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# Exploring the roles of European funds in the life cycle of Romanian spin-offs

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## Abstract

Academic spin-offs bring researchers together, foster experience, sharing a creative atmosphere with the purpose of creating new products/services in order to commercialize them. University spin-offs are an important vehicle for knowledge diffusion and economic growth. Despite their importance, little research exists in spin-off performance or impact at national level in Romania, especially from the perspective of academic entrepreneur. In order to understand the spin-off concept, the main focus of this article is to provide a better understanding of the spin-off mechanism and also how can it be facilitated in a regional context. The paper analysis the situation of spin-offs opened through the European Program “Increase of Economic Competitiveness” (2007-2013) during all the period from the start and till the last available financial dates. In order for Romania to become more competitive it has to improve the activity of the innovative firms, especially spin-offs and start-ups. During 2007-2013 there have been created 120 innovative companies out of which 19 spin-offs and 101 start-ups. But did the EU funds accessed between 2007-2013 had a real impact on the development of this companies? This article analyses and tries to answer this question.

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## 1. Introduction

The knowledge infrastructure is of the greatest significance because industrial production is based on knowledge: industrial technology is knowledge related to material transformation, which is the center of the national innovation system (Van Geenhuizen et al., 2005). In an economy based on a rapid change, the foundation of innovative firms is

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the way to commercialize research results.

In 2002 in Romania, the Government order no.14/2002, encouraged the process of setting-up science and technology parks, later approved by Law no. 50/2003. In 2004, the National Programme “Development of TT&I Infrastructure – INFRATECH”, approved by GD No.128/2004, also provided financial and logistical support to set-up and develop specialized TT&I institutions: TT centers, technological information centers, liaison offices, technological incubators, and science and technology parks. Next, in 2007 the European program, Sectorial Operational Program “Increase of Economic Competitiveness” was launched, in order to stimulate innovation activities, foster entrepreneurship of start-ups and spin-offs, by valorisations of the patented or unpatented R&D results. The target indicator of the program (oriented to supporting high-tech start-ups and spin-offs) established was 50 new companies for 2015.

The paper provides information about the impact of European funds 2007-2013, the Sectorial Operational Program “INCREASE OF ECONOMIC COMPETITIVENESS” (IEC) and also the impact of the innovative companies: spin-offs and start-ups opened through this program in the period 2009-2013. To this purpose, we analyse the life cycle of 8 spin-offs funded through this program and the problems encountered by them.

## 2. Theoretical background

### 2.1. Academic (university) spin-offs and start-up. A literature review

There have been several attempts in the academic literature to define academic (university) spin-offs and start-ups, and there is still lack of consensus on a specific definition. Academic spin-offs are focusing on a technology transfer system at converts into application in society. Following the concept of technology transfer, in a university spin-off, new scientific knowledge is converted into an application in society. Based on this new venture creation, the university research results are disseminated among interested stakeholders (Cernescu, 2015).

Understanding how universities can promote the establishment and growth of spin-offs requires detailed knowledge about how these firms develop and the type of conditions and support that facilitate their success. Academic spin-offs have a historical relationship with university such as their professors previously or former colleagues, which can could to a recommendation and intermediation to potential industrial partners or investors. The firms are different taking into consideration the following terms: the type of resources, the business model and the institutional relationship/background. The knowledge infrastructure is of the greatest significance because industrial production is based on knowledge: industrial technology is knowledge related to material transformation, which is the center of the national innovation system. (Van Geenhuizen et al., 2005).

