

University Fourth Mission, Spin-offs and Academic Entrepreneurship: Connecting public policies with new missions and management issues of universities

Stefano Boffo* and Augusto Cocorullo**

Abstract. Universities are presently considered vital players in the transfer of knowledge, innovation and technology to the economy. This is one of the roots of the diffuse reform processes evident in most European tertiary sectors. In almost 25 years Italian universities have experienced many changes that deeply reshaped their academic institutions. Among other aspects, the need to make an adequate contribution in answer to the demands of society led to an extension and deepening of universities' so-called Fourth Mission (Geiger, 2006; Kretz & Sá, 2013). A multifaceted set of activities were therefore introduced to strengthen the liaison between academia and society. In the past, this role was mainly concerned with granting patents to outsiders, but today universities are also increasingly dedicated to the creation and promotion of spin-off activities. These are instruments designed to respond to social pressures towards accountability and establish a dialogue with the economy through the sharing of academic research findings. In this framework, the main features of each academic institution are an important variable in the spin-offs' development process. Through the use of 4 case studies (University of Messina; Polytechnic of Turin; Scuola Superiore Sant'Anna of Pisa; University of Trento) and the analysis of 40 qualitative interviews with key actors in each spin-off (directly and indirectly involved in the entrepreneurial projects), the paper investigates university spin-offs in Italy from two different perspectives. First, the growing number of spin-offs as related to the present conditions of young Italian academic researchers (increasingly affected by budget constraints), university policies, and new management issues. Second, the identity and self-perception of academic actors involved in the spin-offs' creative process.

Keywords: Academic entrepreneurship, Fourth Mission, identity and self-perception, university missions, management issues, university spin-offs

* Professor, Department of Social Sciences, University of Naples Federico II, Naples and IRPPS-CNR, Rome, Italy, e-mail: stefano.boffo@unina.it

**Postdoctoral Researcher, Department of Social Sciences, University of Naples Federico II, Naples and IRPPS-CNR, Rome, Italy, e-mail: augusto.cocorullo@unina.it

1. An evolving scenario

Under the influence of increased competition generated by globalization processes and the move from mass to universal access to higher education, over the past few years universities have increasingly become aware of new demands from the economy (use of knowledge products), and society as a whole (extension of education level, real–or apparent–social mobility). This is evident, for example, in the exponential spread of MOOCs (Massive Open Online Courses) recorded in recent years, and an intensified diffusion of lifelong and recurrent training at the university level, and these new aspects of the higher education landscape contribute towards creating the conditions for a move from mass to universal access to higher education (Trow, 1973, 1999, 2006).

The spread of these demands in the academic sphere was the catalyst for universities to open up to society in order to better serve the needs of different social groups of users, and to develop strong ties with each. This type of active role implies a deep transformation of the identity of universities as institutions, at the same time capable of dialogue with society while avoiding being overwhelmed by the contractual power of their interlocutors. This need is also related to the present epistemological nature of knowledge, and to the changing modes of its production. Knowledge is a combination of explicit and tacit aspects where the transfer of results cannot leave aside users nor producers (Polanyi, 1966). At the same time, knowledge production has evolved from a traditional “linear process” (basic research–applied research and innovation–innovation–engineering) to an “iterative and interactive” mode where there is a continuous mix between producers and users (from Mode 1 to Mode 2, as defined by Gibbons et al., 1994; see also Etzkowitz & Leydesdorff, 1997; Nowotny et al., 2001). In some cases, these transformations have found universities to be inadequate or insufficiently prepared. Insufficiencies and shortcomings in physical and pedagogical curricular structures, as well as in organizational and government structures have highlighted the increasing inadequacy of both the quality of training and research products. This, in turn, has made urgent the problem of closer ties with the economic world, seen as a potential source of resources and pre-formulated models of demand that can aid the development of appropriate training profiles and research products.

Despite difficulties and inadequacies, contemporary higher education institutions remain key players in the production, transfer and dissemination of knowledge and maintain a potentially significant role for the social process of knowledge production, despite no longer being monopolistic in this regard. Academic institutions can act as subjects of knowledge creation and dissemination through a variety of mechanisms, including contract work and collaborative research (Gunasekara, 2006). The set of activities produced by academic institutions have been for many decades subjected to economic pressure. Literature often offers an explicit or implicit regulatory position, according to

which the commitment of universities to the productive context and institutional is, in and of itself, a good thing (e.g. Holland, 2001)¹.

This is the framework in which we see an increasing expansion of the set of activities that we call the *Third Mission*, implying that they do not concern either education nor research traditionally developed in the academic sphere. The third mission concerns situations in which academic institutions conduct activities involving actors outside the core social bodies forming a university (teachers, technical-administrative, “traditional” students). What is referred to as the Third Mission in Europe is called the *Third Stream* in the Anglo-Saxon countries, or sometimes, when encapsulating orientation and promotion activities, *Outreach*. All these definitions focus on the application of resources of the academic institution for the benefit of part or all of the community, as well as for the university itself. Therefore, we refer specifically to the generation, transmission, application, and safeguarding of knowledge for the direct benefit of actors and groups outside of core academic bodies. These activities include different forms of knowledge transfer and also encompass the provision of lifelong learning and initiatives of social or civic engagement.

Academic institutions are presently considered fundamental co-actors in the knowledge transfer process, alongside the productive sector and service industry (McQueen & Wallmark, 1982; Chiesa & Piccaluga, 2000; Benneworth & Charies, 2004; D’Este, Mahdi & Neely, 2009), but this role is not limited to granting patents to outsiders, but also encompasses promotion, creation, and support of new enterprises in the economic and social exploitation of scientific research results. Thus, academic institutions have the potential to turn into instruments of growth closely linked with innovation-driven regional development processes. Although not a new phenomenon (it has been already reported by “classical” fellows, e.g. Clark, 1998; Etzkowitz & Leydesdroff, 2000; Clarysse & Moray, 2004), only in the recent years have university spin-offs become a “popular” target of interest among higher education researchers. Moreover, in Europe attention to this growing form of exploitation of scientific research results has only been focused at the regional policy level—spin-offs are a major mechanism in the relationship between universities and business, as well in the creation of jobs and wealth—but also at the level of the re-organization of academic structures, which aim to maximise the impact of the results of university research (European Trend Chart on Innovation, 2002; Degroof & Roberts, 2004; Laredo, 2007; Algieri et al., 2011). The present paper takes into account multiple aspects of these dynamics: organizational effects in the academic structure; strategic variables, like degree of openness of universities towards *Fourth Mission*—the new mission of today’s universities “to be entrepreneurial” (Kretz & Sá, 2013)—practices; and policy directions such as labour market and human capital strategies.

