
Introduction: Factors influencing the patterns of growth of academic spin-offs

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During the past two decades, there has been a growing interest on the so-called ‘third mission’ of universities, that is the direct contribution of universities to the social, technological and economic development, alongside their traditional teaching and research roles. Within the third mission framework, the university-industry technology transfer (TT) emerges as one of the prominent goals (Goldstein, 2010). The pursuit of this goal involves different processes, tools and strategies aimed at transferring the research results obtained by universities to the companies and to the market. Various TT strategies have been discussed in the extant literature (Festel, 2013); increasing attention was paid, in recent years, to the creation of a new type of ventures, labelled as academic or university spin-offs, as a means of value generation from universities research.

An academic spin-off (henceforth, ASO) can be defined as “companies founded by an academic inventor aiming to exploit technological knowledge that originated within a University to develop products or services” (Bigliardi et al., 2013). These companies are created to commercially exploit the results of research conducted in academia and contribute to TT following a two-steps process: firstly, they transfer technology from their parent organisation to themselves and, secondly, they transfer the technology to customers. Moreover, they are considered important for economic growth because of their positive impact on the processes of technological change and economic

development (Vincett, 2010). In other words, they are firms that exploit research developed within an academic environment to the benefit of economic, social, and regional development. ASOs are receiving growing interest from both researchers and policy-makers because of their ability to create wealth (e.g., Fini et al., 2011), and consequently considerable financial outlays are directed towards their development and growth (Lockett et al., 2005). Indeed, they have been increasingly acknowledged as possible drivers of regional and national competitiveness in the global landscape (Di Gregorio and Shane, 2003). Their relevance is confirmed by the proliferation of studies on this topic: most of the existing contributions deal with the characteristics of the university systems (e.g., Mustar et al., 2008), their performance (Bigliardi et al., 2013), the effectiveness of TT offices (e.g., Bigliardi et al., 2015), the presence of venture capitalists in the economic system (e.g., Clarysse et al., 2011), or with motivations, personality and intents of the individual founders (Prodan and Drnovesk, 2010; Galati et al., 2016).

Some empirical studies proposed for ASOs a life cycle process similar to that of non-spin-offs companies. These studies differ in terms of number and type of phases. For example:

- 1 origination
- 2 concept testing
- 3 start-up supports were proposed by Degroof and Roberts (2004).

Vohara et al. (2004) propose the four phases:

- 1 research
- 2 opportunity framing
- 3 pre-organisation
- 4 re-orientation and sustainability.

Similarly, Vanaelst et al. (2006) in their research adopt a four-phased cycle:

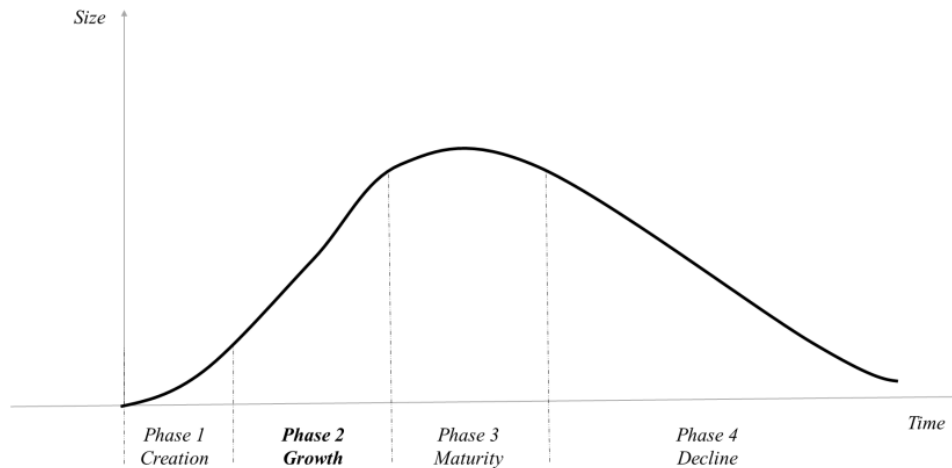
- 1 research commercialisation and opportunity screening
- 2 organisation-in-gestation
- 3 proof of viability of the newly established venture
- 4 maturity:
 - pre spin-off phase
 - spin-off establishment
 - post spin-off phases were proposed by Helm and Mauroner (2007).

Finally, Bigliardi et al. (2013) in their review summarised the possible phases of an ASOs life cycle as follow:

- 1 searching for ideas, making decisions and creating a business plan
- 2 market entry
- 3 establishment.

