Scientific research support in developing sustainable transport in Romania

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Abstract: The aims of this study are to reveal the present level of scientific research in Romania, to identify the obstacles that have caused low support research and development for sustainable transport development in Romania, as well as, to bring into discussion the measures that have been suggested for improving the existing situation, particularly the production and use of biofuels which are considered an important chapter in greening of transport. The study investigated, first the targets, mechanisms and supporting tools for transport scientific research by comparing the situation in Romania with those in some other EU member states, as well as, provided an analysis of the intensity of scientific research in Romania and the requirements for improving the quality and volume of transport using 1990 as the reference year for changing of the national economic system before presenting a set of recommendations for improvement of the transport.

Keywords: European scientific research; R&D intensity; Romanian R&D policy; R&D projects in transportation; biofuels.


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He is currently the leader of a research team in the area of transport economy
within The Romanian Academy.

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research as main support for sustainable transport development – the case for

1 Highlights of scientific research in the European Union

The European Union is facing presently important issues such as climate change and
depletion of renewable resources, population growth and increasing security needs that
require collective action to save the European way of life based on economic prosperity
and solidarity. The Lisbon Strategy for growth and employment, prepared by the
Commission of the European Communities (COM, 2005a) defines a broad range of
policies and reforms designed to make the regulatory framework more conducive to
innovation and economic prosperity. Essentially, the aim is to raise R&D spending to 3%
of GDP.

The European public research system is based on three pillars, namely:

a EU funded programs (research framework programmes – RFP)

b major European scientific and technological organisations such intergovernmental
CERN and ESA, as well as
c technological cooperation programs such as Eureka.

All the members of the European Economic Area (i.e., Liechtenstein, Switzerland,
Iceland and Norway) are associated with the framework programmes. Unfortunately, at
the European level, the coordination of research programmes has remained an unrealised
goal. European Treaties provided the possibility of launching joint research programmes
of several Member States financed through the frame, but the operation has been very
complex because it was subjected to the Council European Ministers and Parliament
concurrent decision-making. In the recent years, the general direction of European policy
has taken on a new trend, namely directing the community development model of
sustainable development of all sectors towards defined political objectives. The EU
transport and energy policy are closely related, since they both aim at reaching common
goals such as reducing CO2 emissions and minimising the EU’s dependency on imported
fossil fuels. As shown in Fistung (1999) “shipments, a powerful energy intensive sector,
absorb about 71% of the oil consumed in the European Union: 60% is consumed by road
transport and 9% by air. Rail shares its electricity consumption in (75% of total energy)
and fuels (25%)”.

The high cost of fossil fuels and the need to reduce the strategic dependence called
for urgent measures to optimise the efficiency and energy consumption for each transport
mode separately.

Within these circumstances, the role of scientific research is extremely important. In
this respect, renewed research efforts and large investments, such as combining research
programmes in the field of energy and transport, undertaking research for the construction of intelligent and environmentally friendly vehicles, using information and communication technology (ICT) are needed in order to improve the fuel efficiency, as well as the creation of viable public-private partnerships. Currently, Europe does not need new commitments; it needs political leadership and determination. Instead of preserving the pre-established structures which proved unable to cope with the 21st century challenges, the EU must be ready to invest, anticipating and supporting structural change. This requires, in particular, a redeployment of resources towards education, research in ICT, as well as, creating highly skilled jobs and growth.