¹ Holland sees the university institution engaged in direct interaction with communities and external subjects through the exchange, exploration, and application of knowledge, counseling, and information with mutually beneficial results.

2. University spin-offs in Italy

University spin-offs are presently central to the ongoing debate regarding the country's ability to value the innovative capabilities of its economic systems. However, in the Italian case, the media and specialized publications seem to offer a partial, uninformed, and sometimes distorted image of the phenomenon. Moreover, they rarely link spin-offs with the transformation of the university system and existing academic institutions. For this reason, it is necessary to undertake an in-depth analysis of this issue which, although already studied in some important reports (Netval, 2016; Anvur, 2013, 2014, 2016, 2017), suffers from a lack of qualitative information on the relationship between university spin-offs and existing academic institutions. These insights allow us to try to build upon the purely statistical dimension of our understanding and to investigate specific subjects, stories and dynamics.

Firstly, we started from a phase of synthesis, filing and codifying the numerous definitions of academic spin-offs that had been previously elaborated and refined in existing studies on this subject. Secondly, the analysis of literature revealed a substantial absence of a unique term used to identify the subject, the consequence of which is shared use of the same terms to describe phenomena which are quite different in nature. Such plurality of definitions “involves not only problems of a theoretical nature, but, above all, a practical one, as it makes very difficult to quantify the phenomenon and to compare it in terms of time and space dimensions, so that there are often significant deficiencies of the support policies that should be set in the programming phase and in the implementation phase” (Grossi & Ruggiero, 2008, p.58). Steffensen, Rogers and Speakman (2000, p.97) provided the definition in this paper, adopted because of its breadth of applicability: “A spin-off is a new company that is formed by individuals who were former employees of a parent organization, and a core technology that is transferred from the parent organization.”

The analysis of the university spin-offs phenomenon in the Italian case requires a preliminary glance at the number of active spin-offs, as reported by the three official sources in this field. In particular, it is possible to argue that the heterogeneity of the definitions founded in the literature is reflected in the equally heterogeneous detection (and subsequent cataloging) of the university spin-offs. Firstly, the *Spin-off Italia* platform lists 1196 active spin-offs² out of a total of 1389 companies included in the database. Alternatively, according to data provided by Netval, which has been reworked in light of the growth of the spin-offs trend in Italy, there seem to be 1254³ active spin-offs. Finally, according to the Anvur (VQR 2011-2014), the total number of university spin-offs founded

² Updated to December 31, 2016; the total number of active spin-offs includes those created by both universities and public research institutions.

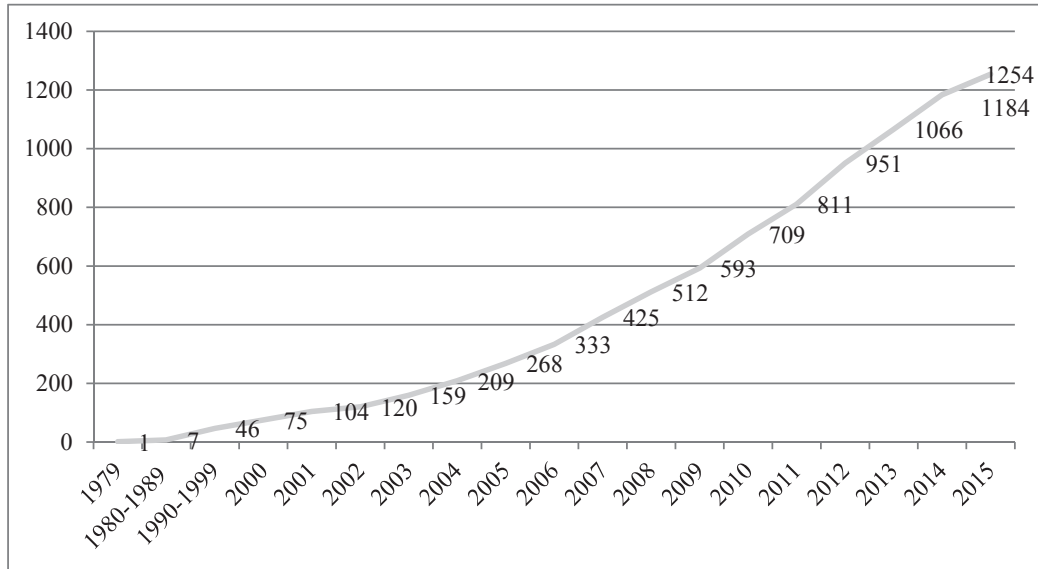
³ Updated to December 31, 2015; the total number of active spin-offs includes those created by both universities and public research institutions.

between 2011 and 2014 was 1115⁴, originating jointly from universities and public research institutions, and considering both active and inactive companies. Compared to the total recorded, there are 891 active spin-offs, 753 of which were born from a university. If we add the number of inactive academic spin-offs (n=24), the final result is of 777 academic spin-offs established as of December 31st 2014. Although the data are collected according to different time bands, the numerical divergence existing between the three sources is evident, unless attributable to a “miraculous” boom of spin-offs in 2015.

Now, another important factor must be considered, that is the number of universities and/or public research organizations, respectively, according to the sources being surveyed. In particular, while the *Spin-off Italia* database contains the spin-offs from 88 different structures including both universities and public research organizations, Netval data is derived from the sum of the responses of universities and public entities within their network, for a total of 61 members, of which only 53 are universities. Finally, the VQR surveys of the Anvur refer to the 95 Italian universities, of which only 60 have at least one active spin-off⁵. In Italy, the creation process of university spin-offs started at the beginning of the 2000s, and nearly 1200 enterprises have been founded since (Netval, 2016). In particular, a gradual increase in university spin-offs lasted until 2007, with the creation of about 100 new entrepreneurial ventures each year (Figure 1).

⁴ Updated to 31 December 2014.

