

## **How to evaluate the impact of academic spin-offs on regional development**

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### ABSTRACT

The paper proposes a framework to evaluate the impact of academic spin-offs at regional level and applies it to the context of the Marche region (Italy). Spin-off creation is the most complex way of commercializing academic research, compared to licensing and R&D collaborations, but with the highest potential impact on the regional context. The empirical analysis shows that when measured in quantitative terms the impact of spin-offs on local economies is rather low; however, there are qualitative direct and indirect effects that must be taken into consideration. By focusing on providing R&D services, spin-offs play an important role in promoting the up-grading of the regional industrial system, which is mainly based on small and medium-sized firms in low and medium-tech sectors. Though not very successful in terms of growth and job creation in the short run, spin-offs provide an entrepreneurial experience for a high number of young researchers. We can expect that in the longer terms these people can play an important role within the local system in the start-up of new companies or as agents of innovation for established firms.

Keywords: spin-offs, technology transfer, regional innovation system.

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## **1. Introduction**

Over the last decade there has been an increasing interest toward academic entrepreneurship, i.e. the direct involvement of academic scientists into the development and commercialization of their research. The commercialization of scientific and technological knowledge produced within publicly funded research institutions such as universities, laboratories and research centers is increasingly considered by policy makers as one of the key elements for developing and sustaining regional economic growth. This paper focuses on one of the most promising ways to transfer research results to the market place: the creation of academic spin-offs. Some researchers argue that the direct involvement of academic scientists in commercial activities can solve some of the problems in the knowledge transfer process, and motivates researchers to undertake projects with greater economic and social relevance (Etzkowitz et al., 2000). Governments throughout the world agree that universities, their staff and students, should be more entrepreneurial and should contribute directly to economic development through business activities such as the formation of spin-off companies, and the patenting and licensing of technology (O'Shea et al., 2005; Martinelli et al., 2008).

In Italy the phenomenon of university spin-offs started to be relevant during the last decade, partly as a result of regulatory changes that introduced the possibility for universities and research institutions to authorize, on a temporary basis, their staff to participate in business ventures for the exploitation of research results. Academic spin-off is a phenomenon with significant potential for Italy, most of all, in view of the need for the Italian economy to move from so-called 'traditional' or 'low-tech' sectors to 'high-tech' sectors (OECD, 2005). According to the endogenous growth theory (Braunerhjelm et al., 2009), for which technological innovation is seen as the most important factor for achieving long-term economic growth, Italy has a need to rapidly develop activities with a greater knowledge content. In this context, there has been a reevaluation of the role of research centres and universities not only as producers of new knowledge but also for the transfer of knowledge to business activities. Knowledge-based economies are innovation driven: there is widespread agreement that in high-tech sector the production of new knowledge, its transfer to technological innovation, and industrial competitiveness are closely linked. Innovation is defined by Lawton Smith and Ho (2006) as an industry-

based concept and has become increasingly complex as firms seek external inputs for in-house innovation to develop new technologies and to promote market differentiation and expansion. The universities are a key resource for high-tech firms, especially in the early stages of product development. Moreover, proximity and agglomeration plays an important role in R&D collaboration, so that in assessing the role of universities in technology transfer we have to consider the local context where universities are located (Boschma, 2005; Hewitt-Dundas, 2011). In this paper we focus on the role of university spin-offs on regional development.

According to common definitions of academic spin-offs three types of companies are included in such a category: 1) companies founded by university teachers, researchers or other staff-members; 2) companies founded by students and graduates in order to commercially exploit the results of the research in which they might have been involved at the university; 3) companies founded by outsiders that exploit the results of university's research. In this paper, by academic spin-offs we include the first two categories: as a result, spin-offs are defined as "... companies which evolve from universities through commercialization of intellectual property and transfer of technology developed within academic institutions" (Djokovic and Souitaris, 2008, p. 225).

After about ten years experience of spin-off promotion by universities and local institutions in Italy, there is a growing concern about the evaluation of the impact of spin-offs on universities' technology transfer and local economies. Up to now the empirical studies of the phenomenon has focussed on analyzing the characteristics of spin-offs and their growth processes (Iacobucci et al., 2011). As found in other European studies, the empirical evidence about Italy indicates that most academic spin-offs experienced a very low growth and that only a few of them can be considered as 'gazelles'. Most university spin-off companies start small and remain small, reflecting founder aspirations, capabilities, and resource endowments. Leitch and Harrison (2010), based on a detailed analysis of university spin-offs in Northern Ireland, conclude that academic spin-offs are technology lifestyle businesses not dynamic high-growth potential start-ups. They suggest that the prominence given to spin-offs in the analysis of technology transfer and in discussions of the economic impacts of universities is misplaced. In this regard, there is a growing recognition that the overall significance of the now widely accepted technology transfer model is based on the atypical experience in technology hotspots, such as Silicon Valley and the Boston area (Nicolaou and Birley, 2003). Such US contexts that European policymakers have sought to emulate involve atypical high-tech