Table 1 The percentage of R&D expenditure, within the member states of the EU for the period 2007–2012

<table>
<thead>
<tr>
<th>Geo/time</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
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<th>2011</th>
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<td>1.53</td>
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<td>1.25</td>
<td>1.27</td>
<td>1.21</td>
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<td>1.69</td>
<td>1.68</td>
<td>1.77</td>
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<tr>
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<td>1.77</td>
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<td>1.89</td>
<td>1.93</td>
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<td>1.77</td>
<td>2.07</td>
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<td>Sweden</td>
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<tr>
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<td>1.3</td>
<td>1.25</td>
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Source: EUROSTAT (2013)
Internationally, according to the US National Science Foundation (2012), in 2009, EU allocated almost 20% less funds relative to GDP than the OECD average (2.33%). Interestingly, however, apart from Israel, who is the leader of funding for R&D in relation to GDP (4.28%), the following countries allocated significant amounts of R&D as the EU (3.96% Finland, Sweden – 3.62%), followed by South Korea (3.36%), Japan (3.33%) and far away from the USA (2.88%); at the opposite end there are countries such as Egypt (0.21%), Mexico (0.37%), Pakistan (0.46%) and Romania (0.47%). According to Toffler and Toffler (2006), “USA still occupies the first place in most areas related to digital technology, microbiology and science in general. USA spends 44% of R&D global budget”.

The allocation of funds for scientific research intensity has been different in the EU Member States. Thus, according to EUROSTAT (2013), analysing the share of GDP spent on R&D performed by government and higher education institutions, the highest values for the year 2012 were in Estonia (2.12%), Germany (2.02%), Portugal (1.99%) and Finland (1.89%). France and Germany funds were characterised by a higher level of spending on research and development of state administration (0.37% and 0.34% of GDP). In contrast, Sweden and the Netherlands were distinguished by a higher level of expenditure in higher education (0.8% and 0.5% of GDP). Across the EU-27 this ratio was 1.42% (Table 1). At the opposite end, there were countries such as Greece (0.56%), Romania (0.6%), Slovakia (0.66%) and Bulgaria (0.71%).

The R&D allocations in Romania between 2007 (the year of Romanian accession to EU) and 2012 are revealed in Figure 1. In the EU, the level of these allocations remained almost constant around 1.5%. At the same time, it can be observed that the global financial crisis impact was felt more acutely in terms of funds allocated for R&D in those countries that usually devote lower R&D allocations (including Romania) in stark contrast with those countries, such as Germany, Sweden and Estonia which are usually allocating important sums for R&D activities. The main reason for this phenomenon is the continuous underestimation of innovation in areas of high value to society, areas where public authorities, at all levels, can and should act quickly. Overcoming these obstacles would allow for decisive steps in the creation of a genuine European area of R&D. Efforts should be made to provide a better combination between ownership and exploitation of research results – development and associated intellectual property rights can be combined better with fundamental missions of public research agencies. Some of the most important aspects that can be traced for fostering this situation are:

1.1 Quality of higher education systems

In this vein, the lack of necessary skills, particularly in areas of science and information and communication technologies (ICT) have been identified as major challenges. According to EUROSTAT data on human resources in science and technology, as outlined in the European Commission document SEC/2006/639, even though the degrees in mathematics, science and technology have increased number-wise, they have dropped percentage-wise fact that aggravates Europe’s future ability to innovate. This is a problem not only for most new EU member states, but also for the old member states such as Austria, Germany, Italy, Netherlands and Portugal.
1.2 Reduced use of the internal market potential

Barriers still exist domestically. They continue to hamper mobility, depriving the economies of scale needed for businesses to capitalise on investments in research and innovation thus hindering the innovation potential of EU. These barriers are affecting not only the areas of goods and services, but also the consumers who want to have access to them, as well as, the mobility of workers together with the availability of venture capital funds. They must be abolished in order to create a European space for innovation. This aspect per se will lead to an increase on competitiveness.

1.3 Fragility of a regulatory environment together with the failure of an effective framework for intellectual property rights

Without adequate protection of intellectual property rights there is no motivation for innovation. Regulations should be predictable, flexible, simple and effective. Some progress has been achieved on improving the regulation according to documents of the European Commission (COM, 2005b) at European and national levels through measures such as:

- promoting cooperation among all projects’ stakeholders
- sustained financial support for research and innovation
- strengthening the role of catalyst national government policymaking
- facilitate the emergence of lead markets oriented innovation.