The spin-offs biggest obstacle is the fact that evolves from an initial idea in a non-commercial environment to becoming established as a competitive firm. Clarysse et al. (2005) highlight the problems of conflicts between stakeholder objectives with regard to the type of ventures they wish to create and the resources they seek to commit. In order to understand the mechanism of these firms it is important to understand the nature of these firms. From Krabel and Mueller (2009) perspective the creation of a spin off depends on the patenting activity of the scientist, entrepreneurial experience, the personal opinions about the benefits of commercializing research and close personal ties to industry. Some of the distinctive criteria that help distinguish university spin-offs from a broader category of technology start-ups include: the origin of the firm’s core technology, the current or former affiliation of the founding member(s) with a particular parent organization, and the sources of funding used to start up the firm, all of which are in some form linked to a university (Bathelt, 2010). When it comes to licensing of the university inventions, made by the faculty, staff and students to an established business or to an entrepreneur founding a spinoff company, technology licensing officers play an every important role (Thursby et al. 2001). Shane (2014) shows that in technology licensing officers vision the best inventor for opening a spin off needs to have the main characteristic of an entrepreneur: male, immigrant, with industry experience, and easy to work with. In the literature spin-offs can be found also under the name of ‘university spin-outs’ or ‘research related start-up ventures’ (Bercovitz and Feldman, 2006), and also as new firms created to exploit commercially some knowledge, technology or research results developed within a university” (Pirnay et al., 2003).

Among several definitions for a start-up we have identified the next one: it is an entrepreneurial venture/company designed to search for a repeatable and scalable business model, according to (Blank and Dorf, 2012). According to the World Economic Forum Annual Meeting 2007, an excellent example is the spin-off: Oxford

Medical Diagnostics biotechnology (founded in 2004 by the University of Oxford) which combined truly innovative solutions with business environment and made an impact on society. Another famous spin-off is Flisom from Switzerland (founded in 2005 by the Laboratory of Solid State Physics of the Swiss Federal Institute of Technology Zurich - ETH Zurich), commercialise renewable energy research. Some of the distinctive criteria that help distinguish university spin-offs from a broader category of technology start-ups include: the origin of the firm's core technology, the current or former affiliation of the founding member(s) with a particular parent organization, and the sources of funding used to start up the firm, all of which are in some form linked to a university (Bathelt, 2010).

## 2.2. Stages of development of an academic (university) spin-off

Ndonzuau (et al. 2002) identifies 4 stages in the forming of an university spin-off (fig.1). The first stage generates and assesses ideas with regard to possible commercialisation; the second stage transforms the ideas into final entrepreneurial concepts; the third stage realises the best concepts by launching new spin-off firms and the fourth stage consolidates and strengthens the economic value created by these new firms.

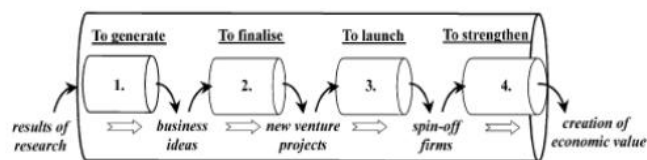


Fig. 1. The global process of valorisation by spin-off  
Source: (F.N. Ndonzuau et al. 2002)

The Core Entrepreneurial Action, developed by Bathelt et al. defines transformation of knowledge into the creation of economic value and follows 4 stages (Bathelt et al. 2010, Elpida et al. 2010). *The first stage (idea)* involves mechanisms and criteria used for selecting the ideas of products and services. In terms of risks, because the idea comes from a result of basic scientific/technological research, need to be selected. In order to reach a structured process, it is necessary to use the right abilities and skills in order to identify and evaluate the most promising ideas above all mutual trust and efficient internal exchange of information (Ndonzuau et al., 2002). *The second stage (business model)*, which is the stage where a firm is designed, and the feasibility of the concept is tested from financial, technical, scientifically, commercial potential perspective. Elpida et al. 2010 suggests 3 business models: first, technology/scientific research, which involves the ability to assess the extent to which research results are stable and sufficiently developed to lead to industrial exploitation by identifying their possible applications, assessing their technical feasibility, consistent and economical production and, in some circumstances, suggesting further research and development; second, market research, which involves the commercial potential to verify the extent to which there might be a potential market; third, protection potential, which involves the potential of any concept to be protected. *The third stage (financial sources)* deals with finding the financial resources to sustain the business concept. *The fourth stage (entrepreneurial culture)* involves strengthening an entrepreneurial culture necessary for fertilising the ideas and concepts.