clusters that are generally absent in Europe. The spin-off process in the latter contexts is likely to be very different from that in more developed high-tech entrepreneurial environments such as Boston or Silicon Valley where the capability to select the best projects and allocate resources to them already exists. Moreover, also the US experience has often been exaggerated (Lester, 2005). There is a need for assessing the effective role played by university spin-offs in advanced economies, starting from the premise that their impact change significantly when we take into account the differences in local contexts (Benneworth and Charles, 2005).

We adopt a local perspective also because of the critical role of proximity to the transfer of knowledge. This is true in the case of university-firm relations, giving the importance of face-to-face interactions (Hewitt-Dundas, 2011). It is even more true in the case of spin-offs, that are normally located very close to their parent institution (Lindholm Dahlstrand, 1997). This is due to several reasons: a) the incubation role played by universities in the start-up phase; b) the direct involvement of academicians employed in the university; c) the continuous collaboration between spin-offs and university departments.

Compared to other ways of technology transfer by universities - licensing of intellectual property and joint research projects involving universities and firms - spin-off is characterized by the following: a) the start-up of a new company; b) the involvement of university staff in the ownership and management of the spin-off (O'Shea, Chugh, & Allen, 2007).

The effective capacity of spin-offs to have a significant impact on regional systems depends on two aspects: a) the capacity for rapid growth of at least some of these initiatives, b) the generation of positive externalities in the regional system.

If we consider the widespread consensus among scholars and policy makers about the positive role of spin-offs, it comes as a surprise that few empirical studies are available that assess the contribution of academic spin-offs to technological change and local development (Berggren and Lindholm Dahlstrand, 2009).

The object of this paper is to contribute to fill this knowledge gap. It has two main aims:

- a) developing an analytical framework to evaluate the impact of academic spin-offs on university technology transfer and on regional development;
- b) applying this framework to a specific regional context.

The empirical analysis is based on a sample of 32 spin-offs set-up between 2000 and 2012 from Università Politecnica delle Marche (UNIVPM). UNIVPM is a middle size, technology oriented university, located in a small, highly industrialized region of central Italy (the Marche region). The region is characterized by the presence of small and medium-sided firms, organized in industrial districts and operating in low and medium tech industries.

For each spin-off balance sheet data and information about ownership and governance were examined. The analysis of the ownership and management team, and its change over time, was made through information provided by Chambers of Commerce. Publicly available information have been supplemented with a questionnaire aimed at collecting qualitative information about the relations of spin-offs with their parent institution and with the local economy.

The paper is organized as follows. Section 2 develops a framework for analysing the impact of academic spin-offs at regional level and a set of indicators to measure this impact. Section 3 provides information on the data and methodology used in the empirical part of the paper. Section 4 reports the results of the application of the framework to the case of the Marche region in Italy. Section 5 discusses the main findings of the analysis.

## **2. A model for evaluating the local impact of academic spin-offs**

The commercialization of university research can take place through various mechanisms: licensing of patents, spin-offs creation, consulting and joint research agreements. They are often addressed as separate, alternative transfer mechanisms; however, in practice effective commercialising of university research may require a variable mix of all those instruments. The question of what instrument is best suited to transfer different pieces of knowledge has been the focus of many contributions. The incentives of adopting these mechanisms may differ between individual researchers and university administrators (Franzoni and Lissoni, 2006). The overall extent of technology transfer activities is influenced by the institutional features of national university systems. These institutional features affect the intensity of patenting and firm creation activities and influence how and when commercial activities may help scientist to progress in their careers and universities to profit from the technology transfer activity.

Financial benefits are one of the main incentives for people and institutions involved in technology transfer when choosing the appropriate mechanism. Figure 1 shows the potential financial benefits of spin-offs activity and compare them with the other forms of technology transfer.

In terms of financial benefits, the most important way of commercializing university research is through contract research. Most of these benefits are appropriated directly by the academicians involved in the research and consulting activity. However, a significant share is retained by the university to cover general expenses and to contribute to the research infrastructure<sup>1</sup>. If universities are to develop close links with industry to generate research income, they have to build areas of expertise that firms are interested in. This is a particular problem for mid-range universities that may have a mix of international, national and regional/local objectives. As a result, contract research will tend to be focused towards a small number of departments in each university (Wright et al., 2008).