The European research activities have recognised a recrudescence lately because of the European Technology Platforms led by the industry which brings together stakeholders including the research community and the financial world. In this respect, the new generation of European regional policies for 2014–2020 tends to favour an approach
based on regional innovative clusters, not only in urban centres but also in poorly developed rural areas.

2 Scientific research oriented to support sustainable transportation structure in Romania

The evolution of research and development in Romania in the recent years has been mainly influenced by the political and economic transformations due to the process of accession to the European Union, which has increased the interest on research and development institutions as a result of the pressure generated by the need to meet the technical and economic conditions of EU accession to the European and international markets, and the need to increase the international visibility of Romanian research and community involvement in science and technology through participation in research and development EU and integration into the European Research Area.

Financial resources, private and public, domestic and external sources of funding were used to cover the total costs of R&D, particularly the operating expenditure during a period in the units for all payments representing the cost of labour, materials, and other current expenses, capital expenditures (investments) which include payments made during a period for realisation of construction works, purchase of equipment, tools, machinery and equipment and other expenses this nature, aimed at contributing to the growth of fixed assets of the unit.

The Romanian research development innovation (RDI) system went across a very difficult period after 1989. The underinvestment and postponed restructuring allowed only for a vague connection to the global trends in science and technology. Practically isolated, the Romanian RDI system was somehow fragmented, as various components tried to survive with the minimum available resources, within mostly formal systems, mainly from public funding.

Presently, in spite of its considerable late registered progress, to the present date, Romania still shows a serious lagging behind competitiveness-wise compared to the other EU states (Romanian Government, Ministry of Education and Research, 2006). The reasons behind the lag can be found at the level of all the elements determining competitiveness. There has been no separate plan to support transport research in Romania. The projects conducted over the years were financially and administratively supported under a number of research-development programmes, covering various thematic areas, most of them under the state’s authority. Moreover, the national funding of transports specific projects did not represent a priority for the past governments and were placed behind other fields regarded by the Romanian authorities as more important for Romania’s future (e.g., medicine, nanotechnologies, communications, etc.).

The Romanian RDI system consists of several main types of research institutions: National Institutes, Universities, Institutes of the Romanian Academy and of the branch academies, other public research institutions, private non-profit research institutions and private for-profit research institutions (Figure 2).

The National Authority for Scientific Research (NASR) is the governmental body authorised to elaborate and implement the national RDI strategies and programmes, thus ensuring a unitary coordination of the activities in the line with those carried out in the universities, national institutes, as well as, Romanian Academy institutes and field
academies. In this respect, NASR has promoted strategic documents defining the prospects of developing the RDI domain over the period 1999–2013.

According to the employment data on R&D activities provided by EUROSTAT (2013), in 2011, Romania had a total of 42,363 researchers (i.e., 1.07% of total EU-27), surpassing countries such as Bulgaria (20,810 researchers) and Ireland (36,442 researchers), but surpassed, by far, by countries with a smaller population such as Hungary (55,386 researchers), Austria (107,949 researchers) and Denmark (85,375). This shows the relatively low interest for R&D activities of Romania.

The National RDI for 2007–2013 strategy adopted by the Romanian Government assigned a crucial role in supporting the development of research infrastructures of knowledge and human resources for research.

Figure 2  Structure of the RDI financing in Romania (see online version for colours)

Notes: CNPST – National Council for Strategic Development of Science and Technology.  
CCCDI – Advisory Board for RDI.  
CNFIS – National Finance Council for Higher Education.  
CNCS – National Council for Scientific Research.  
UEFISCDI – Executive Unit for Higher Education Financing, RDI


In this respect, a number clear priority for investment in research infrastructure on the following areas as follows was identified:

a ICT
b energy
c environment
d physical and fundamental sciences
e health
f agriculture, food safety and security

g biotechnology

h materials, processes and innovative products

i space and security

j socio-economic and humanistic.