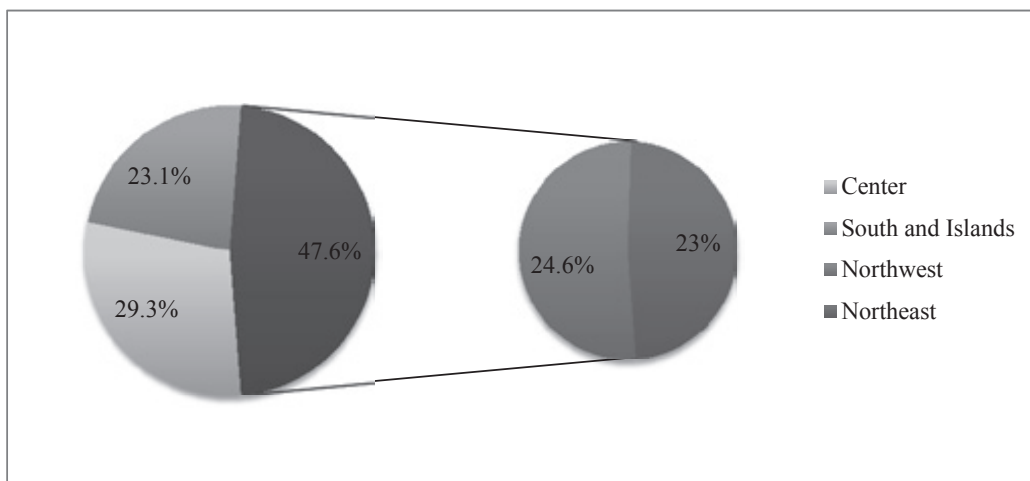
⁵ It is necessary here to specify that the criterion that has been used to select each source (Spin-off Italia, Netval, Anvur) prioritised the regular update of each source, as well as the effective availability of the different kinds of data. If, in fact, the tables containing descriptive information on all the university spin-offs had been constructed from data contained in the *Spin-off Italia* database, which is also the only one to provide a description of the main activities carried out by each spin-off, ... The analysis of the spin-offs phenomenon at a national level derives from Netval data, which, compared to the other official sources, are characterized by the highest updating degree. The reflection on the economic impact and the revenues of the university spin-offs, on the other hand, was developed on the basis of the Anvur data contained in the last VQR 2011-2014 which, although build on data to the end of 2014, only became available in February 2017.



Source: Netval (2016), authors' elaboration

Figure 1. Cumulative frequency graph of the creation of university spin-offs

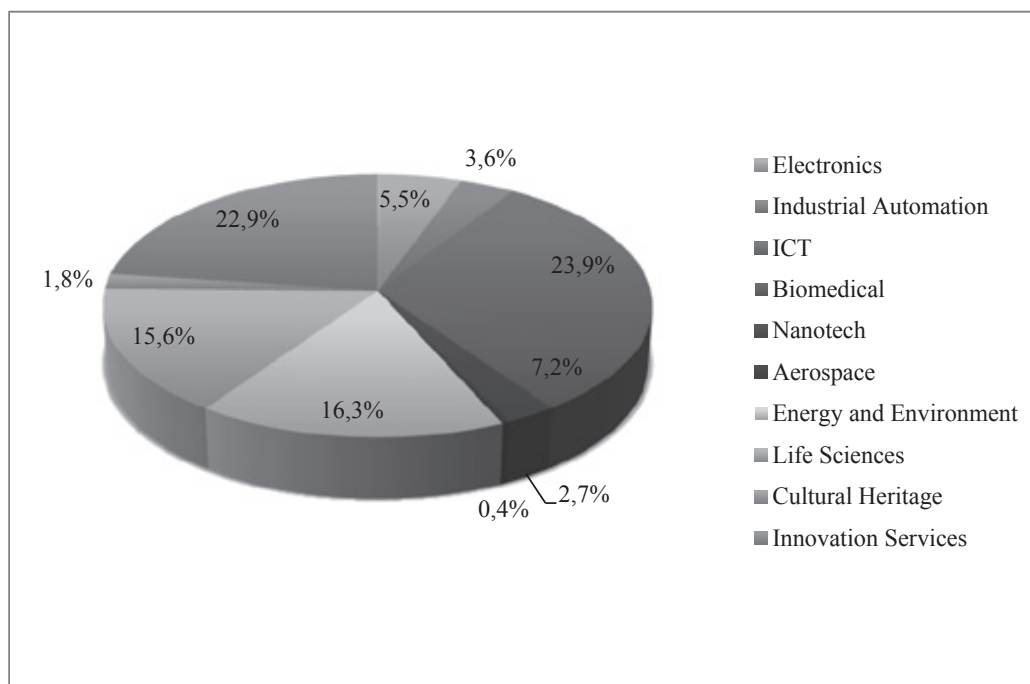
As mentioned, in Italy there were 1254 active university spin-offs at the end of 2015 (Netval, 2016). From the end of '90 until 2015, there has been a steady increase in the number of companies. An interesting point is the geographical distribution. It is evident that the regions initially most active in the creation of spin-offs have maintained a high level of activity throughout the whole period. The phenomenon is concentrated in the northern regions (Figure 2), where 47.6% of the total spin-offs are located, and in the Center (29.3%), while the remaining 23.1% is distributed between the South and the Islands. The latter, due to their traditional economic difficulties and the heavy consequences of the financial crisis, are the least active territories.



Source: Netval (2016); authors' elaboration

Figure 2. University spin-offs' geographic distribution (macro-areas)

Another interesting aspect is related to the disciplinary context from which spin-offs derive. Specifically, the sector that seems to encompass the largest number of companies (23.9%) is ICT (Information and Communications Technology), immediately followed by Innovation Services (22.9%) sectors. A significantly lower proportion emerges from the Energy and Environment sector (16.3%), Life Sciences (15.6%), Biomedical (7.2%), Electronics (5.5%), and Industrial Automation (3.6%). Nanotechnology (2.7%), Cultural Heritage (1.8%), and Aerospace (0.4%) are the source of even fewer spin-offs (Figure 3).

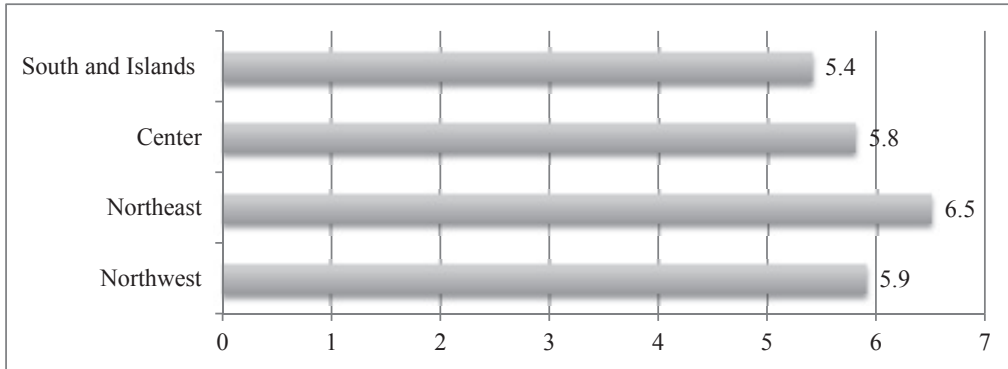


Source: Netval (2016); authors' elaboration

Figure 3. University spin-offs' business sectors

The empirical evidence confirms a theoretical strand widely discussed in the literature: Italian university spin-offs are more service-oriented than product-oriented (Chiesa & Piccaluga, 2000; Conti et al., 2011; Lazzeri & Piccaluga, 2012), and are based mainly on forms of tacit knowledge (Polanyi, 1966; McQueen & Wallmark, 1982; Rappert et al., 1999; Pirnay et al., 2003). It is possible that this peculiar feature, while promoting the spin-offs' survival capability, can, at the same time, significantly flatten their evolutionary potential on the market in terms of growth. Now, in order to add an additional element to the analysis, it is useful to refer to geographical variation in the average life-expectancy of spin-offs (Figure 4). The differences are relatively limited: the highest

