovation itself, there are at least three additional ways to develop new products and processes:

a) achieving small improvements to the existent products and processes based on the creative abilities of the professional staff in the company;

b) the imitative reproduction that does not need R&D in case of adoption of certain innovations by the users;

c) the combination of scientific and technologic knowledge in a way that implies industrial design and engineering.

The innovative activities without having specialised R&D sectors in the companies are very common, representing a proportion of over 52.2% of the total number of companies.

The innovative potential of the companies that do not develop R&D activities must be taken into account when formulating the policies to stimulate their innovative capacity as well as the cooperation with in-house R&D activities, with companies contracting R&D with third parties or companies having minor in-house creative activities and companies acquiring new technologies from other companies (technologies adoption).

In crisis and post-crisis periods, the choice of innovation strategies through R&D and non-R&D activities (contracting R&D from third parties, licenses, consultancy services, obtaining new technologies by buying other companies or hiring new highly qualified employees) becomes particularly important in terms of resource savings and R&D efficiency growth.

Under the crisis circumstances, both the R&D and non R&D companies are involved in the well-known process of the creation and diffusion of R&D results according to the following stages: first creators and adopters (about 5% of companies); early adopters (15% to 30%); majority adopters (about 40%); late adopters (about 25%). In our opinion, the recovery imposes for developed countries a more intense R&D process in the category of first creators and first adopters, while for developing countries, a special effort should be devoted for the so-called majority adopters, meaning in fact an intensification of technology transfer.

[2] *Third European Innovation Survey (LIS-3).*

The general ability of companies to finance and manage innovation **depends on their dimension and export capacity**. Ever since 1950, Schumpeter considered that, in the mature market economy, the big companies are the most important generators of technologic progress. Unlike the small companies, the big ones have enhanced capacities to generate funds that can be invested in R&D projects with a relatively high risk-degree, taking advantage of the scale economies. The relation between the company's size and the R&D intensity differs from one sector to another, but it is generally known that big companies have more possibilities than the small ones to engage in research activities that need growing investments. The small companies lack the adequate financing sources in most of the cases and for this reason they need specific measures and policies of micro-financing R&D in this sector.

The export, as an indicator measuring the innovative activity reveals that on average, the **export companies** are more R&D active than the non-export ones, using a greater volume of intangible assets and allocating more resources for R&D. Exporters' competitiveness is tested on the external markets especially by more opportunities, the access to a relatively extended number of technologies, comparatively with the internal market technologies. There is a clear advantage that export companies can afford supplementary expenditures for R&D, leading to maintaining their external competitiveness.

Generally, the companies performing in-house innovation with or without R&D have a higher innovative capacity than those acquiring new technologies developed by others and that remain early, late or majority adopters.

The highly skilled labour force is another indicator reflecting innovation, and is an *intangible good* of companies, especially in the industries based on knowledge, where they are organised in complex, often multi-disciplinary, research teams, with clear labour divisions among the team members (the scientist giving the ideas, the executors, the R&D results marketing specialists etc.), and also beneficiaries of products and services.

The companies with a low innovative capacity (especially the small non-exporter companies that do not have highly skilled labour force and innovation internal activities) can innovate more by non-R&D activities which however could result in creativeness.

The differentiation of innovative activities according to the final results – the product or the process – highlights a series of particularities for each activity type.

The product innovation means making new or significantly improved goods and services, while t**he process innovation** means introducing improvements to the operations, logistics, information flows and equipments.

The product innovation implies more research, and the process innovation more external suppliers and this frequently means creative activities (that do not necessarily need R&D resources or efforts) such as buying cars and modern tools, hardware, software, patent and licence, training investments and other activities such as design, engineering.

However, a very close interdependence between R&D and non R&D activities seems to be the optimal solution for crisis remedies.

Information is an important source of multiplying the technological and innovation opportunities.