As can it be observed the research aimed explicitly at the transport sector is inexistent in Romania. In principle, the themes that support sustainable transport can be included in almost all of the areas above.

The release of the first National Research Development Innovation Plan PNCDI (I) in 1999 and funding approach based on the research programmes essentially determined an increase in performance and a change in mentality with respect to access to resources. PNCDI (I), which ended in 2006, managed to polarise researchers from all the domains during the period 1999–2006, but, according to Constantin et al. (2010) most of all, engendered a sense of competition and brought forth the desire to propose and offer projects which, by getting applied to the economic and social milieu, may have a positive impact on the life quality in Romania.

PNCDI (I) included nine programmes and 267 projects which approached the field of transports. The most numerous and the most representative projects were funded under the programmes RELANSIN – Economic Revival through Research and Innovation (128) and AMTRANS – Landscape Development and Transport (101).

As it can be seen in Table 2, 31 projects covered several transport modes, namely: rail-road, aeronautic-sea and road-sea. The number of transport research projects is relatively small, less than 10%, and their modes of distribution indicate the fact that the support for sustainable transport development has not been necessarily a priority.

National Plan – PN II (2007–2013) was coordinated by NASR and included six funding programmes: human resources, capacities, ideas, and competitiveness through partnership, innovation and institutional performance supporting. The most important transport projects were funded under the Innovation and Partnerships programmes.

The innovation programme started in 2007 is aimed at the budgetary financial support of the pre-competitive research projects, initiated by economic agents and achieved in collaboration with RDI development. The programme is dedicated to technological development and innovation, having innovation capacity enhancement, technological development and research results assimilate into production, as general objectives. Under the Innovation programme, projects are covering all the transport modes. The projects were developed and mainly conducted by SMEs.

For each of the priority domains, representative scientific and technical domains have been identified. Surface transports in the priority domain include ‘Innovative materials, processes and products’ (having the biggest share – 55.5%), with the following representative sub-domains: transport infrastructures; means of transport; transport technologies; traffic control systems and equipment; freight distribution and logistics.

Aeronautics is included into the priority domain ‘Space and security’ with the following sub-domains: aero spatial propulsion systems; aviation – and aero spatial structures; on-board installations and equipment; aero spatial technologies.

PNCDI (I) was finalised in 2006, and the next National Plan started in 2007. In order to make a connection between PNCDI (I), the National Plan 2007 (PN II) and FP7
(European Community), CEEX – Excellence Research Programme was released and carried on starting with year 2005, with a significant share in the NASR budget (24.98%).

Notwithstanding this, the budget allocations for research projects have always been extremely low. In this respect, for example, in 2008 the transport sector of the GDP was 9.8% while the amount of money allocated for transport research was only 0.05%. Under these circumstances, it becomes obvious that the good results expected to enhance the importance of the economy transport sector are difficult if not impossible to be achieved.

A number of approximately 171 projects in the line of transport were carried out under PN II (2007–2013). The most relevant component programmes, under which transport research projects were funded, are: ‘INNOVATION’ and ‘PRIORITY DOMAINS PARTNERSHIPS’ Programmes.

Programme 4 – Partnerships in priority domains has created the setting for a better collaboration among the various RDI entities, economic agents and/or public administration entities, with the intent to come up with solutions to the problems arisen, under powerful partnerships. Under Programme 4 – Partnerships in priority domains, a number of 49 transport projects were funded.

Table 2 presents the distribution of R&D programmes/projects funded under PN II in the field of transports according to transport modes, during the period 2007 ÷ 2013.

As it can be seen in Table 2, 11 projects covered several transport modes, namely: rail-road, aeronautic-sea and road-sea.