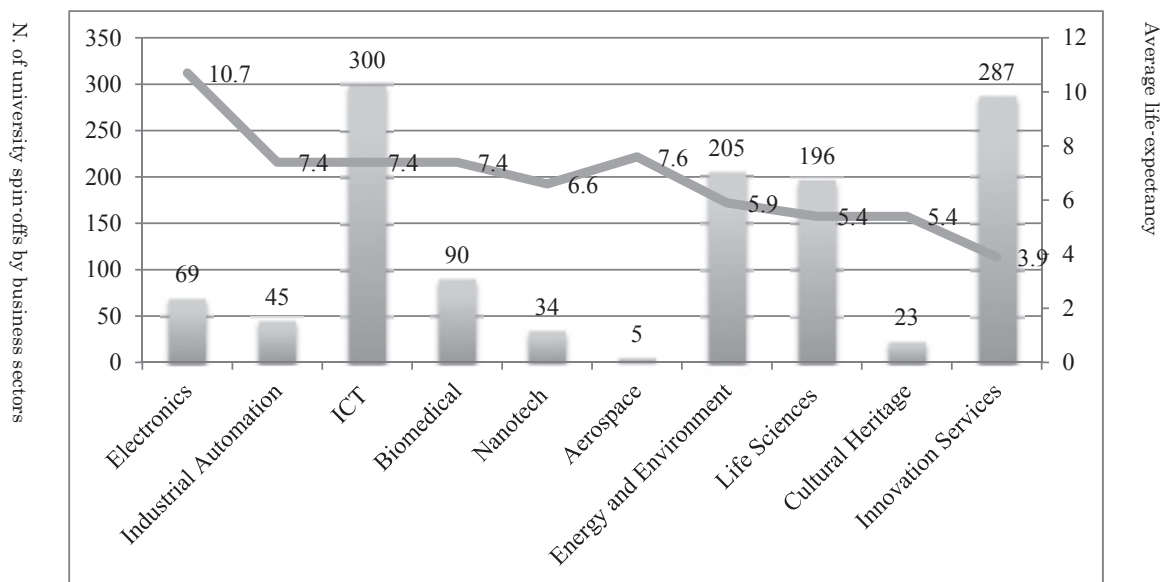
life-expectancy is in the Northeast, while the Center and Northwest are comparable, followed by the South and Islands.



Source: Netval (2016); authors' elaboration.

Figure 4. University spin-offs' average life-expectancy (in years) (macro-areas)

It might be useful to consider the average life-expectancy according to the business sector of the university spin-offs (Figure 5). It is quite clear that the relative homogeneity in life-expectancy across geographic regions is not reflected across business sectors, where the result varies from a maximum average of 10.7 to a minimum of 3.9 years.



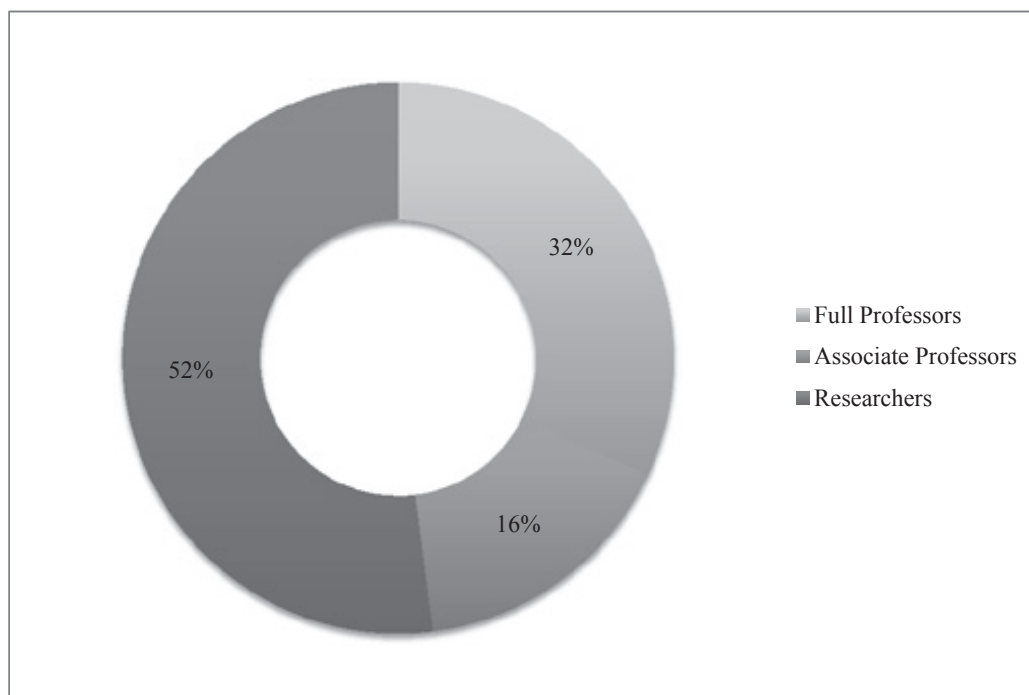
Source: Netval (2016); authors' elaboration

Figure 5. Average life-expectancy (in years) and number of university spin-offs for business sectors

The Electronics sector shows the highest survivability (average age of 10.7 years), followed by Aerospace (7.6 years), Industrial Automation, ICT, Biomedical (7.4 years), Nanotechnologies (6.6 years), and Energy and Environment (5.9 years). Spin-off companies in the fields of the Life Sciences, Cultural Heritage, and Innovation Services are characterized by a lower life-expectancy with an average of 5.4 years in the first two cases and just 3.9 years in the third.