**Figure 1 - Pecuniary beneficiaries of technology transfer activity**

	<b>Contract research and consulting</b>	<b>Patenting and licensing</b>	<b>Spin-offs</b>
<b>University</b>	Share in external contracts	Fees	Dividends and capital gains (when there is a share in the spin-off)
<b>Faculty</b>	Remuneration	Fees	Remuneration (in the incubation phase); Dividends and capital gains
<b>Former students and temporary researchers</b>			Salaries; dividends and capital gains
<b>Firms</b>			Dividends and capital gains (when there is a share in the spin-off)

In the case of patents issued as a result of publicly fund research, the financial benefits goes to the university and to the inventors, depending on who is the owner of the patent<sup>2</sup>.

<sup>1</sup> The share is variable according to university regulations. In the case of UNIVPM the cumulative share of university and departmental fees reaches 20% of the external contract

<sup>2</sup> Italy has recently adopted the so-called 'professor privilege' for university patents. It means that it is a choice of the academicians whether to be the owner of the patent (leaving a share to the university) or allowing the university to patent (and retaining a share of its ownership).

In recent years there has been a significant improvement in IP management by Italian universities (NetVal, 2009). However, several studies demonstrate that even in universities that manage a large portfolio of patents the revenues from fees hardly cover the expenses.

From the university point of view, spin-offs are not likely to be a major source of income, as compared with licensing or contract research. However, it is the most important in terms of economic impact on the local economy (see Figure 2). This is for two reasons: on the one hand spin-offs have a larger range of potential beneficiaries than just the university and academicians; on the other hand, besides the financial benefits, spin-offs have several non-financial benefits, most of which at the local level.

Spin-off creation is the most complex way of commercializing academic research in terms of process, people involved, risks, etc. It is expensive and resource consuming for universities but with little or no prospective financial returns; however, it has the highest impact on the local context, because of:

- the possibility of a direct transfer of new knowledge into commercially viable products and services;
- the economic benefits for the local community;
- the potential knowledge spillovers to other firms in the region.

**Figure 2 - Geographical impact of technology transfer activities**

	<b>Contract research and consulting</b>	<b>Patenting and Licensing</b>	<b>Spin-offs</b>
<b>Local</b>	++		+++
<b>Regional</b>	+++		+
<b>National / Global</b>	+	++	

+ low impact, ++ medium impact, +++ high impact

The literature has already identified a wide range of economic benefits of spin-offs (Benneworth and Charles, 2005):

1. they generate high-tech entrepreneurship (Etzkowitz and Leydesdorff, 2000),
2. they stimulate the building of new networks to access finance and to develop sales and marketing (Lindholm Dahlstrand, 1999),

3. they retain close linkages with their ‘parent’ institution through the recruitment of young researchers and research collaborations (Heydebreck et al., 2000)

4. they are sources of knowledge spillovers to the local community, and can promote and shape the emergence of regional technology clusters (Di Gregorio & Shane, 2003),

5. they stimulate business support services and infrastructure, benefiting other start-ups (Lockett et al., 2003).

Figure 3 defines a set of indicators that can be used to evaluate the quantitative and qualitative impact of the above mentioned benefits.

**Figure 3 - Set of indicators to measure the impact of academic spin-offs**

<b>Impact</b>	<b>Indicators</b>
High-tech employer	Sector of activity Number of employees
Source of technological entrepreneurship	Sector of activity Promoters, owners, managers
Links with parent institutions	Grants and contracts with the parent university
Creation of international networks	Presence of foreign companies in the ownership International co-operative projects in R&D Extent of geographical market
Source of technological spill-over	Collaboration with other firms at local level Labour mobility
Stimulate business support services	Incubators Start-up competitions Entrepreneurship courses

The number of employees and promoters, combined with information on the sectors of activity, measures the capability of spin-offs to create hi-tech employment and entrepreneurship.

The number of grants and contracts with the parent university measures the ability of the spin-off to act as a useful link between research and markets. This is especially true for spin-offs that perform R&D activity for industrial and service companies and that act as technology transfer agencies between the university and the market. This is especially beneficial for small firms that can have problems in directly accessing university facilities.

The capability of spin-off to create global networks for finance, technology and market is of specific value at local level; once established, these networks can be beneficial also for other firms in the local context. The ability to create international networks could be



evaluated through the number of international collaborations in R&D, the ownership structure of the spin-off and its geographical market.

Labour mobility is one of the main way in which knowledge spillover are propagated at local level. The importance of this mechanism can be evaluated by looking at the turnover of promoters and managers and following their career choice after exiting from the spin-off.

The number of incubators, start up competitions and entrepreneurship courses that are developed at local level (often by the same university) can be considered not only as factors promoting spin-offs but also as a side-effect of spin-off activity at local level. These activities typically involve more people than just those involved in spin-off creation. They help setting a favourable environment for entrepreneurship and start-up, that is beneficial for the local community as a whole.