![Table 2](attachment:image.png)

In Figure 3, it can be observed the evolution of the projects share according to the areas of interest. Even though the number of projects that aims at ‘greening’ of transportation decreased from 35 (granted between 1999 and 2006) to 28 (granted from 2007 and 2013) the share from total granted projects increased by 4% in the same period. Comparing the structure of the research projects already run on modes of transport (see Figure 3) with the structures of modes with respect to passengers’ transport and freight/cargo transport
activities, no significant differences have been observed (the air transport in 2010 for example, had a 3.2%, i.e.).

In the latter half of year 2008, the management activities were disturbed, mainly because of the financial crisis which led to a further even out/delay of the payments to the contractors, to diminishing or complete cancellation of certain payments, to an adjournment, over unlimited time duration, of certain contracting activities, as well as, all of the above led to an uncertain atmosphere with consequences affecting the long-term public RDI system’s credibility.

**Figure 3** Distribution of projects carried out under PNCDI I (1999 ÷ 2006) and PN II (2007 ÷ 2013) according to action types (see online version for colours)

![Distribution of projects carried out under PNCDI I (1999 ÷ 2006) and PN II (2007 ÷ 2013) according to action types](image)

Source: Constantin et al. (2010)

According to the Romanian Government, Ministry of Transport (2013a, 2013b, 2013c, 2013d, 2013e), the ‘Transport Sector Operational Program’ – TSOP – for 2007–2013 is a strategic tool developed based on the objectives of the National Strategic Reference Framework which sets out priorities, objectives and financial allocation for the development of the transport sector in Romania with EU Community support during 2007–2013. The specific objectives of the TSOP took into consideration the following aspects:

- modernisation and development of TEN-T – measures necessary for environmental protection
- modernisation and development of national transport networks – all in accordance with the principles of sustainable development
• promotion of rail, waterborne and intermodal modes of transport
• support sustainable transport development by minimising adverse effects of transport on the environment and improving traffic safety and human health.

The TSOP that was approved by the European Commission through Decision no. 3469 of 12 July 2007 (with the first revision of the document on August 2012 and on July 2013 the second one) had a total budget of about 5.3 billion in the financial support of the Commission European Cohesion Fund (CF) and European Regional Development Fund (ERDF) counted for 4.57 EUR billion and from the national budget 0.805 EUR billion.

Unfortunately, the absorption of funds made available to TSOP was totally unsatisfactory though according to the Romanian Government, Ministry of Transport (2013a, 2013b, 2013c, 2013d, 2013e) published documents the results presented present a different picture (see Figure 4 – an annual absorption of only 32.5%).

For the first four years of the programme (2007–2011), the absorption value of the total funds available was only 4.22% which seems unbelievable but unfortunately true. This poor startup can be explained by the lack of organisation of the authorities in charge of the programme coordination, as well as, the lack of transparency in the tendering of projects which in turn generated major acts of corruption.

Figure 4 Evolution of absorption of funds allocated under the POS-T by EU, in 2013 (see online version for colours)

TSOP was divided into four priority axes, which include areas of intervention in which transportation projects were funded:

Priority axis 1 modernisation and development of Trans-European Transport Network (TEN-T) in order to develop an integrated sustainable transport system with EU transport networks

Priority axis 2 modernisation and development of national transport infrastructure outside the TEN-T in order to create a sustainable national transport system

Priority axis 3 modernisation of transport to help protect the environment and public health and safety of passengers

Priority axis 4 technical assistance for TSOP.
The main beneficiaries of the TSOP are national administrations rail infrastructure, road and water, as well as, the national and regional administrations of airport infrastructure.

4 Key aspects of European projects support a research in support of sustainable transport

According to the Romanian Government, Ministry of Transport (2013a, 2013b, 2013c, 2013d, 2013e) published reports, in recent years, the main European R&D support programmes for transport have been:

4.1 Marco Polo program

The program aims at easing traffic congestion and reducing pollution caused by transport activities by adopting more environmentally friendly modes of transport for the European movement of goods. Railways, shipping routes and waterway currently have excess capacity available to absorb the transfer of freight from the road. Private companies, public companies, public or consortia of companies which have viable projects can apply for Marco Polo program financial support. Since launching of the program in 2003 and a budget for 2007–2013 of 450 million EUR, more than 500 companies in the EU have successfully accessed funding from the Marco Polo program. Unfortunately, no firm Romania has participated in projects under this program, yet.