3. University spin-offs’ founders’ group: a first interpretation

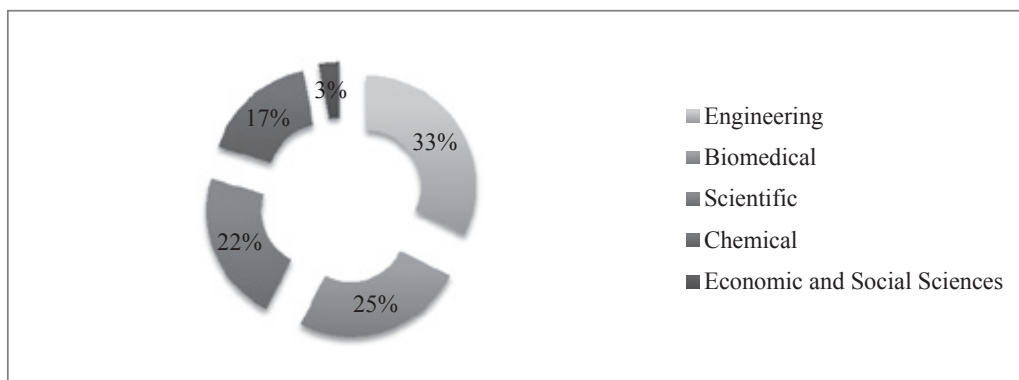
An important aspect that has to be considered is the composition of university spin-offs’ research groups, an aspect which influences future spin-offs’ life on the market. It is indeed important that the group of researchers that contribute to an academic spin-off is well balanced in terms of research and technical-managerial skills. An analysis of the academic rank of founders of university spin-offs to date (Figure 6), shows that 52% of them are research fellows, 32% full professors, and 16% associate professors. The relatively high presence of young researchers is quite evident, but may be even higher if other young researchers were represented in the data, but while this information is reported in some specific cases, it is missing for all Italian universities.



Source: Netval (2014); authors’ elaboration.

Figure 6. University spin-offs’ founders’ composition (by category)

As for their scientific field, most founders are from the field of Engineering (32%), followed by those from Biomedical sciences (25%), the Scientific⁷ (22%), the Chemical sciences (17%), and a residual 3% from the areas of Economic and Social Sciences (Figure 7).



Source: Netval (2014); authors' elaboration.

Figure 7. University spin-offs' founders' composition (by disciplinary sector)

The prevalence of research fellows within spin-offs' founders' groups has interesting implications for a broader analysis of the present condition of Italian universities' research staff. In 2010, a new law for universities⁸, among other effects, radically changed the process for the recruitment of research fellows. The law, abolishing the tenured research fellow position (RTI), multiplied apprenticeship⁹ roles and drastically reduced tenure possibilities. Accordingly, the data¹⁰ for the period from 2008 to 2016 (Figure 8) shows a sharp reduction in tenured research fellows.

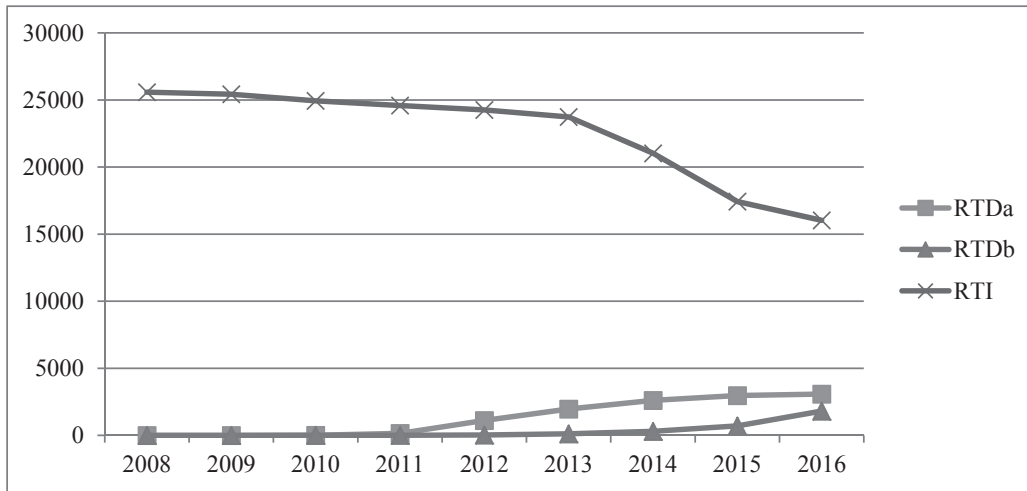
⁷ This sector includes the following disciplines: *Mathematics, Physics, Geology, Agriculture and Information Technology* (Netval, 2014).

⁸ Law 30 December 2010, n. 240 – “Rules on the organization of universities, academic staff and recruitment, authorizing the government to enhance the quality and efficiency of the university system”, promoted by the Minister Gelmini, and published in the Official Gazette no. 10 of 14 January 2011 – Suppl. Ordinary n. 11; full text available at the following address:

<<http://www.camera.it/parlam/leggi/102401.htm>>.

⁹ These figures are: the Research Grant, which can be recruited for a maximum of 4 years (subsequently increased to 6); the “Type A” fixed-term researcher (RTDa) (3 years and renewable for 2); the “Type B” time-limited researcher (RTDb) (3 years non-renewable).

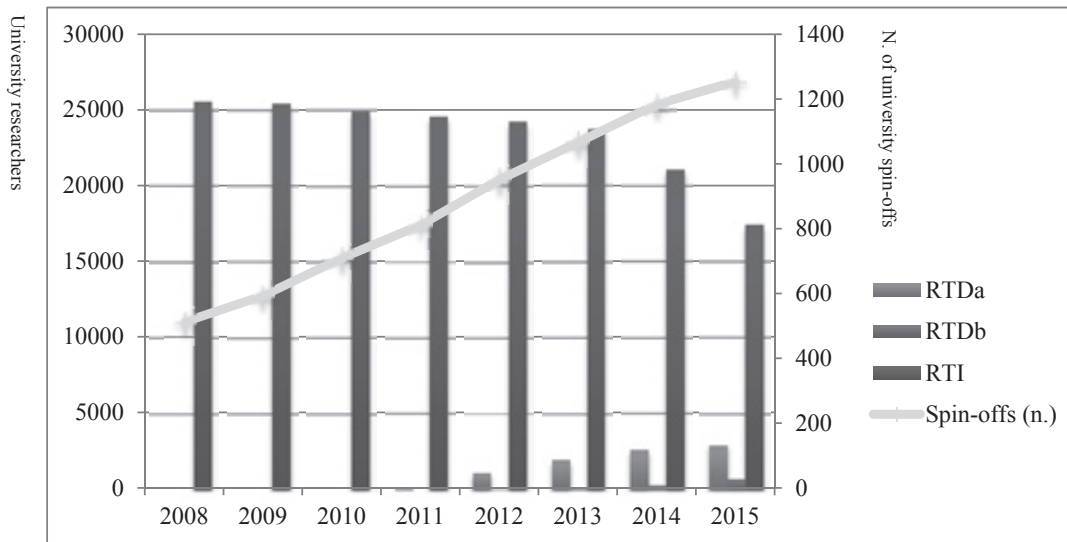
¹⁰ Data updated as of December 31st of each year.



Source: Cineca; authors' elaboration.