The sectors in which the suppliers have an important role (the light industry, leather, footwear) mainly innovate when impelled by the equipment and material suppliers, spending most of the allocated funds for purchasing new modern equipment and tools. The companies dependent on suppliers and very productive in the wood industry, pulp industry, textile industry, leather industry, footwear industry, metal products, printing and publications, paper, plastic, rubber, vehicles spend over 50% of their innovation budget on non-R&D activities, such as purchasing new equipments, machinery and logistics. The science-based sectors (pharmaceuticals, IT&C, radio, precision instruments, computers) develop most of their technology with their own effort, through R&D activities, allocating over 50% of their total expenditures for innovation.

The decision to invest in R&D is limited by the company's capacity to recover the investment expenditures as soon as possible or to decrease production costs to comfortable levels. At the same time, the R&D strategies have to pay more attention especially on patent protection, brand and commercial secret, benefiting of the time advantage versus competitors, the complexity of the design and the proprietorship of the different types of tangible and non-tangible assets. Although patents are one of the most suitable value-generating means, they cannot be fully taken advantage of by themselves. They can rather be used with some other forms of intangible assets.

In appendix 3 we presented the results of a survey[3] regarding the *behaviour of the companies in the EU member states during the crisis in 2009-2010* from the point of view of innovation expenditures behaviour of companies, based on relevant the following: the company size; the innovation intensity; the importance of innovative products/services for sales; the opportunity for innovation; the implication of the potential innovation users; the significant changes in the area of the policies with a positive effect on innovation.

Annex 3 shows that generally only a proportion between 28-32% of the total number of companies expects the reduction of innovation expenditures in the near future (the first half of 2010).

5. **The remuneration of the intensive science branches – potential recovery factor**

Using the classification of the national economy branches, according to the *intensity degree of innovation* (see annex 1), *the average monthly net wage by economy sectors*, calculated for the following branches in Romania between 2003 to 2008: **highly innovative (HI); average-highly innovative (AHI); average innovative (AI); poorly innovative (PI).**

[3] See Kanerva M., Hollanders H., *The impact of economic crisis on innovation. Analysis based on the Innobarometer 2009*.

Table 2

The monthly net wage in Romania, by economic branch groups and innovation level

Lei/ employee

Branch groups	Years		
	2003	**2005**	**2008**
Total economy	**484**	**746**	**1309**
• Highly innovative branches (HI)	533	812	1289
• Average highly-innovative branches (AHI)	597	893	1438
• Average innovative branches (AI)	565	873	1411
• Poorly innovative branches (PI)	644	877	1798

Source: *Own calculations based on data from the Romanian Statistical Yearbook*, 2009, p. 295, 302.

The data in table 2 and annex 2 reveal some important aspects regarding the average level of monthly wages, grouped by innovation intensity, that can be used as benchmark for a remuneration and income policy in order to boost Romania's recovery after the crisis, by stimulating the innovative activity.

Compared to the net average wage in all the analysed years, the employees from the poorly innovative branches received much better salaries than the ones working in the highly innovative branches, which may be seen as a paradox. Generally, the intensive-science branches, which are the driving force of the knowledge-based society are the best paid in the developed countries.

However, the situation in Romania is exactly the opposite. The causes of such anomaly may be explained by:

– the Romanian market and the decision makers do neither fully understand or appreciate the contribution of this branch group (HI) to the economic and social progress, nor the creative input of the intangible assets or of the intellectual capital for the profit generation, including multiple positive externalities, as a proof of their poor expertise and abilities;

– the highly innovative branches (HI) do not have the necessary and sufficient *de facto* output, proven at least on the short term, still achieving relatively weak performances compared to other countries.

Although it is hard to give a strait-forward answer to this "vicious circle", we consider that the maintenance of the status quo in matters of remuneration in this field cannot contribute to Romania's recovery from the crisis.

In order to validate one of the two explanations or a combination of both we need to study more thoroughly the causes of the under-performances of the national innovation system, taking into consideration the necessity to solve the problem against the background of certain restrictions regarding the financing sources and their efficient allocation, on different time horizons.