4.2 TEN-T program

The objective of the TEN-T program is to assist financially (studies and works) projects within the field of transport (air, sea, road, rail) that address the expansion and the modernisation of European transport networks. In this respect, between 2007–2013 a total budget of 8,013 billion EUR was allocated. Besides the sources of funding from the Structural Instruments granted by the European Commission (ERDF and CF), the development and modernisation of the transport network TEN-T are benefitting from the support of the European funding under the TEN-T.

TEN-T plays a crucial role in ensuring the free movement of passengers and goods in the European Union. This includes all transport modes and supports about half of the passenger traffic and cargo. One of the important objectives in terms of creating an intermodal networks is to provide the proper assistance in terms of choosing the most efficient mode of transport for each stage of the journey.

The construction of trans – European transport network is a major factor in boosting economic competitiveness and sustainable development of the European Union contributing to the implementation and development of the internal market, as well, to the increase of the economic and social cohesion.

TEN-T development involves the interconnection and interoperability of national transport and access. By 2020, the TEN-T will include 89,500 km of roads and 94,000 km of track, including approximately 20,000 km of high speed lines on which trains will be capable to run at a speed of 200 Km/h. The waterways will measure 11,250 km and will include 210 river ports. Besides, the TEN-T network will also include a number of 294 seaports and 366 airports.
Completion of the TEN-T network will have a major impact in reducing the journey time for passengers and goods and also will bring important environmental benefits by reducing pollution.

4.3 Structural instrument for pre-accession

Structural instrument for pre-accession (SIPA) which is a European Union program, has been in place since 2000. Its objective is modelled around the development of a transport infrastructure and environmental protection in the candidate countries for accession to the European Union. SIPA support was concentrated on the improvement of two particular sectors, namely, transport and environment. Out of the 60 Financing Memoranda signed between the European Commission and the Government of Romania in 2000–2006, 20 targeted the transport sector.

Projects funded to date through SIPA in the transport sector have considered the upgrading and the rehabilitation of the transport infrastructure for liaising with EU transport networks (mainly the two pan-European corridors crossing from west to east Romania (Corridor IV) and from north to south (Corridor X), multimodal corridors because they composed all types of transport infrastructure and multimodal node throughput), improve service and increase traffic safety for all modes of transport and minimising adverse effects of transport on the environment.

5 Biofuels – a major orientation for sustainable transport research projects in Romania

In the European Union and around the world more than 21% of the total quantity of emissions of greenhouse gases is due to transport and related activities and the percentage continues to increase. To meet the requirements of sustainability, especially reducing greenhouse gas emissions under the Kyoto Protocol is essential to find ways of reducing emissions from transport. Therefore, in recent years, many EU member states have developed numerous research projects aimed at producing new types of biofuels and, implicitly, to adopt the necessary technical solutions for their use in freight and passenger transport vehicles.

From the wide range of this type of fuel, biodiesel occupies almost 80% of the EU market. Germany is the largest producer of biodiesel, followed by France and Italy. In what concerns bioethanol, the main production leaders in EU are Spain, France, Poland and Sweden.

5.1 Romania

The potential for producing biofuels is high and can be achieved by converting to biofuel production which is part of the regular processing of raw materials (i.e., part of production intended for the sugar beet can be redirected towards the production of bioethanol), by increasing the productivity of crops, as well as, by increasing the cultivation of energetic crops. Oilseed (i.e., sunflower, soybean, and canola), cereals (i.e.,
wheat, corn, and oats), sugar beets, potatoes and sorghum are important crops for the production of biodiesel and bioethanol.