### **3. Data and methodology**

To apply the framework developed in the previous section we use two sources of data. The first are data taken from a database of Italian spin-off developed within the Center for Entrepreneurship and Innovation of UNIVPM. The database contains information on all the spin-offs set-up by universities and other PRI in Italy in the period 2000-2012. This database contains financial information (annual reports), information about the ownership and management of spin-offs and their activity.

During the period of observation 32 spin-offs were set-up in UNIVPM. Four of these spin-offs closed during the period. Moreover, for 5 of them quantitative information on sales and employees are not significant because they were set-up in 2011 and 2012.

The second source of data is a direct survey conducted on the spin-offs of the UNIVPM. The direct survey allowed us to collect quantitative and qualitative information that were not present in the previously mentioned database. Questions addressed the following issues:

- type and number of collaborations with the parent university and other partners;
- characteristics of products and services offered by spin-offs;
- fundamental changes that had a positive impact on spin-offs growth;
- number and location of customers;
- entrepreneurial and organizational factors.

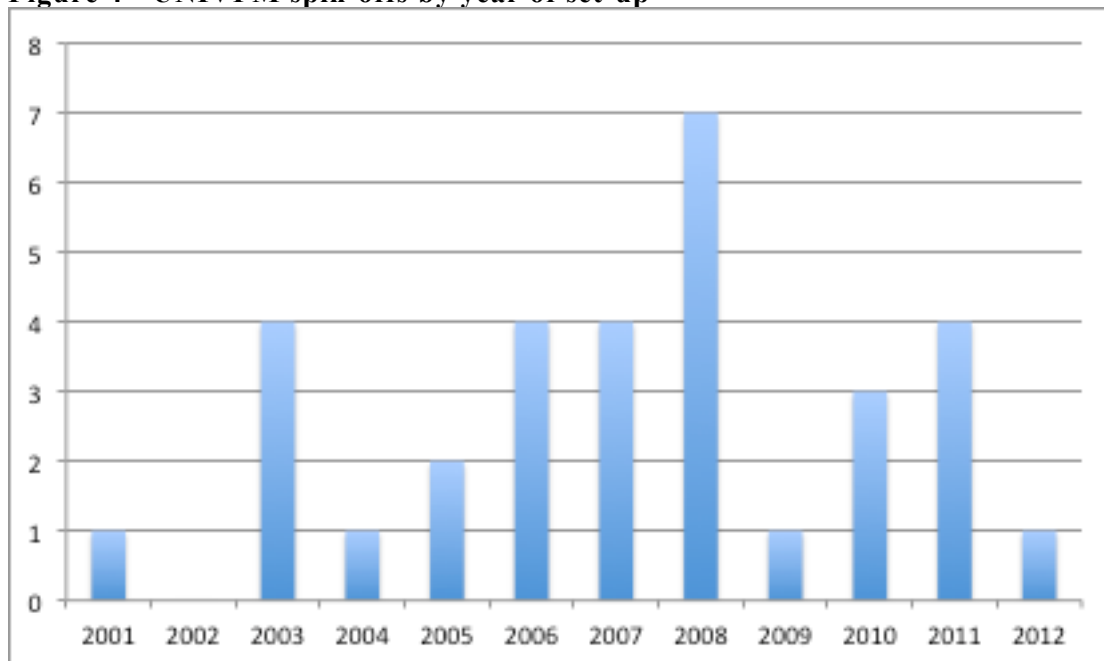
The questionnaire were sent to 23 spin-offs of UNIVPM, 10 of them answered.

The choice of the period is because only since the early 2000s, following the adoption of a specific legislation, has the phenomenon of research spin-off become significant in Italy. In particular, a Parliamentary act of 1999 authorised universities and other public research institutions (PRI) to issue regulations that allow researchers and professors, as an exception to existing rules, to participate in the capital and the management of newly established companies aimed at the industrial use of research. Following this legislation, in the early years of 2000s, universities developed specific regulations governing the involvement of their permanent (such as professors and researchers) and temporary staff (such as doctoral students, research grant holders, etc.) in spin-off companies.

The number of spin-offs calculated by various sources differs depending on the parameters used to define them. In this paper we consider the spin-offs that are officially recognized by the parent institution and that involve the presence of at least one academicians as a promoter and owner-manager. As observed in other countries, in Italy spin-offs are not uniformly distributed between the different PRI: the 5 most important universities have developed about one third of the spin-offs. As a results, there is a strong concentration of spin-offs at regional level, with most initiatives being in the Center and Northern parts of the country. The UNIVPM is one of the most active universities in promoting spin-offs.