The 25% decrease in the public sector wages – measure implemented by the government in 2010 – affects the employees in research, health and education and will aggravate even more the situation in the HI branches, therefore delaying the recovery.

The HI branches confer solid premises for internal and external competitiveness, export promotion and increase of the added value. Wage-wise, their disadvantage is not meant to stimulate the innovative input in Romania. The G-20 summits, as well as other economic and social international organisations highlighted the necessity to avoid the drastic funds cuts for R&D during the 2009-2011 crisis years. The decision of certain developed countries to maintain the level of investments in the R&D sector during the crisis should be considered as an example.

Table 3

The R&D expenditures in Romania and other countries during 2008-2919

– bil USD –

Country	GDP 2008 bil. $ PPP	GDP 2009 bil. $ PPP	R&D stimulants 2009 bil. $ PPP	GDP 2010 bil. $ PPP	2010 R&D as % GDP	2008 expenditures R&D bil. $ PPP	2009 expenditures R&D bil. $ PPP	2010 expenditures R&D bil. $ PPP
Romania	**271**	**248**	**-**	**249**	**0,53**	**1,434**	**1,314**	**1,320**
USA	14,260	13,875	787	14,083	2,85	397,629	389,203	401,919
Japan	4,329	4,095	110	4,165	3,41	147,800	139,640	142,026
China	7,939	8,651	586	9,429	1,50	102,331	123,709	141,436
Germany	2,918	2,763	103	2,772	2,46	71,861	67,970	68,191
South Korea	1,335	1,322	11	1,369	3,13	41,742	41,379	42,850
France	2,128	2,077	33	2,096	1,98	42,233	41,125	41,501
UK	2,228	2,128	36	2,147	1,75	38,893	37,240	37,572
India	3,297	3,475	4	3,697	0,90	26,706	28,148	33,273
Canada	1,300	1,268	-	1,294	1,83	23,781	23,204	23,680
Russia	2,266	2,096	20	2,127	1,04	23,482	21,798	22,121
Italy	1,823	1730	6	1,733	1,08	19,678	18,684	18714
Brazil	1,993	1979	4	2,048	0,91	18,136	18,009	18,637
Spain	1,403	1350	113	1,340	1,28	18,000	17,280	17,152
Sweden	344	327	-	331	3,51	12,076	11,478	11,618
Netherlands	672	644	8	648	1,63	10,950	10,479	10,562
Israel	201	201	-	206	4,40	8,846	8,844	9,064
Austria	330	317	-	318	2,58	8,530	8,179	8,204
Switzerland	317	311	1	312	2,36	7,474	7,340	7,363
Belgium	389	376	3	376	1,81	7,028	6,808	6,806
Turkey	903	844	-	876	0,76	6,830	6,414	6,658
Finland	194	182	-	183	3,36	6,520	6,115	6,149
Czech Republic	265	254	-	257	1,44	3,814	3,658	3,701
Poland	668	675	4	458	0,74	3,654	3,552	3,611
Portugal	238	229	3	369	1,21	2,850	2,711	2,783
Greece	343	340	-	340	0,53	1,828	1,802	1,802
Hungary	197	184	6	182	0,93	1,823	1,711	1,693
Slovenia	59	56	-	57	1,38	0,828	0,784	0,798
Slovakia	120	114	-	119	0,42	0,498	0,749	0,500

Source: *R&D Magazine*, Battelle, OECD, IMF, CIA 2009, http://www.rdmag.com/Featured.Articles/2009.

In 2008, a larger gap between the nominal net average wage in the HI branches and the average salary in the national economy (1,309 lei/ employee vs 1,289 lei/employee) is visible and cannot be considered as a promising trend.

If doctors, teachers, researchers are paid less than an average skilled worker, it means that the economic and social value axis is strongly distorted, and it does not take into account the economic and social input on the short, medium and long terms of the different levels of the labour force skills. Consequently, the wage discrepancies, even if existing *de facto* in the emergent market in Romania as some specialists or theoreticians might claim, is far from being sustainable and solution-oriented.