Clarysse and Moray (2004) defines 4 stages of the academic spin-off: idea phase, pre start-up phase, start-up phase, post start-up phase. Vohora et al. (2004) talks about how academic spin-offs go through a number of distinct phases in the development of resources and dynamic capabilities. He identifies 5 stages: (1) research phase; (2) opportunity framing phase; (3) pre-organization phase; (4) re-orientation stage; and finally (5) sustainable returns phase. Figure 2 describes the stages of development and also the critical junctures of a spin-off. In the transitions from one phase to another, spin-offs encounter barriers preventing them from progressing into later stages. These barriers are defined as critical junctures and are identified as it follows: opportunity recognition; entrepreneurial commitment; venture credibility, and venture sustainability (Vohora et al., 2004). The ability to make the connection between specific knowledge and a commercial opportunity requires a set of skills, aptitudes, insights, and circumstances that are neither uniformly nor widely distributed. The cognitive conditions, incentives, and mental processing strongly influence the search for and exploitation of an opportunity, and they also influence the success of the exploitation process (Venkataraman, 1997).

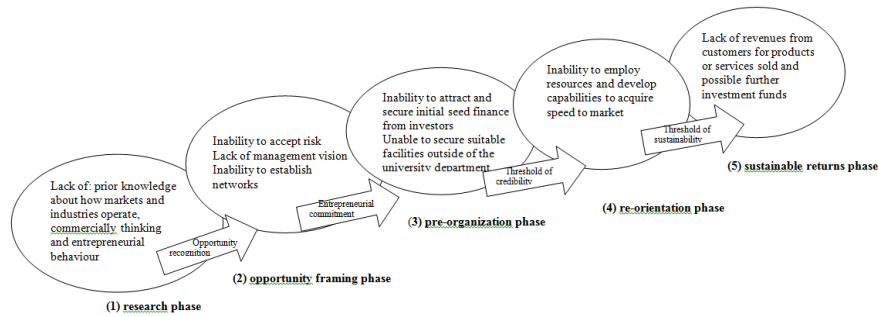


Fig 2. Factors initiating critical junctures  
Source: adapted after Vohora 2004

### 2.3. The factors influencing the academic spin-offs

Rasmussen (2006) talks about the differences between academic entrepreneurship and industrial entrepreneurship, while (Anderson, 2001) argues that the difference in culture and work practice is substantial. Four principal groups are involved in the spin-off process: the technology originator (scientist), the entrepreneur, the R&D organization itself, and the venture investor (Rasmussen, 2006). It is important to mention that scientists are motivated by the quest for knowledge, the decisions of what to explore are not so much connected to financial rewards, but prestige. Likewise, research on university spin-off creation focuses on factors that explain university spin-offs, but fails to consider the role of TTOs and universities (Mirabent et al., 2015). When it comes to licensing of the university inventions, made by the faculty, staff and students to an established business or to an entrepreneur founding a spin-off, technology licensing officers play an every important role (Thursby et al. 2001). From the behavior aspect, people tend to favor cases that look like the standard example.

Academic spin-offs receive from the university resources like: access to research facilities, accommodation and knowledge on management, patenting, manufacturing and practical issues. In other words the university provide the spin offs with basic research and human capital creation. This is why the positive relationship between university and spin-offs are the key for a successful business. By maintaining strong relationships with university contacts, academic spin-offs strengthen legitimacy, improve image in front of external organizations, and increase the chance of getting research funding (Soetanto & Geenhuisen, 2015). Academic spin-offs have a historical relationship with university such as their professors previously or former colleagues, which can could to a recommendation and intermediation to potential industrial partners or investors. There are different factors that affect the spin-off foundation such as: the effect of the nature of the technology developed (Shane 2001; Pressman 2002; Shane 2004), the industry in which the technology would be exploited (Shane 2002, 2001b), the university in which the invention was created (Di Gregorio and Shane 2003; Shane 2004; Zhang 2009; Astebro et al. 2012), and career experience (Levin and Stephan 1991; Roberts 1991; Shane and Khurana 2003); research skills (Zucker et al. 1998). The firms are different taking into consideration the following terms: the type of resources, the business model and the institutional relationship/background. The spin-offs biggest obstacle is the fact that evolves from an initial idea in a non-commercial environment to becoming established as a competitive firm. Clarysse et al. (2005) highlight the problems of conflicts between stakeholder objectives with regard to the type of ventures they wish to create and the resources they seek to commit. In order to understand the mechanism of these firms it is important to understand the nature of these firms.