#### **4. Empirical analysis**

Figure 4 shows the founding year of the 32 spin-offs that were set-up by professors and researchers of UNIVPM. Following the same pattern observed in Italy, the birthrate of spin-offs reached a first peak in 2008, suggesting a boom effect generated by the introduction of this model in the Italian system. In 2009 we observed a slow down in the number of spin-offs induced not only by the reaching of the maturity stage but also by the financial crisis that hit the European economies starting from the autumn of 2008.

**Figure 4 - UNIVPM spin-offs by year of set-up**

Source: UNIVPM Spin-off database

The prevalent sectors of activities are ICT, energy and green economies and innovation services (see **Errore. L'origine riferimento non è stata trovata.**). The sectoral composition of spin-offs from UNIVPM doesn't necessarily reflect the research field in which the university is stronger in terms of research and teaching, but those that are more active in technology transfer activity and in relations with industry. Infact, most of the spin-off originate within the engineering faculty.

**Table 1 - UNIVPM spin-offs by sector and year of set-up**

Sector set-up \ Year of	2001	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	TOT
<b>R&amp;D SERVICES</b>		1		1		3	2	1	1	2		11
<b>ICT</b>	1		1		1		3		2	1		9
<b>ENERGY &amp; GREEN ECONOMY</b>		2		1	1					1	1	6
<b>LIFE SCIENCE</b>		1			1		1					3
<b>BIOMEDICAL</b>					1		1					2
<b>ELECTRONIC</b>						1						1

Source: UNIVPM Spin-off database

The first aspect analyzed is related to the volume of sales recorded by the sample companies for each years after the set-up. Given the nature of spin-offs, their success on

the market is critically important for assessing their capacity to exploit research results. In 2010 the 19 spin-offs of UNIVPM for which balance sheet data are available, had total sales of more than 5 million euros (see Table 2).

**Table 2 – Sales of UNIVPM spin-offs (thousands of Euros)**

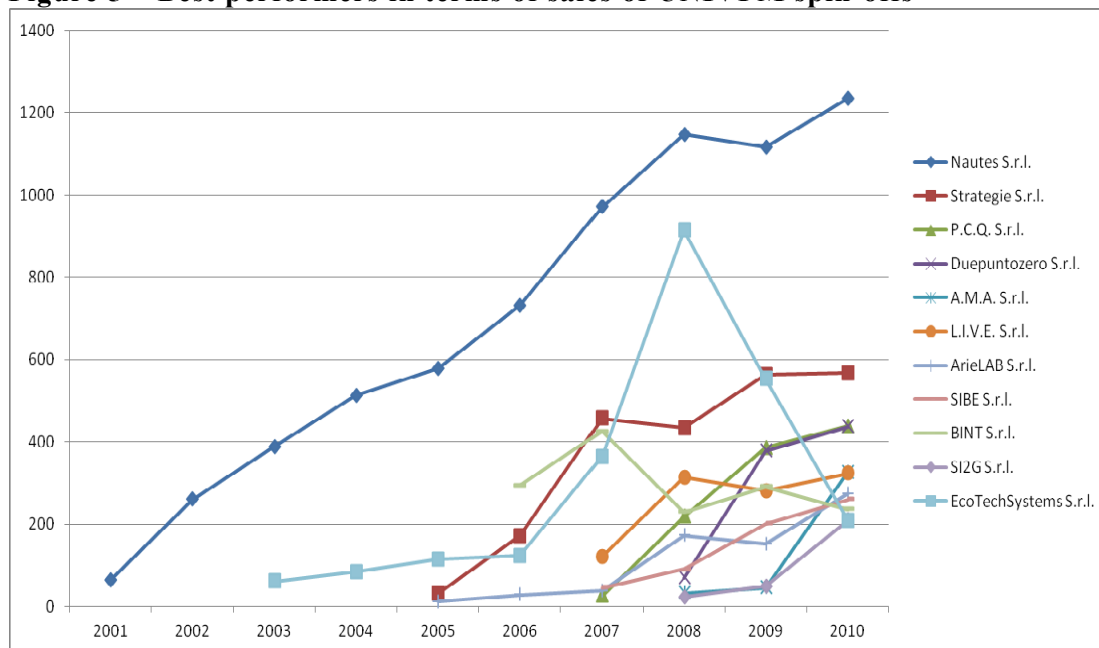
Spin-off	Year of set-up	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1 Nautes S.r.l.	2001	65.4	260.7	389.0	513.4	578.3	731.5	971.3	1146.8	1116.6	1234.1
2 Strategie S.r.l.	2005					32.4	171.4	457.4	434.1	563.3	567.8
3 P.C.Q. S.r.l.	2007							26.5	219	386.4	438.4
4 Duepuntozero S.r.l.	2008								70	378.3	437.5
5 A.M.A. S.r.l.	2008								33	46.3	326.5
6 L.I.V.E. S.r.l.	2007							121.2	313.6	280.6	324.1
7 ArieLAB S.r.l.	2004					12.0	28.5	39.2	172.6	152.5	274.8
8 SIBE S.r.l.	2007							46.2	90.9	201.5	260.3
9 BINT S.r.l.	2006						294.1	426.1	229.8	291	236.6
10 SI2G S.r.l.	2008								23.5	49.3	209.8
11 EcoTechSystems S.r.l.	2003			61.7	84.8	115.1	124.4	363.7	914.2	553.6	208.3
12 IDEA Soc Coop.	2007							18.4	7.2	17.7	165.1
13 Smart Space Solutions S.r.l.	2008								10.0	93.1	127.7
14 Artemis S.r.l.	2003			68.5	19	27.7	27.1	81.1	39.9	85	120.6
15 NOW S.r.l.	2009									31.5	50.0
16 Tecnosuoli S.r.l.	2008								9.5	22.8	21.7
17 H.E.O.S. S.r.l.	2008								n.a.	4.2	17.8
18 Oce. AN. Soc. Coop.	2003			1.8	23.1	30.2	133	56.8	32.5	14.8	16.6
19 CEDAR Solutions S.r.l.	2007							0	5.2	120.7	14.2
20 ASSET S.r.l.	2010										n.a.
21 OPENMOB S.r.l.	2010										n.a.
22 Seismotechnologies S.r.l.	2005					8	6	32	51.6	100.8	n.a.
23 Ingegna S.r.l.	2006							57.6	C		
24 VLRA.BO. S.r.l.	2003			2	0.8	C					
25 Hyperlean S.r.l.	2010										n.a.
26 Alpiquadro S.r.l.	2008								n.a.	C	
27 Thermal TI De S.r.l.	2006						n.a.	n.a.	C		
<b>Total</b>		<b>65.4</b>	<b>260.7</b>	<b>523.0</b>	<b>641.1</b>	<b>803.7</b>	<b>1.516.0</b>	<b>2.697.5</b>	<b>3.803.4</b>	<b>4.510.0</b>	<b>5.051.9</b>