Some average-highly innovative branches (AHI) also have superior remuneration levels than the HI branches over the analysed period. We think this confirms the preponderance of the technology transfer to Romania, as priority. It is important to keep in mind that the technology transfer, the assimilation of new products and processes in Romania perpetuate its position as catching-up country. The relative or absolute reduction of the above-mentioned wage gaps is possible through an optimal combination of intensifying scientific research and the effective original R&D outcomes (inclusively through development of the imported, transferred technologies) and the assimilation through patents and licences of the products and processes from other countries.

The data in table 3 highlight a series of important aspects regarding the R&D GDP/expenditures relations, among which we mention:

– the developed countries which allocate a greater percentage to R&D expenditures from the GDP, compared to the less developed countries;

– the decrease in GDP in 2009 happened in most of the countries, except for China, Poland, Israel, Switzerland, Norway and Poland;

– the volume of expenditures allocated to R&D in general was smaller in 2009 comparative to 2008, except in China and India;

– a series of countries allocated in 2009 special incentives funds for R&D, among which the USA (787 bil. UDS), Japan, Spain and Germany over 100 bil. USD, France and England – 33 and 36 bil. USD.

– Romania, in line with some other countries, did not allocate incentive funds, but reduced the R&D financing in 2009;

– the PIB prognosis and the R&D expenditures forecast for 2010 increases comparatively to 2009, even if the recession continues this year in certain countries.

We must take into account the fact that the foreign direct investments in Romania are mostly in fields that are average or poorly innovative and that the results of the research within the parent company are transferred to the subsidiaries in Romania. This situation is not meant to stimulate the Romanian R&D sector.

There are certain exceptions as well. We shall refer now to the case of Dacia Renault Automobile Company (table 4) which enhanced the research activities in Romania offsetting the effects of the crisis, increasing or maintaining the turnover during 2009-2010.

Table 4

The innovation activity – Dacia Automobile company turnover relation

Years	*Dacia Automobile Company turnover* (Bil. Euro)	The evolution of *innovation activity*
2003	390	Dacia only sold Dacia Super Nova and had a 100 bil. lei loss.
2004	593	Dacia Logan's introduction – First product built at Mioveni on the low-cost technical platform
2005	1,250	Diesel motorization of 1,5 litres and 70 horsepower, completing the commercial driving force range for Logan with an economical version
2006	1,575	Logan MCV's (break) introduction representing approx. 25%
2007	2,078	Logan VAN and Logan Pick-Up (utilitarian vehicles for the small business) introduction
2008	2,075	SANDERO's introduction – 50% of the sales (for the 20-45 year-old category)
2009	2,125	SANDERO STEPWAY's introduction
2010	2,000-2,010	DUSTER's introduction – the first SUV in the history of the brand

Source: Dacia Automobile Company data.

Over 2003-2010, Dacia Renault Automobile managed to increase the turnover through successive improvements of the Dacia car based on R&D, even if the local and international business was hit by the crisis. The new Dacia model – Duster – incorporated elements from Nissan, Renault and Dacia. The financial crisis raised certain issues regarding the company management, as the component suppliers registered delays at delivery.

The Duster project started in France in 2006 after Dacia Logan had been introduced in 2004. For the first time, the technologies integrated the traction system with the low-cost platform of the former Logan model. It is interesting that about 50% of the Duster project was developed in Romania, by Romanian engineers within the *Renault Technologie Roumanie* (RTR) Engineering Centre, which designed elements connected to the motors, car bodies, brakes, gear boxes, etc. In 2009, the Dacia sales increased by 20% to more than 310.000 units over Europe, while other companies in the field registered lower sales rates. The Renault research centre in Titu employed 300 engineers recruited amongst 1,200 candidates. RTR currently works at the mini version of Renault. The *facelift* version will be built by Romanian engineers. At the same time, the larger version of the utilitarian *Kangoo* is under construction, most of the project being developed in Romania. All these results encouraged Renault France to rely to a larger extent on the innovation capabilities of their Romanian branch.