Also we find all the elements that are involved in the creation of an academic spin-off in Elpidia's opinion (2010) under the name The Spin-off Chain. The supportive structures in the beginning of the academic spin-off development are: market needs, human capital, appropriate government policies and appropriate legislation. *Market Needs* is a critical factor for sustainable success of the spin-off is to connect the new concept with adequate market needs. The relationships between the university, entrepreneurs and the clients are crucial for the new venture in order to identify opportunities and limitations. *Human capital*. Plays crucial role in the context of spin-off development. Skills and experiences of the entrepreneurial inventors are indispensable for a successful commercialization of the invention. *Policy makers*. Implementing an effective government strategy for innovation is particularly important as key trends – the spread of global value chains, the increasing importance and

mainstreaming of knowledge based capital (KBC), and rapid technological progress, including the rise of the digital economy – are 3 leading to the emergence of a “next production revolution” (OECD, 2015a). The contribution of university to economic development and growth has made policy makers interested in the role of universities as potential vehicles for innovation and employment. There where created a lot of organizations like incubators, technology transfer offices, commercialization units and entrepreneurship centres. Especially, in the initial phase of the creation of university spin-off companies, a range of public interventions are being required starting from incubators. It is necessary a policy for that is encouraging the commercialisation of the public research. In this way entrepreneurship would be fostered. Getting the policy mix right can help governments in shaping and strengthening the contribution that innovation makes to economic performance and social welfare. The introduction of the Bayh-Dole Act in the US is one of the most influential and well-known policy changes to stimulate commercialization of university research. This Act transferred the ownership of intellectual property (IP) to the universities, and contemporary policy changes stressed the expectations that the universities could contribute more directly to industrial development (Stevens, 2004). *Legislation.* At local, regional, national or even global level legislation can influence the spin-off creation. The environment can foster entrepreneurship through the tax and regulatory environment for new businesses, insolvency law reforms and promoting efficient financial markets in all member states. *Nature of capital.* Having the idea or invention is not enough, finance becomes critical for a spin-off company. As external source financing we find venture capital and business angels financing. The gap in the provision of spin-off finance is just after the seed capital stage creating what is known as the "death valley" (Gompers and Lerner 1999). Grant aid from public authorities is often available for proof of concept and related research activities, it is much more difficult to finance the next stage when commercial development starts but the company has not yet begun to generate sufficient revenue for its costs. Business Angels are an important potential source of capital funding at this stage filling the gap. The early stage funding gap can be addressed in different ways. For example, by provision of government grants and public incentives for creating regional venture capital funds (Reitan, 1997). *Bridging Institutions.* In this category it enters: technological parks, incubators, innovation centers, develop and encourage the process of diffusion and transfer of knowledge and technology.

In general, their economic, organizational and administrative missions are assigned by policy making bodies and their role is to span the gap between the different stakeholders involved in different levels, at the complex process of the university spin-off (Mustar *et al.*, 2006). Successful spin-offs need to be integrated into networks allowing interaction between a wide variety of actors (e.g. enterprises, public agencies, technological programs, customers and finance companies). Incubators play a very important role for the academic spin-offs because of the following reasons: cheap and flexible accommodation, including shared services and access to pre-seed capital, programs for improving the entrepreneurial capabilities of founders/managers. The incubator acts as mediator or a direct supplier of resources without substantial costs. In terms of efficiency, academic spin-off firms tend to remain relatively small and fail to grow, as is witnessed in the European Union (EU) with most spin-offs not larger than 10 employees after 6 years of existence. In order to become more profitable and more well-known the academic spin-offs has to be included in a business incubator. In this way, likelihood of failure is reduced and the business incubator in provides an ideal environment to create, exploit, and share knowledge.

### 3. Research methodology

The objectives of this study are: (1) to assess the impact of the European funds (IEC Program) regarding all innovative start-ups and spin-offs funded between 2007 and 2013; (2) to establish what is the focus of Romanian spin-offs funded from IEC (2007-2013), what are their visions, and their annual turnover growth rate, the specificity of the problems encounters by the innovative 19 spin-offs funded by IEC during 2007-2013 in their life cycle, to identify common and specific features in spin-offs funded from IEC (2007-2013); (3) which factors have the highest impact on the development of academic spin-offs.