C = cessation

n.a. = data not available

Source: UNIVPM Spin-off database

Overall, about half of the UNIVPM spin-offs for which data are available show a continuous process of growth; with the exception of a few service companies that were affected by the economic crisis of the last years (see Figure 5).

**Figure 5 – Best performers in terms of sales of UNIVPM spin-offs**

Source: UNIVPM Spin-off database

The high concentration of spin-offs in R&D services is one of the main issues debated in relation to the phenomenon of spin-offs. In fact, service activities are rather problematic both for the relationship with the parent institution and for the growth prospects of the spin-off. On the one hand there may be potential conflicts of interest between the activities carried out by the spin-off and the research activities carried out by the parent institution. On the other hand service activities are fundamentally linked to the skills of the people involved and, for that reason, their growth potential is strongly conditioned by the availability of time of these people.

Apart from the growth of sales, another important aspect of spin-off growth is the ability to create jobs. Since the data concerning staff are not always given in the balance sheet notes, the amount of personnel costs was used as a proxy for wage and salary employment. The data shows that the spin-offs are very prudent in hiring full-time employees, even when the amount of sales would be sufficient to justify them: around 30% of our sample has no personnel costs.

We try to make an estimation of how many people are employed in spin-offs by dividing the expenditure for personnel with the average salary for a full time employee (about 30,000 Euros). We obtained a number of about 34 full time employees in 2010. This number is underestimated because some of the people working for spin-offs have collaboration contracts; the cost of these contracts are not included in the item “personnel

costs” but are considered within the item “services”. Several spin-offs maintain a cautious approach in structuring the organization by avoiding to hire full-time employees.

Considering the ownership structure, almost all the research spin-offs have the legal status of limited liability companies, with a few exceptions of corporations and cooperative companies. The use of the legal status of a limited liability company is associated with a small initial endowment of capital, generally close to the minimum required in Italy for setting up a limited company (10,000 Euros). Three years after set-up, the average capital continues to be relatively low. The ownership structure of the spin-off is, in most cases, made up mainly by individual partners. However, in a significant number of cases we also observe the presence of the parent university and other firms. The presence of financial companies and other institutional investors are never observed.