The first company to start producing biodiesel in Romania according to Hubca (2008) was Ultex Țăndărei. The company produced in 2006, biodiesel under the brand name Biodil. Since then, Ultex invested large amounts of money towards increasing its capacity of processing soybeans and canola, a fact that in turn helped Ultex consolidate its market share. Similar ventures were claimed by Ulerom which is one of the Racova Group members, Expur Uzriceni and SC Autoelite SRL Baia Mare.

Beside the Romanian companies, some foreign investors have been interested in producing biofuels in Romania. They were investors from the UK, the Netherlands, Portugal and Spain. Presently, there are, in various stages of development, a number of projects that envision the production of biodiesel from vegetable oils. It is worth mentioning in this respect, Atel Company, near Sibiu, where the German company MAN Ferostaal built a biodiesel plant. In the Calarasi district, Martifer, a Portuguese company, invested over 55 million EUR in a biodiesel refinery located in Lehluiu Station. Canah International opened a hemp oil manufacturing facility in Salonta, Bihor District. Its processing capacity has been 1,000 tons of seeds per year; this figure represents the equivalent of 250,000 gallons of hemp oil per year.

Rompetrol Downstream, the retail division of Rompetrol Group, sold since January 1/2008, diesel fuel containing 3% biodiesel in the 350 stations they operate. Petromidia, the largest refinery of the group is producing Euro 5 diesel.

Sunflower hybrids with 80% oleic acid content started to become a very important source for biodiesel production. Since 2002, sunflower containing high levels of oleic acid crops were financed and exported by a number of prestigious firms. The first type of hybrid was recorded by Pioneer Company under the brand name PR65A22. Since then a number of other hybrids were produced and recorded; Aurasol in 2005 created by Monsanto Company, Vera in 2006 created SC ITL SRL.

The cultivation of oleic hybrids will successfully expand since the oil is both a preferred source of nutrition and biodiesel. The content of oleic acid in these hybrids is 81.5% versus 21.5% in the traditional ones. For production of biodiesel, experts considered that oleic acid hybrids produced in Romania have a great adaptability to different climatic conditions. Vera domestic hybrid, for example, which has been subjected for three years of testing in ten domestic centres recorded an average production of 3,547 kg/ha, exceeding witness Alex by 12% and witness Splendor by 14%. When tested in Italy, the oleic acid in Vera hybrid was certified at 90.14% content.

Presently, in the arid and dry areas of Romania safflower oil started to be promoted as a new biodiesel source, even though the safflower plant – Carthamus Tinctoria is still unknown to farmers in Romania. From safflower biotypes containing more than 80% were recently obtained, compared to 13% for the traditional varieties. Across the globe, safflower crop recognised a recrudescence reaching a stalling 1.2 million ha, of which in India – more than 700,000 ha, Mexico – over 100,000 hectares and the USA about 90,000 ha. Given the imminent changes of climate in Romania caused by pollution, safflower crops can be assessed as promising sources of biodiesel. Though it sounds promising, since the biofuel industry seems to ensure an economic growth at all levels: local, regional and national, it has also some disadvantages. The main disadvantage pertains to the fact that the cultivation of biodiesel producing crops limits the space allocated for those crops that assure the food for people and domestic animals.
6 Conclusions and recommendations

Analysing the current situation in Romania, the study found differences competitiveness-wise in relation to the Western and Central Europe states. This situation is due to the fact that Romanian companies’ access to capital remained limited. Large enterprises and small and medium-sized are the engine of economic growth and their performance depends on the competitiveness of the whole economy. Thus, the scientific research had suffered as a result of the declining levels of investment in the public and private sectors, number of highly skilled and number of centres of excellence.