Figure 8. Trends in university researchers' employment status

Specifically, the number of the “Type A” fixed-term researchers has grown since 2011, reaching 3074 in 2015, and the number of “Type B” researchers grew from 24 in 2012 to 1809 in 2016. These values do not offset the sharp decline in the number of the tenured research fellows, from 25587 in 2008 to 16026 units in 2016¹¹. It is interesting to emphasize the gradual deterioration of employment prospects for young academics, an aspect which might be related to the increase in university spin-offs (Figure 9).



Source: Cineca; Netval (2016); authors' elaboration.

Figure 9. Trends in university researchers' employment status and new spin-offs (per year)

¹¹ In this scheme, there are no search grants, not only because of the complexities in quantifying their actual number, but also because there is no specific search key between the parameters of the Cineca portal.

Despite the main goal of university spin-offs being the enhancement and application of the results of academic research, it seems reasonable to assume that, over time, the spin-offs phenomenon has taken on an additional element (Simmons, 2017). The increasingly difficulties in finding a permanent position within universities encourages researcher fellows to negotiate possible alternatives to a traditional academic career, both in terms of the accumulation of economic resources and finding a physical environment where they can conduct their research activities.

From this perspective, the university spin-offs act as an “anchor” for those figures that could otherwise be excluded from the research world due to restrictions on academic recruitment. This reflects the earlier description of the composition of research groups, which indicated that there is a large proportion of early career researchers compared to professors. However, it could be wrong to suppose that in these researchers we are necessarily witnessing a collision between what Parente and Feola (2003) define “entrepreneurial commitment” with the traditional “academic commitment.” On the other hand, it would also be interesting to evaluate whether the professional trajectory of young researcher-entrepreneurs can also evolve towards a formal academic position. In other words, could an entrepreneurial inclination encouraged by opportunity (what Acs and Varga 2005 and Acs 2006 call *opportunity entrepreneurship*), connect with entrepreneurship dictated by necessity (*necessity entrepreneurship*), in an osmotic relationship of mutual compensation and interrelationship, due to their shared dual purposes and final destination? An investigation of this aspect would require an extended period of research that the present study does not allow, but is a fruitful course for future development.

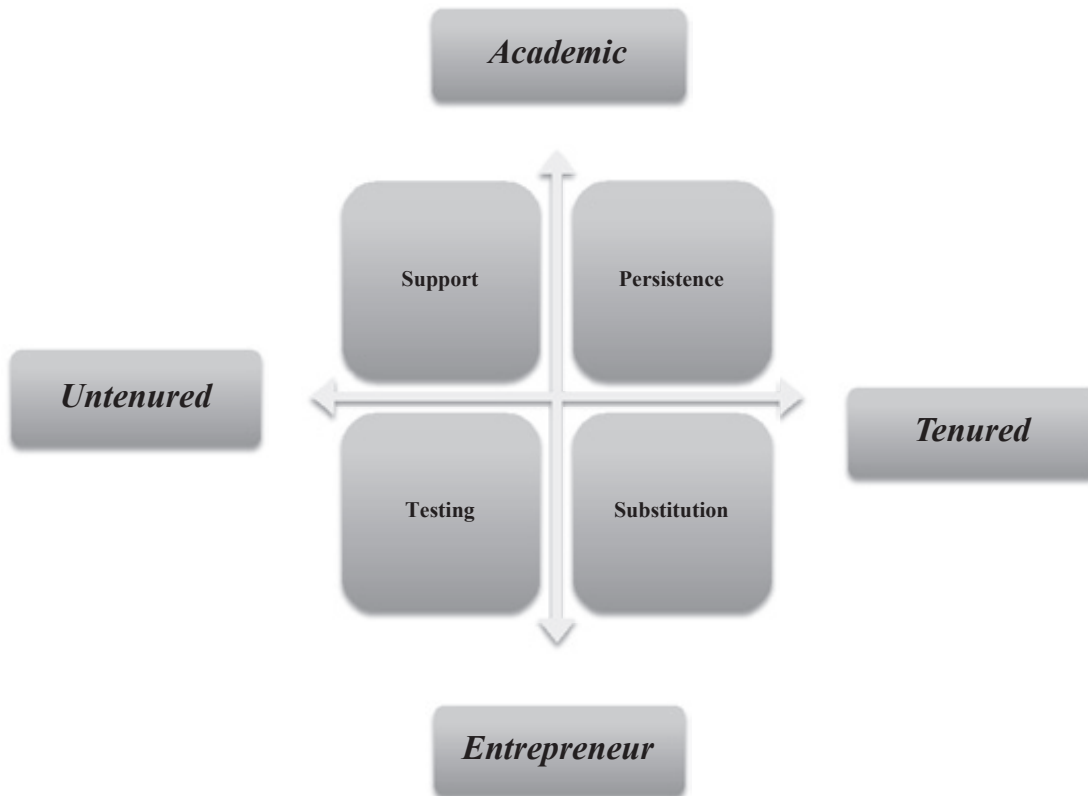
4. University spin-offs’ founders’ group: a second interpretation

In this section we consider a second aspect of the diffusion of university spin-offs, focusing on the consequences for academic identity and academics’ self-perception, through the use of 4 case studies (University of Messina; Polytechnic of Turin; Scuola Superiore Sant’Anna of Pisa; University of Trento) and the analysis of 40 qualitative interviews with key actors in related spin-offs (directly and indirectly involved in the entrepreneurial projects). The “entrepreneurial environment” introduced by university spin-offs exposes academic identities to a heretofore unexperienced strain. If university spin-offs are a valuable tool for enhancing research results, the new configuration of higher education that results seems to push Italian universities towards a deep identity change, associated with the dilation of its missions, boundaries, and disciplinary fields with the broader spheres of society, such as the business or the financial sectors.

It seems, however, that in literature as in practice, due attention has not been paid to the implications that this identity mutation may have had among the subjects involved in the process,

especially among academics (Pekkola et al., 2017). It has been shown that, in most cases, a university spin-off must include an academic founder, whether she/he is tenured or not. Therefore, the academic who decides to take the road to entrepreneurship has to experience a dual role which encompasses the “traditional” role of the professor/researcher and the “innovative” role of the entrepreneur. This dual role can disrupt the identity and self-perception of the academic-entrepreneur, and particularly affect the side of traditional academic identity, generating dissonance in the perception of the real (or prevailing) identity of individuals. This condition is made more difficult by the fact that academics’ evaluation processes encompass a double disincentive to entrepreneurship: not only due to the time that the realization of “measurable” outputs (spin-offs, in this case) requires, but also because the spin-offs do not constitute added value for the individual academic who participates in the spin-offs’ creation process, but only for the university in which the spin-off is founded. So, we present a classification proposal of the possible configurations assumed by the two roles (academic-entrepreneur), that are distant in terms of purposes, functions and interests. For this purpose, such a classification may be a useful analytic tool to not only guide the analysis of the problem of academics’ identity and self-perception, but also to create a useful graphical representation of what we might call the “matrix of trends.”