The data show a significant difference between the financial commitment of the university and that of firms. The university is present in 50% of the spin-offs with an average share of about 10%. The university generally enters into the capital of the spin-offs at the time of their set-up with a minority share; the main purpose behind this presence is, in fact, to provide credibility for the spin-off rather than to provide equity capital. In contrast, in the case of industrial companies, entry is motivated by the aim of contributing to exploit the technology developed by the spin-off. This leads to greater selectivity in entry and a greater financial commitment (see Table 3).

**Table 3 – Spin-offs by ownership share of universities, companies and financial institutions at set-up**

Share of legal entity owners	No shares	< 10	10-19	20-49	≥ 50
University	16	13	3		
Industrial Companies	17		4	9	2
Financial Companies	32				

Source: UNIVPM Spin-off database

The team of promoters is made up by 5 partners on average. Of these, 1 or 2 are faculty members while the others are researchers or former students. The role of faculty members is that of promoting the spin-off and providing professional advice during the incubation stage. According to the present rules, faculty members are supposed to recede from managing roles within spin-offs after the incubation period (3 years), but can retain their ownership share. This means that for each spin-off an average of 4 persons try the

entrepreneurial carrier. The complexity of the entrepreneurial team at start-up could be one of the weakness of spin-offs because this often results in the lack of clarity in the definition of entrepreneurial roles (Iacobucci et al., 2011). However, the fact that a large number of young people are involved in an entrepreneurial experience is important in the long run given that these people have a higher propensity to start other companies during their lifetime.

Table 4 shows the available data concerning the quantitative impact of spin-offs in 2010.

**Table 4 – Quantitative impact of UNIVPM spin-offs**

	<b>Direct impact</b>
High-tech employer (full time equivalent)	34
Source of technological entrepreneurship (people involved in ownership and management)	150
Volume of sales	5mln

Source: UNIVPM Spin-off database

Besides the quantitative impact, the framework developed in section 2 suggests that the phenomenon of spin-offs could have positive qualitative impacts in several directions; moreover, these impacts are not easily measured in the short term. Spin-offs can be important drivers of local economic development because they generate hi-tech entrepreneurship: in the case of UNIVPM, spin-offs have been the source of about 120 young technology entrepreneurs (excluding the university staff involved). It is likely that most of them will remain within the same area and start new firms in the same technological fields.

Furthermore, these young technology entrepreneurs represent a connection for other firms to access the know-how and skills within universities, encouraging the expansion of local networks where new technologies and knowledge can be shared. Following the “network paradigm” to analyze a territorial-system (Mosey and Wright, 2007), a primary network is between innovative firms and local sources of scientific knowledge as Universities. This relationship contributes to build up for innovative firms the

technological environment to support their innovative competences. Academic spin-offs represent a significant example of network between research centres and small firms. Last but not least, they are companies in high-tech sectors, so they can contribute to the development of knowledge based activities that could improve the quality of regional innovation system.

Concerning the relationships with the parent university, the collaboration are split in consulting services, joint research projects, fellowships and PhD grants. Table 5 shows the financial relationship between spin-offs and UNIVPM.

**Table 5 – Financial relationship between spin-offs and UNIVPM (thousands of euros)**

	UNIVPM to spin-offs	Spin-offs to UNIVPM
Consulting	137	
Fellowships		192

The total amount of joint research projects is 1,456 thousands of euros (298 of this amount concerns research project with universities different from UNIVPM). The relationships with other institutions are essentially R&D projects, while 20% of them are for market development. 40% of collaborations are with partners within the Marche region, while just only 11% are with foreign partners.

At the beginning of activity, no spin-offs had a product or service available for sales, 3 spin-offs had a prototype and none had a patent. At the moment of interviews, there were 9 prototypes and 14 commercialized products or services. This means that most spin-offs start up at a very early stage of technology development and use the incubation phase to develop a prototype and a business concept. Moreover, a few spin-offs rely on the development of a property right strategy based on patenting; just one of the most successful spin-offs owns 8 patents (see Table 6).

**Table 6 – Patents owned by UNIVPM spin-offs in 2011**

	Spin-offs	Patents
Owning patents	2	9
Bought patents	1	1
Made an application	1	1
No patents	6	



Spin-offs were asked to indicate which were the most important changes that helped fostering their development. **Errore. L'origine riferimento non è stata trovata.** shows the frequency of reply (multiple choices were possible). The most important factors are the collaborations with industrial partners and with the parent university. This confirms the networking role of UNIVPM spin-offs between the industrial companies (mostly located within the Marche region) and the university (see Table 7).