The analysis of data on the intensity of research and development in Romania compared to that of other EU member countries revealed a number of the significant issues, namely:

- The expenditures for research and development of Romania, made in both the public and private sectors, although they showed a relatively low level continues to decline as a share of their gross domestic product (GDP) from 1.01% in 2005 to 0.6% in 2012 (see Table 1), well below the average level of the EU-27.
- It is noted that in almost all EU states, the share of R&D expenditure from GDP declined in the period 2008–2012 which can be explained by the negative impact of the financial and banking crisis, a fact that led to the failure of their commitment to achieving the Lisbon strategy.
- Based on the level of R&D intensity in 2012, in the EU-27 where the average was 1.42% one can distinguish four groups of countries, namely:
  1. group of countries with high R&D intensity (> 2%) such as Germany and Estonia
  2. group of countries with medium-high intensity of R&D (between 1.7% and 2%) such as: Denmark, Finland and Portugal
  3. group of countries with medium – low intensity R&D (between 1% and 1.7%) which includes 13 EU states
  4. group of countries with low R&D intensity, less than 1% of GDP which includes eight EU states including Romania.

Therefore, for Romania to face major challenges in the coming years, it is crucial to support research and innovation policies as scientific activities are going through major changes on their way to achieving and sharing of knowledge from different fields of science.

Priorities for investment in research cover nine areas: information systems technology, energy, environment, health, agriculture, food security and safety, biotechnology, materials, processes and innovative products, space and security, socio-economic and humanities research. Within these nine areas, the development of centres of excellence – a process that will be gradually based on competition, public investment focusing on the development of infrastructure and collaborative structures in areas that provide the best results – is sought.

Even though, the research in the transport sector is not a priority area of concern in Romania, at least for the government activities specific to the transport field can be traced in other areas financially supported. As a result, the development of an institutional
A coordination mechanism that will integrate the scientific research activities in Romania around an agency whose scope and objective is to lobby the research and development activities in transport seems to be the sine qua non-condition for economic success and prosperity.

At the same time, a reliable measurement of the research capability revealing the involvement of Romanian companies in European research projects needs to be developed. To this date, some few Romanian organisations, unfortunately, have successfully participated within European transport research projects but the numbers indicate that there is potential for more involvement. For example in 2007, for FP7 SST calls, 81 proposals in which Romanian companies participated were submitted. Out of the 81 proposals, 19 were selected for funding. In 2008, out of 53 proposals, 8 were selected for funding. A truly negative fact is that up-to-date no Romanian organisation has managed a European project. While the seventh framework programme is the most popular European research program in Romania, the overall national research projects outnumber the European ones at a ratio of 4:1.

From the perspective of the university research sector participation several important conclusions were drawn:

- there is an acute lack of predictability of funding through public funds both on short and medium term, partially explained by the unfavourable overall economic conditions
- the competitive distribution of the available funding is seen by the government as important but with little chance to actually be aggregated at a national strategic level
- there is a reduced applicability of research results in various economic practices
- several research fields face major risks to diminish their own developing potential and this implies negative impacts upon other research fields and upon the national development potential.

In the near future, for supporting sustainability, transport research is expected to focus on:

- developing and promoting products and technologies for increasing the energy efficiency of the transports and reducing polluting effects
- development of intermodal transport systems/technologies aimed at restricting traffic external effects and reducing resources consumption
- integrated supply, technological, distribution logistics, as well as reverse logistics integrating transport, handling, storing, conditioning, packing, marketing, fabrication, recycling technologies
- transport quality management and traffic monitoring and control systems
- solutions for reducing traffic congestion in urban agglomerations as correlated with urban planning and life quality enhancing
- internalisation of negative externalities due to transportation.
Priorities are determined by the requirements of the EU in the field, but also by the objective reality of the current state of Romanian transport. For Romania, joining the EU has been a great opportunity to create a modern transport infrastructure as well as, the development of a system based on sustainable principles.

The current stage of transport sector infrastructure development does not constitute an advantage, but rather a handicap, if we are taking into account the fact that usually economic activities develop properly where favourable conditions are in place. Overall, there is an expectation that achieving these goals will enable the creation of a sustainable transport system in line with EU requirements.

References