The “matrix of trends” presents all the possible configurations of a particular feature related to a subject or an event, in identifying its crossing with an additional property, that is also divided between two extremes. The analysis considers the *position* and the *role*: the *position tendency* describes academics’ (tenured or not) status in their universities; the *role tendency* refers to academics’ self-perception of their own professional mission. By considering the intersection of these two dimensions, it is possible to create a classification of the “identity profiles” that the founders of a university spin-off may assume. Specifically, on the horizontal axis there is the set of the positions that individuals can inhabit within a higher education institution, from the highly structured (including tenured researchers, associate professors or full professors), to the group of individuals not formally framed in the staff of a department (such as the Ph.D. fellows). Intermediate positions on this axis relate to the granters and “Type A” and “Type B” research fellows. Students have been excluded from the analysis because of the relative quantitative irrelevance of student entrepreneurship in Italy. On the vertical axis is the set of roles that the subjects feel represent their position (if tenured) or that they think may represent (if not tenured), that specific phase of their career. Therefore, at the top there is the individual who perceives himself to be an academic (in reality or in aspiration), while, in a narrow sense, at the bottom there is the individual who perceives himself to be an entrepreneur in all respects (here, too, in reality or aspiration). The intermediate positions refer to those who have not yet developed a well-defined identity profile or whose profile “wavers” between the two possibilities having departed on the road to entrepreneurship.



Source: authors' articulation

Figure 10. The matrix of trends

At the intersection of these axes are four different configurations – here defined as *models* – each of which describing the identity of a spin-offs' founder according to the relationship between the two previously analyzed variables. The *persistence model* refers to the academic who, although engaged in a business project based on his research results, remains strongly anchored to the traditional academic profession and its missions. Despite experiencing the coexistence of the two vocations, there is a clear predominance of the academic profile over the entrepreneurial. The *substitution model* represents the opposite choice, describing the academic who, although formally still member of a higher education institution, decides to change his professional direction by prioritizing the entrepreneurial road. Proceeding clockwise through the matrix quadrants, the *testing model* represents the particular condition of an untenured researcher who sees a university spin-off as a possible test, helping to confirm (or deny) their entrepreneurial personal attitude. Finally, the *support model* describes the position of the “aspiring” academic who uses experience in a university spin-off as a tool to extend (and possibly to consolidate) his presence in a higher education institution, not only in order to continue with research, but also aspiring to become tenured as academic.

This seems to be the most popular model among the untenured individuals in Italy, struggling with the aforementioned difficulties in developing an academic career (Parente & Feola, 2013; Simmons, 2017). To confirm the matrix's ability in effectively representing the Italian situation requires an additional field survey and in-depth interviews. However, field surveys conducted to date revealed one influential aspect regarding the identity of the subjects involved in the spin-off creation process in Italy. In the initial phase the figure of the "*professor entrepreneur*" has prevailed, who, after having started a spin-off, continued to deal primarily of the traditional academic profession. The present stage of this phenomenon is characterized by the figure of the "*accompanying professor*," not directly involved in the spin-off process, but still involved as a mentor to the founding group members, and still inclined to consider his entrepreneurial side as an essential component of his professional identity.

Conclusions

The quantitative analysis of university spin-offs allowed the construction of the configuration assumed by the phenomenon in the Italian case. The image that emerged from this inquiry is of a reality rather fragmented and heterogenous, partially due to the concentration of the phenomenon in the central and northern areas of Italy. More generally, the presence of spin-offs is higher in those areas with a higher degree of industrialization degree, and closer to incubators and/or business accelerators, concentrated in the Center-North of Italy. It is also interesting to underline how the inconsistency or lack of national and local policies on scientific research support and promotion, has resulted in a quite heterogenous distribution of spin-offs at national level.

Another aspect which emerged is a likely correlation between the numerical decline of tenured academic positions within universities and the growth of the phenomenon of university spin-offs in Italy. It is possible to put forward the hypothesis that, in this framework, spin-offs might play a role of *academy substitution* for those who are unable to find a tenured academic position as a consequence of employment restrictions for universities introduced in legislation at the beginning of the present decade. A final consideration foregrounds the identity of the subjects involved in the creation of university spin-offs. We propose a possible interpretation of this phenomenon through the so-called "matrix of trends," which considers individuals' inclination to the academic or entrepreneurial profession. The insufficient diffusion among the various subjects involved of the essential soft skills for starting a business project such as a university spin-off represents a further critical element (Shane, 2000; Chell & Oakey, 2004). There is also a cultural factor linked to the inability of some researchers to develop a long-term vision of such a business project, an aspect which once again appears to be related to the different mindset of academics compared to entrepreneurs.

This usually leads the researcher to perceive entrepreneurial action as too risky and uncertain, and failing to grasp the prospect of a high degree profitability in the event of a positive affirmation of the

project on the market. This is exacerbated by the lack of availability of venture capital and the real difficulty in identifying financial partners willing to join the project (Gupte, 2007; Hayter, 2015; Guerrero et al., 2016). It's a pity that there are still all these difficulties in founding university spin-offs. In fact, given the configuration of Italian industry, featuring the prevalence of small and medium-sized enterprises operating in sectors not always with a high technological impact, university spin-offs would potentially be among the most suitable subjects to start a revitalization and innovation process in a sector traditionally reluctant to invest in development and innovation and to interact with the research world.