Unfortunately, we cannot enumerate many examples of positive responses to the crisis based on the R&D input, such as the case of the above-mentioned company, which belongs to the average-highly innovative branch group.

The classification of the economic sector according to the innovation intensity

Sector	**CANE sector**
Highly innovative	29: Cars and equipments 30: Office equipment and computers 31: Electric equipment and devices 33: Medical, precision, optical and watch-making instruments 72: Computers and connected activities 73: Research & development
Average-highly innovative	17: Textiles 23: Coal, petrol products and nuclear fuel 24: Chemical products 25: Rubber and plastics 26: Other mineral non-metallic products 27: Basic metals 34: Motor vehicles, trailers and semi-trailers 35: Other transport equipment 64: Post office and telecommunications
Average innovative	20: Wood and wood products, woodblocks, except furniture 21: Cellulose, paper and paper products 28: Metal products 36: Furniture and other manufacture products 62: Air transport 65: Financial intermediation except the insurances and the pension funds 70: Real estate 71: Car hiring, personnel equipment and domestic goods 74: Other business
Average-poorly innovative	10: Brown coal and coal extraction 11: Petrol and natural gas extraction 15: Food and beverages 16: Tobacco products 22: Publishing houses, publications, reproductions and recordings 40: Electricity, gas, steam and hot water suppliers 41: Water management, purification and distribution 45: Constructions 66: Insurances, pensions fund, except the compulsory social security

Average net monthly wages (lei/ employee) at the economy level and according to branch groups taking into consideration the innovation level

	2003	**2005**	**2008**
Average net monthly salary	484	746	1309
1. **Highly innovative**			
– cars and equipments	514	759	1252
– office equipment and computers	547	417	1129
– electric equipment and devices	504	694	1083
– media equipment, television sets	665	1281	1628
– medical instruments and devices	488	851	1107
– education, R&D	477	829	1538
Media (1)	532,5	811,8	1289,5
2. **Average-highly innovative**			
– textiles	356	523	831
– coal, petrol products and nuclear fuel	942	1475	2357
– chemical products	639	951	1531
– rubber and plastics	457	638	1011
– other mineral non-metallic products	484	755	1253
– basic metals	634	971	1543
– motor vehicles, trailers and semi-trailers	543	833	1397
– other transport equipment	644	938	1445
– post office and telecommunications	673	957	1576
Media 2	596,8	893	1438
3. **Average innovative**			
– wood and wood products, woodblocks, except furniture	300	455	741
– cellulose, paper and paper products	472	687	1060
– metal products	447	714	1532
– furniture and other manufacture products	348	517	821
– air transport	673	957	1576
– financial intermediation except the insurances and the pension funds	1246	2065	3208
– real estate	469	720	1339
– car hiring, personnel equipment and domestic goods	-	-	-
– other business	-	-	-
Media 3	565	873	1411
4. **Poorly innovative**			
– brown coal and coal extraction	988	1352	2304
– petrol and natural gas extraction	805	1346	2665
– food and beverages	388	582	959
– tobacco products	948	1717	2623
– publishing houses, publications, reproductions and recordings	470	676	1116
– electricity, gas, steam and hot water suppliers	858	1348	2389
– water captation, purification and distribution	537	763	1345
– constructions	424	628	1156
– commerce	364	575	1040
– public administration, security	692	1136	3386
Media 4	644,4	877,2	1798,3

Source: *Romanian Statistical Yearbook*, INS 2009.