In general, a simpler model, suitable for all type of companies (spin-offs and non-spin-offs) can be proposed as depicted in Figure 1. Such a framework will be used in the following of the editorial to map the contribution of the papers included in this special issue.

Figure 1 A general life cycle of ASOs



The topic of ASOs has still to be fully explored, both at academic and policy level. In particular, empirical observations show that the majority of ASOs, especially in Europe, are and remain very small-sized enterprises (e.g., Mustar et al., 2008). US evidence also suggests that on average ASOs do not perform as well as their non-academic counterparts (e.g., Ensley and Hmieleski, 2005); therefore, it is important to identify the reasons that limit the performance of this type of high-tech start-up. Moreover, the extant literature is almost all focused on the creation of this kind of new ventures (*phase 1* of Figure 1), while scant attention is paid to their growth (*phase 2* of the same figure).

Based on these premises, the aim of the present special issue is to investigate more in depth the growth phase of an ASO's life cycle, with particular emphasis on (but not limited to) the reasons that limit their growth after its establishment in order to help ASOs evolving through various phases of growth to overcome such difficulties. Specifically, in this special issue, we focus on their growth, due to the fact that they might face difficulties in translating their initial idea to a business opportunity.

The first paper included in the special issue investigates the variables that have an indirect effect on the growth of an ASO. Specifically, Miranda et al. test the influence that certain variables have on the intention of academics in Spanish universities to create a spin-off. Their study is based on the planned behaviour theories, and in particular on the idea that the entrepreneurial intention of academics is an antecedent of their entrepreneurial behaviour that, in turn, may affect the growth of the ASOs. The authors, after reviewing the existing literature, conducted a survey of 1,178 academics from 82 of the higher education institution in Spain (involving 1,030 faculties or schools and 2,998 university departments) in order to understand which variables affect their entrepreneurial intentions. Their results show that the variables influencing this intention are the entrepreneurial personality, the gender, the academic experience and the

entrepreneurial abilities of the individual, as well as the perceived utility of being an entrepreneur, the assessment of the economic environment and the productivity of their research group in terms of patents and articles published. These results lead to argue that certain features of the researcher are a powerful predictor of the initiative for entrepreneurship. As a consequence, actions aiming at the promotion of entrepreneurship should focus on increasing the skills needed and on simplifying the bureaucracy involved in creating an ASOs. This, in turn, affects the future growth of the ASO.

The second and third papers included in the special issue investigate the factors that directly impact on the growth of an ASO. In the second paper, Bessièrè et al. derive the drivers of growth by adopting a resource-based view and a dynamic capabilities approach. Specifically, they aim at investigating the link between resource endowment and the growth of these companies. In order to reach this aim, they measure growth in terms of employment and revenue, and consider available resources and dynamic capabilities as drivers for growth. Their study is based on an empirical survey that involved 118 French ASOs, and shows as main drivers the following ones: fund raised, entrepreneurial orientation, skills, support and technological capabilities as drivers of growth in terms of job, skills acquisition and technological capabilities as drivers of growth in terms of revenue. Similarly, Helm et al., drawing on a database of 177 spin-offs, identify five factors influencing their growth. Their study is based on the metaphorical classification of spin-offs into two extreme forms, Gazelles and Mice, with their own specific characteristics. According to this classification, Gazelles are fast running, and thus fast growing in entrepreneurial terms, and promising, while Mice use to remain small and within the parent organisation for a long time. The different path of growth depends on internal and external characteristics of the firms, and in particular the study identifies two different dimensions of influencing factors: spin-off related and parent-related. As for the former, the number of new patents resulted to be positively linked to the growth of spin-offs, while technological application resulted to have a positive impact on the growth only for younger spin-offs. As far as parent-related factors are concerned, cooperation between spin-off and the parent organisation is an influencing factor of growth.

The fourth paper, authored by Baroncelli and Landoni, presents a comparison analysis of practices of university support and in particular it investigated the impact of these practices on the entrepreneurial dynamics, and thus on AOSs' growth. Specifically, they investigate 81 ASOs established in Boston and consider differences in the attitude and practices of universities towards ASOs, with the final aim to explain variation in characteristics of these particular kind of firms. Their initial assumption is that these differences impact not only on the propensity to create a spin-off, but also and in particular on the shape of spin-offs behaviour. They find that different practices of support induce ASOs to adopt different behaviour, which in turn influence their performance and growth. Results from their analysis show that in top-academic institutions the availability of patents, university equities, and venture capitalists is more likely, while in low-rank universities spin-offs rely on incubators to overcome capital limitations.