References

- Acs, Z.J., & Varga, A. (2005). Entrepreneurship, Agglomeration and Technological Change. *Small Business Economics*, 24(3), 323-334.
- Acs, Z.J. (2006). How is Entrepreneurship Good for Economic Growth? *innovations – Technology, Governance & Globalization*, 1(1), 97-107.
- Algieri, B., Aquino, A., & Succurro, M. (2011). Technology transfer offices and academic spin-off creation: the case of Italy. *Journal of Technology Transfer*, 38(4), 382-400.
- Anvur (2013). *Valutazione della Qualità della Ricerca 2004-2010*, Roma.
- Anvur (2014). *Rapporto sullo stato del sistema universitario e della ricerca. 2013*, Roma.
- Anvur (2016). *Rapporto biennale sullo stato del sistema universitario e della ricerca. 2016*, Roma.
- Anvur (2017). *Valutazione della Qualità della Ricerca 2011-2014*, Roma.
- Benneworth, P., & Charles, D. (2004). University spin-off companies and territorial knowledge pool: building regional innovation competencies. paper presented at the DRUID Summer Conference 2004, *Industrial Dynamics, Innovation and Development*, Elsinore, Denmark, 14-16 June.
- Chell, E., & Oakey, R. (2004). Knowledge creation, its transfer, and the role of science enterprise education: A research agenda. *Innovation. Organization & Management*, 6(3), 444-457.
- Chiesa, V., & Piccaluga, A. (2000). Exploitation and diffusion of public research: the case of academic spin-off companies in Italy. *R&D Management*, 30(4), 329-339.
- Clark, B.R. (1998). *Creating Entrepreneurial Universities: Organizational Pathways of Transformation*. Oxford: Iau Press/Pergamon/Elsevier Science Ltd.
- Clarysse, B., & Moray, N. (2004). A process study of entrepreneurial team formation: the case of a research-based spin-off. *Journal of Business Venturing*, 19(1), 55- 79.
- Conti, G., Granieri, M., & Piccaluga, A. (2011). *La gestione del trasferimento tecnologico. Strategie, modelli e strumenti*. Milano: Springer-Verlag Italia.
- D'este, P., Mahdi, S., & Neely, A. (2009). Academic Entrepreneurship: What are The Factors Shaping The Capacity of Academic Researchers to Identify and Exploit Entrepreneurial Opportunities?

- paper presented at the DRUID Summer Conference 2009, CBS – Copenhagen Business School, Frederiksberg, Denmark, 17-19 June.
- Degroof, J.J., & Roberts, E.B. (2004). Overcoming Weak Entrepreneurial Infrastructures for Academic Spin-Off Ventures. *The Journal of Technology Transfer*, 29(3), 327-352.
- Etzkowitz, H., & Leydesdorff, L. (Eds.) (1997). *University and the Global Knowledge Economy*. London: Pinter.
- Etzkowitz, H., & Leydesdorff, L. (2000). The Dynamics of Innovation: From National Systems and Mode 2 to the Triple Helix of University – Industry – Government Relations. *Research Policy*, 29, 109-123.
- European Trend Chart On Innovation (2002). The changing role of public support to academic spin-offs. *Policy Benchmarking Workshop*, 19-20 February, European Commission, Enterprise Directorate-General Innovation/SME Programme.
- Geiger, R.L. (2006). The Quest For ‘Economic Relevance’ by US Research Universities. *Higher Education Policy*, 19(4), 411-431.
- Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The new production of knowledge. The dynamics of science and research in contemporary societies*. London: Sage Publications.
- Grossi, G., & Ruggiero, P. (2008). *Lo spin-off accademico. Attori ed ambiente nella fase di gestazione aziendale*. Padova: Cedam.
- Guerrero, M., Urbano, D., Fayolle, A., Klofsten, M., & Milan, S. (2016). Entrepreneurial universities: emerging models in the new social and economic landscape. *Small Business Economics*, 47(3), 551-563.
- Gunasekara C. (2006). Leading the horses to the water: The dilemmas of academics and university managers in regional engagement. *Journal of Sociology*, 42(2), 145-163.
- Gupte, M.A. (2007). *Success of University Spin-Offs. Network Activities and Moderating Effects of Internal Communication and Adhocracy*. Wiesbaden, Germania: Deutscher Universitäts-Verlag.
- Hayter, C.S. (2015). Social Networks and the Success of University Spin-offs: Toward an Agenda for Regional Growth. *Economic Development Quarterly*, 29(1), 3-13.
- Holland, B.A. (2001). Toward a Definition and Characterization of the Engaged University. *Metropolitan Universities*, 2(3), 20-29.
- Kretz, A., & Sá, C. (2013). Third Stream, Fourth Mission: Perspectives on University Engagement with Economic Relevance. *Higher Education Policy*, 26(4), 497-506.
- Laredo, P. (2007). Revisiting the third mission of universities: Toward a renewed categorization of university activities? *Higher Education Policy*, 20(4), 441-456.
- Lazzeri, F., & Piccaluga, A. (2012). Le imprese spin-off della ricerca pubblica: convinzioni, realtà e prospettive future. *Economia e Società Regionale*, 1, 43-65.
- McQueen, D.H., & Wallmark, J.T. (1982). Spin-off Companies from Chalmers University of

- Technology. *Technovation*, 1(4), 305-315.
- Netval (2014). *Unire i puntini per completare il disegno dell'innovazione – XI Rapporto Netval sulla Valorizzazione della Ricerca nelle Università e negli Enti Pubblici di Ricerca in Italia*, Milano: Maria Pacini Fazzi Editore.
- Netval (2016). *Ricerca, valorizzazione dei risultati ed impatto – XIII Rapporto Netval sulla Valorizzazione della Ricerca nelle Università e negli Enti Pubblici di Ricerca in Italia*, Pavia: Edizioni ETS.
- Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking Science*. Cambridge: Polity.
- Parente, R., & Feola, R. (2013). Entrepreneurial intent and entrepreneurial commitment of young researchers. *International Journal of Technology Management & Sustainable Development*, 12(2), 155-166.
- Pekkola, E., Siekkinen, T., Kivistö, J., & Lyytinen, A. (2017). Management and academic profession: comparing the Finnish professors with and without management positions. *Studies in Higher Education*, 1-15.
- Pirnay, F., Surlemont, B., & Nlemvo, F. (2003). Towards a typology of university spin-offs. *Small Business Economics*, 21(4), 355-369.
- Polanyi, M. (1966). *The Tacit Dimension*. London: Routledge & Kegan Paul.
- Rappert, B., Webster, A., & Charles, D. (1999). Making Sense of Diversity and Reluctance: Academic-Industrial Relations and Intellectual Property. *Research Policy*, 28(9), 873-890.
- Shane, S. (2000). Prior Knowledge and the Discovery of Entrepreneurial Opportunities. *Organization Science*, 11(4), 448-469.
- Simmons, T.J. (2017). Perspective: Can The Entrepreneurial University Solve The Postdoc Problem? *Postdoc Journal*, 5(3), 40-46.
- Steffensen, M., Rogers, E.M., & Speakman, K. (2000). Spin-offs from research centers at a research university. *Journal of Business Venturing*, 15, 93-111.
- Trow, M. (1973). *Problems in the Transition from Elite to Mass Higher Education*. Berkeley: Carnegie Commission on Higher Education.
- Trow, M. (1999). From Mass Higher Education to Universal Access: The American Advantage. *Minerva*, 37, 303-328.
- Trow, M. (2006). Reflections on the Transition from Elite to Mass to Universal Access: Forms and Phases of Higher Education in Modern Societies since WWII. In J.J. Forest, & P.G. Altbach (Eds.), *International Handbook of Higher Education* (pp. 243-280). Dordrecht: Springer.