**Table 7 – Factors that helped fostering the development**

<b>Development factors</b>	<b>Frequency</b>
Collaboration with industrial partners	6
Collaboration with university	4
Investments in commercial assets	3
Public funds	3
Enlargement of the products' supply	3
Entry in a new market	2
Entry of owner with previous entrepreneurial or managerial experience	1
Investment in the intellectual property management	

Concerning the entrepreneurial and organizational factors, the analysis confirms the results of previous empirical study (Iacobucci et al., 2011). There is an imbalance in the team sponsors towards technical functions; only in one of the spin-offs interviewed one of the founding partners had previous marketing and sales experience. In two cases, one of spin-off promoters had already set-up another company (see Table 8).

**Table 8 – Spin-offs with experienced promoters by area of expertise**

<b>Previous experience</b>	<b>Frequency</b>
R&D	8
Production	1
Marketing/sales	1
Accounting	3
Entrepreneurial	2

The identification of a lead entrepreneur is a critical factor for the development prospect of spin-offs. According to respondents, 4 spin-offs had identified the entrepreneurial figure since the beginning and 3 of them after the incubation period (3

years). In 3 spin-offs there is still a lack of clarity about the people who are genuinely interested in the entrepreneurial career. As a consequence of the growth process there has been a significant increase part-time and full time employees and in the structuring of functional roles: at the time of interviews 8 people were employed part time and 13 full time.

## **5. Conclusions**

There is a wide consensus about the key role of universities in regional innovation systems where they work together with industry and government to evolve new competitive industrial systems (Etkowitz & Leyesdorff, 2000). Academic spin-offs are one of the main mechanisms of technology transfer from university to industry.

To evaluate the effective role of academic spin-offs, we chose to adopt a local approach due to the differences in local innovation systems. These differences have attracted the attentions of researches as factors influencing spin-offs creation and development. Moreover, we think that the characteristics of the local systems should be considered also when evaluating the impact of academic spin-offs.

In this paper we develop a framework for evaluating the impact of academic spin-offs and apply it to the spin-offs set-up in UNIVPM during the last decade. The Marche region, where UNIVPM is located, is specifically interesting for our purpose as it is a highly industrialized area but specialized in so-called traditional sectors, characterized by the prevalence of small and medium-sized firms, a low level of R&D investment and a lack of systematic relations with research centers.

From the point of view of the university spin-offs are not very promising in terms of potential revenues. However, compared with the other mechanisms of technology transfer, spin-offs can have the major impact at local level in transferring research results in business activities and in promoting the development of high-tech firms and clusters.

The empirical evidence about UNIVPM spin-offs suggests that the quantitative impact on the regional context is not relevant. However, we think that in assessing the impact of spin-offs it is important to focus on qualitative aspects and on long-term, indirect effects. Most of the spin-offs are involved in R&D services. Services activities require little start-up capital and have a more immediate marketability of the skills acquired in academic research. The prevalence of R&D services over manufacturing activities can be seen as a major weakness of academic spin-offs, because it reduces the growth possibility of spin-off and limits the geographical span of their potential market (Iacobucci et al.,

2011). However, in the Marche region context they also show potential benefits. The reduced need of capital at start-up facilitates the involvement of young researchers, thus maximizing the number of people that are involved in an entrepreneurial experience. Whatever the performance of the spin-off, we know that people with a previous entrepreneurial experience have a higher probability to start up new firms during their working career.

Moreover, the geographical limitation of service firms maximize the knowledge spillovers within the local context by providing advanced services to established firms. In this sense, spin-offs contribute to the upgrading of the actual industrial system in the Region rather than creating new technology clusters. In the case of Marche Region this is an important aspect due to the fact that the region is characterized by a strong industrial structure in low and medium tech sectors, thus the need for an upgrading of products and processes. Spin-offs play an important role as intermediaries between university and industry, given the difficulties of small firms to establish direct collaborations with the university. While addressing the local market, spin-offs maintain close relationships with the parent university by participation in joint research projects and providing funds for young researchers and PhD students.

The preliminary results of our analysis could be sum up as following.

1. Importance of focusing on qualitative and indirect impacts rather than quantitative impacts.
2. Importance of considering the local context in terms of industry specialization and policy objectives. In the case of the Marche region spin-offs play an important role as intermediaries between the university and the industrial system rather than aiming at building new high-tech clusters. For this reason the geographical limitation of the spin-offs network can be seen as a positive feature rather than as a weakness.

This study has several limitations that will be addressed in our future research agenda. The first will be to compare the spin-offs impact in different regional contexts to assess to what extent the characteristic of spin-offs, and their potential impact, depends on the policies of the parent institutions (universities) rather than by the features of the regional context.

Another research direction would be a more in depth investigation of the relations between spin-offs and local firms, not only in terms of supply and demand of goods and services but also for the extent of knowledge spillovers. One of the aspects that will be

worthwhile investigating is the careers of the people initially involved in spin-offs as they are likely to remain key agents of innovation in the local context by starting other companies or as employees in established firms.

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