Figure 2 A map of the papers included the special issue

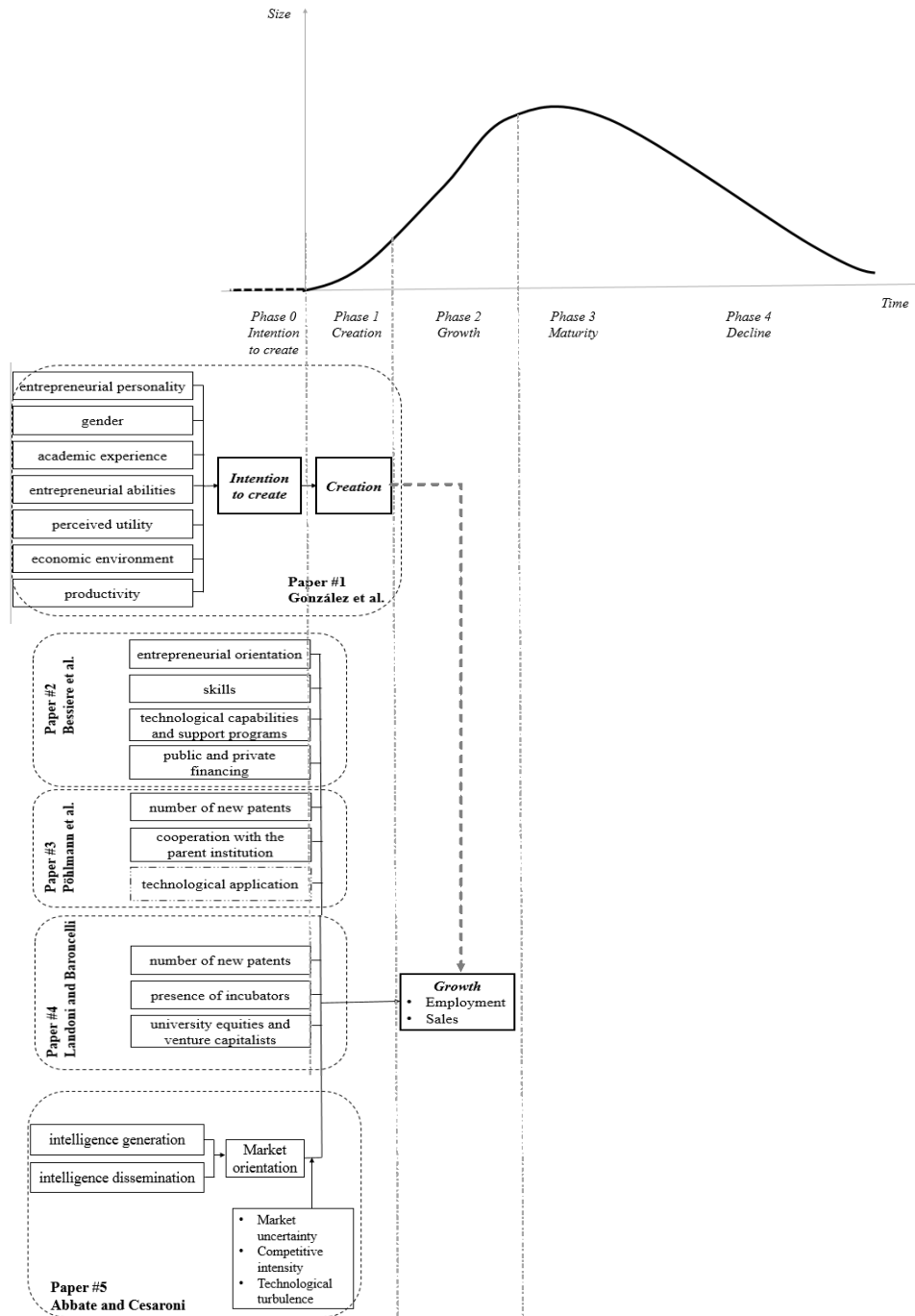


Table 1 Overview of the papers in the special issue

<i>Authors</i>	<i>Objective(s)</i>	<i>Unit of analysis</i>	<i>Methodology</i>	<i>Results</i>	<i>Future research</i>
Miranda et al.	To test the influence of demographic, psychological and environmental variables have on the intention to create an ASOs.	1,178 academics belonging to the 82 higher education institutions in Spain	Correlation, stepwise regression	The variables that influence the intention to create an ASOs are: entrepreneurial personality, gender, academic experience, entrepreneurial abilities, perceived utility, assessment of the economic environment and productivity.	To carry out a longitudinal study to confirm the causal relationships identified, and to analyse the possible barriers that may hinder the entrepreneurial action. To verify the effect of demographic, psychological and environmental variables on the growth of ASOs.
Bessière et al.	To identify the main drivers of ASOs growth.	118 French ASOs	Hierarchical regression	The main drivers that determine the growth of ASOs are: entrepreneurial orientation, acquisition of skills, amount of public and private financing, technological capabilities and support programs.	To identify the best way to acquire the marketing skills required, and to investigate the relationships between the resources and dynamic capabilities of ASOs and their financial performance.
Helm et al.	To understand the characteristics and specifics of growth of ASOs classified as 'Mice' and 'Gazelles'.	177 ASOs	Logistic regression and case selection	The factors influencing the patterns of growth of ASOs are: number of new patents, cooperation, and technological application (only for young ASOs).	To further investigate the impact of technological application on the pattern of growth, to investigate how network contacts can provide access to the necessary resources, and to include a juxtaposition of ASOs and corporate SOs.
Baroncelli and Landoni	To analyse the practices of university support and their impact on the entrepreneurial behaviour of ASOs and thus on their growth.	81 ASOs in Boston	Explorative analysis	In top-academic institutions the availability of patents, university equities, and venture capitalists is more likely, while in low-rank universities spin-offs rely on incubators to overcome capital limitations.	To further investigate which practices sustain the creation of ASOs according to the conditions at the parent organisation
Abbate and Cesaroni	To investigate whether ASOs adopting a market orientation benefit of superior economic and innovation performance.	74 Italian and Spanish ASOs	Quantitative survey data and in-depth interviews	The generation and dissemination of information on customers and competitors directly affect firms' ability to develop technological innovations and to gain profits. The main obstacles that impede a wider implementation of market orientation are: market uncertainty, competitive intensity and technological turbulence.	To better integrate the characteristics of ASOs by considering other measurement scales for market orientation.