In this study we used public data available regarding the monitoring reports of the IEC program during the period 2007-2014, available from the Romanian authorities responsible for the implementation of programs and policies for innovative start-ups and spin-offs. As primary data, the research used public information related to approve grant applications and signed between the National Authority for Scientific Research, as an implementing body, and 120 innovative start-ups and spin-offs, as beneficiaries. The quantitative results of the research were correlated the decreased number of innovative firms opened using European funds, with the most difficult obstacles in doing a business in Romania, identified by the Global Competitiveness Report elaborated by the World Economic

Forum between 2007-2016. We created a database of 19 spin-offs funded from IEC (2007-2013) in Romania and after we applied the turnover criterion, the number of employee's criterion and the highest numeric distribution of spin-offs on counties. We used public data from <https://www.romanian-companies.eu/search.asp>, [www.m.finante.ro](http://www.m.finante.ro) and the web page of each company in order to collect the description of the company, number of employees and financial data from the start of the company till 2015. Looking at the regions with the highest number of spin-offs opened through the IEC Program criterion, we identified 2 counties (Iasi and Bucharest- Ilfov), where we found 8 spin-offs, which will further analyze. In order to make such a fine selection, more extensive investigation work is needed. In the 8 spin-offs opened, the authors have identified firms from the same county in the same line of business or in different fields. The 8 companies were established during 2009-2013 as it follows: one in 2009; one in 2010, three in 2011, three in 2013. The 5 spin-offs from Iasi county are classified, according to their activity of business into: nanotechnology -2, recycling-1, innovative material constructions-1, renewable energies-1. The 3 spin-offs from Ilfov county are classified, according to their activity of business into: IT-2, health-1.

The research methodology implied to collect data from the selected companies webpages and finance page and analyze these data. We have discussed the correlation between the decreasing number of spin-offs established through using European funds, and the most important barriers encountered by them as identified in section 2.2. and 2.3. A stage-based development model of academic (university spin-offs), proposed by Vohora et al. (2004) will be used as part of this research. He identifies 5 stages: research phase; opportunity framing phase; pre-organization phase; re-orientation stage; and final sustainable returns phase. Understanding how universities can promote the establishment and growth of spin-offs requires detailed knowledge about how these firms develop and the type of conditions and support that facilitate their success. Before drawing the conclusions with regard to the life cycle of the spin-offs financed from the UE, we analyzed the content of the information collected from companies in the Iasi County and Ilfov county. The analysis was made considering the 3 factors mentioned in this paper and their specific influence on the studied companies. The companies selected for the content analysis were those who provided access to the relevant information. For the 2 counties with the highest number of spin-offs financed from the UE (8 companies so far), we have complete information related to the referred factors of interest, proceeding to perform the content analysis.

#### 4. Research Results

##### 4.1. *The impact of the Sectorial Operational Program “INCREASE OF ECONOMIC COMPETITIVENESS” (IEC Program)*

The Sectorial Operational Program “Increase of Economic Competitiveness” (IEC) is one of the seven instruments, which have the purpose to increase of Romanian companies' productivity, in compliance with the principle of sustainable development, and reducing the disparities compared to the average productivity of EU. The program IEC (2007-2013) has been structured on 5 axis, having a budget of 2.554 million Euro.

In October 2016 a report shows that the absorption rate was 2 179 933 761EURO (85.94%). The expected impact of the investment of the program was to increase the private expenditures in that sector, by € 270 million in 2015, but also allow further patent applications to be issued. Priority axis 2: Research, Technological Development and Innovation for competitiveness meant to contribute to the following aims: the increase of research capacity by investing in the development of R&D infrastructure, increasing the number of a young researchers from universities, research institutes or companies with research department; stimulating the technology transfer based on the cooperation between R&D institutions, and enterprises; the capacity to innovate; the creation and reinforcement of high-tech firms. The effects of the IEC Program, started from 2008, and the disappearances of the crisis effects determined a decrease of the Romanian competitiveness rank, which in other words signifies that Romania reached a considerable competitiveness increase. In order to reduce the high technological and competitiveness gaps, one key intervention the priority axis 2, had set the following indicator: support for high-tech start-ups and spin-offs. The target of this indicator for 2015 established as it follows: 21 spin-offs and 29 start-ups created. In the table 1 is presented the situation of the achieved target. In 2008, the call was approved by the Ministry of Economy and Finance Order no. 387/ 11.02.2008.