Annex 3

The response of the EU countries companies to the current and awaited decreases of the innovation expenditures, in the conditions of the current economic crisis

-%-

	The innovation expenditures did not decrease in the last 6 months of 2009	**The innovation expenditures decreased in the last 6 months of 2009**	**Total**	**The innovation expenditures are not expected to be reduced in the near future**	**The innovation expenditures are expected to be reduced in the near future**	**Total**
All the companies	76,7	23,3	100,0	70,6	29,4	100,0
Size						
20-49 employees	77,4	22,6	100,0	68,1	31,9	100,0
50-249 employees	75,6	24,4	100,0	75,3	24,7	100,0
250+ employees	76,1	23,9	100,0	71,2	28,8	100,0
Branch groups						
Highly innovative	80,3	19,7	100,0	73,0	27,0	100,0
AHI	71,6	28,4	100,0	60,0	40,0	100,0
innovative	76,1	23,9	100,0	71,6	28,4	100,0
Average innovative	76,9	23,1	100,0	74,7	25,3	100,0
Average-poorly innovative	75,9	24,1	100,0	69,5	30,5	100,0
Poorly innovative						
Innovative capability of the companies						
– leader	83,9	16,1	100,0	77,4	22,6	100,0
– follower	78,6	21,4	100,0	70,1	29,9	100,0
– moderated innovator	71,9	28,1	100,0	64,5	35,5	100,0
– recuperator	67,1	32,9	100,0	67,1	32,9	100,0
2007-2008 innovation expenditures tendencies						
Increasing	82,8	17,2	100,0			
Decreasing	44,0	56,0	100,0			
Stable	77,6	22,4	100,0			
Companies decreasing innovation expenditures in the last 6 months				35,7	64,3	100,0

(continuing annex 3)

Innovator type						
Product or/ and process *innovator*	77,4	22,6	100,0	70,5	29,5	100,0
Marketing and/ or organisational *innovator*	76,5	23,5	100,0	71,0	29,0	100,0
Non-CD innovator	76,3	23,7	100,0	68,0	32,0	100,0
Intensity of the company innovation						
Low (<5%)	76,9	23,1	100,0	72,3	27,7	100,0
Average (5% la 25%)	77,6	22,4	100,0	67,1	32,9	100,0
High (>25%)	65,6	34,4	100,0	61,7	38,3	100,0
The importance of the innovative products/ services for the sales						
The greatest part of sales comes from innovative products or services	76,0	24,0	100,0	78,7	21,3	100,0
The innovative and non-innovative products and services have almost the same weight	81,1	18,9	100,0	72,8	27,2	100,0
The greatest part of sales comes from non-innovative products or services	73,0	27,0	100,0	66,8	33,2	100,0
Companies' integration for the support of the innovation activity						
Knowledge management systems	76,3	23,7	100,0	73,0	27,0	100,0
Staff-rotation for different positions	72,6	27,4	100,0	69,5	30,5	100,0
The implication of potential and common users in innovation activities	76,4	23,6	100,0	71,6	28,4	100,0
The establishment of creativity targets in training and recruitment	78,0	22,0	100,0	72,5	27,5	100,0

(continuing annex 3)

The main advantages in the near future shall be:						
New products, processes and services development	78,5	21,5	100,0	76,8	23,2	100,0
Reduced costs	68,2	31,8	100,0	58,1	41,9	100,0
Public acquisitions interest (obtained contracts, submitted for auctions or investigated opportunities)	73,7	26,3	100,0	70,3	29,7	100,0
Companies operating on international markets	76,6	23,4	100,0	67,7	32,3	100,0
The leader market to own country	77,6	22,4	100,0	72,5	27,5	100,0
The greatest innovation opportunities in the near future come from:						
New export markets	69,9	30,1	100,0	66,6	33,4	100,0
The eco-products demand	76,8	23,2	100,0	71,1	28,9	100,0
Significant changes in the policy areas with a positive effect on innovation						
New demands from environment standards/ regulations	76,6	23,4	100,0	71,4	28,6	100,0
Environment taxes changes	76,9	23,1	100,0	71,5	28,5	100,0
Public financial support changes	82,0	18,0	100,0	75,2	24,8	100,0

Source: *The impact of the economic crisis on innovation. Analysis based on the Innobarometer 2009 survey*, Kanerva M., Hollanders H., December 2009.

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