Finally, the fifth paper of the special issue deals with a specific issue determinant for the growth of an ASO, namely the market orientation. Abbate and Cesaroni aim at investigating whether ASOs adopting a market orientation benefit of superior economic and innovation performance. They assume that ASOs usually show a low rate of growth due to the excessive attention they pay to technological aspects, with respect to marketing ones. Conversely, they stress that in turbulent and competitive environments where ASOs have to operate, technological superiority alone is no more sufficient to successfully compete. Their empirical analysis, based on both quantitative survey data and in-depth interviews involving Italian and Spanish ASOs, shows two main results: first, that the generation and dissemination of information on customers and competitors directly affect firms' ability to develop technological innovations and to gain profits (that is, to grow). Second, it identifies the main obstacles that impede a wider implementation of market orientation, namely: market uncertainty, competitive intensity and technological turbulence.

To summarise, Figure 2 maps the papers included in this special issue onto the life cycle presented in Figure 1. As shown in Figure 2, a new phase (*Phase 0, intention to create*) has been added to the original life cycle proposed, in order to include the results of the first paper included in the special issue. Table 1 provides an overview of the accepted papers, together with the avenue for future research proposed by the authors of the papers included in the special issue.

This special issue is a first step toward filling the existing research gap on the growth of ASOs, thus we believe that it may provide the scientific community with valuable information and knowledge in this field. Nevertheless, we recognise that much empirical and theoretical work has yet to be done to further develop our understanding of this issue. Consequently, we hope that the framework presented in this editorial and in particular the papers collected in the special issue will stimulate future thoughts and inspire other studies.

The value-added by a special issue is only as good as the contributions of the manuscripts it receives, and the quality of the feedback provided by its reviewers. We are very grateful to all the authors, who supported this special issue through their contributions. We are also indebted to the reviewers, who helped us in managing the papers received in a timely manner and provided useful and professional reports about the papers. Finally, we would like to thank the Editor-in-Chief of *International Journal of Entrepreneurship and Innovation Management* who gave us the opportunity to organise the special issue, as well as the Inderscience submissions team who helped us in its successful completion.

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