During the program 2007-2013, the analysis of figure 3 shows a clear trend of growing interest mainly for start-ups, while spin-offs are less. The growth of start-ups from 5 in 2009 to 41 in 2013 can be explained, in general, through the experience gained by Romanian companies in accessing European funds and, in particular, due to the

improvement of university-industry collaboration on R&D, and the fact that companies spend more money for R&D. The share of spin-offs in total innovative companies developed through program IEC (2007-2013) is relatively low (15,83%) due to various factors: relative newness of the concept of innovative spin-off in Romania; the bureaucracy of academic institutions; the lack of entrepreneurial culture and innovation in the entire educational system, in special in universities; the lack of entrepreneurial culture and innovation in companies; the public research base is not oriented to the demands of the economy, and in many fields is poorly developed; the enterprises hesitate to increase their competitiveness based on research and innovation activities, because of high market risks, and technological uncertainties; the financial markets are not supportive.

Table 1. The indicator of the priority axis 2 of IEC Program

Year	Innovative companies		Total
	Spin-offs	Start-ups	
2007	0	0	
2008	0	0	
2009	1	5	6
2010	4	12	16
2011	5	25	30
2012	2	18	20
2013	7	41	48
2014	0	0	0
2015	0	0	0
Total:	19	101	120

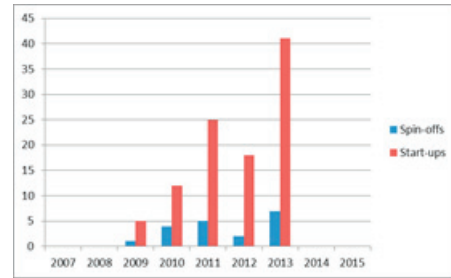


Fig.3. Number of innovative companies, IEC program (2007-2013)

Source: author

Source: adapted after [http://www.fonduri-ue.ro/files/programe/COMPETITIVITATE/POSCCE/RAI\\_2014.pdf](http://www.fonduri-ue.ro/files/programe/COMPETITIVITATE/POSCCE/RAI_2014.pdf)

#### 4.2. Spin-offs opened through the IEC Program 2007-2013 in Romania

The results presented in this paper are based on the content analysis. The study verified several preliminary factors that proved to be relevant with respect to 19 spin-offs established through IEC Program.

Table 2. Specific and common features for spin-off companies

Analyzed factors/variables	Findings of the analysis
Company's purpose	<ul style="list-style-type: none"> <li>is declared (on the company's webpage, for example)</li> <li>indicates taking commitments to business</li> </ul>
Company structure	<ul style="list-style-type: none"> <li>is declared (on the company's webpage, for example)</li> <li>most of the times the parent organization is an university</li> </ul>
Financing source	<ul style="list-style-type: none"> <li>the lack of sustaining funds the difficulty of obtaining bank loans</li> </ul>
Number of employees	<ul style="list-style-type: none"> <li>the fluctuation of human force</li> </ul>
Location	<ul style="list-style-type: none"> <li>spin-offs are opened around the biggest university centers</li> <li>most of spin-offs opened are in Iasi and Ilfov county</li> </ul>

Analyzing the location of each spin-off opened funded from European funds, we concluded that the N-E Region and Bucharest-Ilfov region have the highest number of spin-offs opened, due to the prestigious university centers (Iasi and Bucharest). The turnover growth rates of the spin-offs from Iasi county and Ilfov county, recorded in period 2009-2015 are given in Table 3. Table 4 presents the number of employees.

Table 3a: Annual turnover growth rate in the studied companies Iasi County (%)

Company/ Year	2015/2014	2014/2013	2013/2012	2012/2011	2011/2010	2010/2009
Company C1	509.62	-12.08	-80.41	-30.99	2523.53	70.00
Company C2	0.00	706.45				
Company C3	76.48	-7.75				
Company C4	-31.82	2458.14				
Company C5	0	0				

Table 3b: Annual turnover growth rate in the studied companies Ilfov County (%)

Company/ Year	2015/2014	2014/2013	2013/2012	2012/2011	2011/2010
Company C6	2.14	-7.27			
Company C7					6.38
Company C8	1143.18	1797.23	-98.44	309.53	

Table 4a: Number of employees in the studied companies Iasi County

Company/ Year	2015	2014	2013	2012	2011	2010	2009
Company C1	3	5	8	2	5	0	0
Company C2	2	4	3				
Company C3	3	4	3				
Company C4	4	12	12				
Company C5	1	4	6	8	0		

Table 4b: Number of employees in the studied companies Ilfov County

Company/ Year	2015	2014	2013	2012	2011	2010
Company C6	1	4	1			
Company C7	0	0	0	0	0	10
Company C8	3	2	2	7	6	

The 8 spin-offs, established during 2009-2013, are classified, according to their activity of business into: nanotechnology -2, innovative material constructions-1, renewable energies-2, IT-2, health-1.

**The Company C1** provides research and projection of radio frequency, electrical and electronic measurements, electrical and electronic engineering and also performs measurements in the dielectric/electromagnetic field. Studying the company's website we concluded that the total amount received through IEC Program was around 750.000lei and the parent organization is Technical University "Gheorghe Asachi" Iasi. Since 2010 was involved in a lot of research projects, but still the number of 5 employees (2011) decreased to 3 by 2015.

**The Company C2** develops a lead-acid battery regeneration technology. Studying the company's website we concluded the parent organization is Technical University "Gheorghe Asachi" Iasi, the total amount received through IEC Program was around 623000lei. The number of but still the number of employees has descendent trend. Since 2013 was involved in a lot of research project regarding the collection and recycling of used batteries.

**The Company C3** develops and implements innovative recycling technologies to produce composite materials. The spin-off identifies needs and provides innovation demand for companies in various fields of activity, especially in the construction industry that uses such alternative products. The spin-off started in 2013 with 3 employees and reached 2015 with the same number, although in 2014 had 4 employees.

**The Company C4**, receiving through IEC Program around 740 000 lei, is producing ultra-performing products by applying the multilayer titanising process, introducing into production these products and organizing a private laboratory to provide specialized services of titanium layers. Studying the company's website we concluded that the company is produces cutting tools, hard molds, punches, molds, injection molding pistons, active elements from agricultural machinery, terraced or mining machines, multilayered titanium and advanced services for the evaluation and control of untitled titanated deposits and new multilayer deposits in order to marketing, starting with a result obtained from research-development activity. Established in 2012, the company kept constant the number of employees but in 2014, it seems that the number of employees dropped from 12 to 4.

**The Company C5** develops and solar energy conversion systems with storage capabilities. Studying the company's website we concluded that the parent organization is Technical University "Gheorghe Asachi " Iasi, and since 2012 is involved in a lot of research projects. Established in 2011, the company registered a descendent trend concerning the number of employees, which dropped from 8 in 2011 to 1 in 2015.

**The Company C6**, opened in 2013 received 557.000lei through IEC Program. The spin-off develops an innovative integrated automation system, adapted for use by people with disabilities. The company registered in 2014, after one year of life a number of 4 employees in spite of the fact that it started with just 1.

**The Company C7**, opened in 2009 received 545 000lei through IEC Program. The spin-off produces textile medical devices. Studying the company's website we concluded the parent organization is National Institute of Research and Development for Leather and Textiles - I.N.C.D.T.P. Bucharest. The company had big problems, because it started with 10 employees in 2009 and in the following years it didn't have employees.

**The Company C8** provides soft designed for the management of school situations. Studying the company's website



we concluded benefits from the University of Bucharest. Opened in 2011, the spin-off received around 700 000lei through IEC Program.

## 5. Result discussion and Conclusion

Our study has focused on answering the following questions: are the effects obtained after the implementation of the proposed programmes, still present even after the end of the programme without further public funding? Were the 19 spin-offs profitable, after the funding? The limitations of this paper are related to the lack of financial data before 2007 for the innovation rank for Romania. Another limitation is related to the fact that all spin-offs analysed need a new approach in understanding what were the main factors influencing their evolution through the lifecycle. The article concludes with some theoretical and practical implications and with suggestions for future research.

First, we found that 19 Romanian spin-offs analysed, had a quite erratic life cycle, perceived in the large fluctuation of their turnover and number of employees. Our study shows that all the 19 spin-offs are still functioning, but most of them are facing financial problems concerning the number of employees and turnover. The reason why all the spin-offs are still opened is that the beneficiaries must assure the sustainability of the firm on a period of 3 years. We found that all spin-offs had in the first year of development the highest number of employees, and had a considerable decrease in the life cycle of this spin-off. Also Roberst and Malone (1996) discovered that employment growth is often very high in the early days of spin-off companies and the spin-offs are likely to produce further spin-offs from themselves. We found that from all 8 spin-offs analysed, only C8 reached the final sustainable returns phase, registering a constant positive annual turnover growth rate. Only when academic spin-offs overcome certain critical junctures like: opportunity recognition, entrepreneurial commitment, venture credibility and venture sustainability is when the firm can become an established firm with sustainable return (Vohora et al., 2004). C7 only reached the pre-organization phase, starting with 10 employees in the first year and ended up with none in the following. C1, C2, C3, C4, C5, C6 still remain in the re-orientation stage, with big fluctuation of annual turnover growth rate and number of employees.

Furthermore, our findings highlighted that the highest number of spin-offs established through IEC Program (2007-2013) were established around the most important cities and university centres in Romania. In the world, in advanced countries, a spin-off firm remains one of the key actors in driving the urban evolution towards technological changes and new knowledge perspectives, with an important impact on the socio-economic growth. Consequently, in order to improve the competitiveness of a city, it is essential that the local government and industry system to act more as facilitators in the exchange of knowledge and technology, by setting up an unique and common innovative network. Also, in order to increase the urban/metropolitan competitiveness, the government and local authorities should sustain the innovative companies using a diversified approach to ensuring a local business environment favorable to innovative companies. For example, we have observed that during the life cycle of the 19 spin-offs they registered quite big fluctuation of income, which leads us to conclude that the management of these spin-offs is faulty, managers are lacking business skills and consequently, their companies are unstable on the market. It is known that the entrepreneurship process of opportunity identification and development depends on the prior knowledge of the actors involved (Shane, 2000) and their ability to create the necessary environment for the production and commercialization of their innovative products/services. The creation of innovative firms requires entrepreneurial skills and it requires: to develop a business concept, gain necessary resources and take the right decisions. On the other hand, once established in the business such a company needs a set of business and management skills that usually are not found in a university researcher/teacher/student. However, innovative firms are part of a new economy, because they produce the latest technologies and create the new sectors of production (Bibu, 2016). Therefore, our paper is recommending that universities should first, act quickly and intensively in a targeted manner to use the huge potential for business ideas and entrepreneurs existing inside universities and affiliated research institutions.

Second, we recommend acting in order to integrate the culture of entrepreneurship in university teaching, research and management for the long term, and third, to develop the tool for the credible recognition of students' employability and entrepreneurial skills. The new program Competitiveness Operational Programme 2014 - 2020, allocated 17,905,500 euro for action 1.2.1. in Romania. Its aim is to stimulate enterprises' demand for innovation through RDI projects carried out by enterprises individually or in partnership with RD institutes and universities, in order to innovate the processes and the products in the economic sectors with growth potential. The type of project to be financed is: innovation enterprises by type start-up and spin-off – Section C. We consider that our study must

be carried on in order to identify the specificity of the problems encountered by the innovative spin-offs and start-ups, funded by IEC during 2007-2013 in their life cycle. Furthermore, studies should be made in order to answer the following question "what types of spin-offs were used?": from entrepreneurial perspective- inventor entrepreneur or surrogate entrepreneur (Radosevich,1995); from method of technology transfer adopted - direct spin-offs, indirect spin-offs, technology transfer companies (Upstill and Symington, 2002); from type of knowledge involved (Pirnay et al., 2003).

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