Exploring the Role of Education on the Entrepreneurial Motivations of Academic Spin-offs’ Founders

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Abstract – Academic spin-offs are increasingly assuming a relevant role in the social and economic contexts. However, only a few studies have looked at the specific role of human capital in these organisations. The contradictory dimension in human capital is the role of the founder’s education, in which some studies have revealed the relationship between entrepreneurial motivation and education levels. Other studies indicated that these two variables are uncorrelated. Hence, this study seeks to explore and understand the reasons for these contradictory results by conducting case studies using in-depth interviews on six Portuguese academic spin-offs. The findings have allowed us to understand causes and difficulties experienced by Ph.D. students to create new ventures. Furthermore, they also have allowed us to explore the importance of complementary professional and technical training in entrepreneurial motivations.

Keywords: academic spin-offs, human capital, entrepreneurial motivations, qualifications, founders, case study

1. Introduction

Over the last two decades, human capital has been considered as the key factor for competitiveness and sustainable economic growth (Ali et al., 2018; Mankiw et al., 1992). According to Tan (2014), the theory of human capital refers to the aggregation of values that individuals can do for themselves through their education, training, and professional qualification among other types of personal valuation. These attributes are considered as investments from the knowledge and qualifications obtained throughout the life of an individual according to the theory of human capital. In this sense, the process of human capital development takes place when a person begins to acquire knowledge or skills through learning or training.

Araujo and Lima (2012) established a positive correlation between the abundance of skilled workers in a country and the efficiency of activities that incorporate more advanced technologies.
It is expected that companies that have workers with high levels of human capital can incorporate their production process more easily in emerging technologies to withdraw maximum efficiency. This situation is confirmed by Alvarez and Rodriguez (2011) and Colombo and Grilli (2009) who argued that several dimensions of human capital such as the entrepreneurs' level of formal education, training, and social networks are the determining factors in the sustainability and growth of companies in the market. Furthermore, human capital in companies can boost the development of research and development (R&D) activities by driving the creation of new products (Bodman & Le, 2013).

A place of excellence for the formation of highly qualified individuals in the universities. However, they are currently faced with a set of new challenges since the addition to the traditional role of human capital formation and knowledge production. They need to be involved in their territory, foster the emergence of new partnership projects with the business sector, and promote the creation of new spin-offs that can develop and commercialise technologies in the academic context (Rubens et al., 2017). Rasmussen (2011) defined university spin-off as follows: “a new venture initiated in a university setting and based on technology developed at a university”. University spin-offs have a significant number of specificities, namely their independence from the university even if they have strong links with research centres and departments, small dimension, high academic qualifications of their founders, a strong and systematic investment in R&D, and the promotion of innovation in their products or services (Almeida, 2018; Ensley & Hmieleski, 2005; Ganotakis, 2012).

Although academic spin-offs are mostly entrepreneurs with high academic qualifications, the role and relevance assumed by the founder’s education are not unanimous. Various studies revealed the relationship between entrepreneurial motivations and education levels, indicating that high qualification levels of entrepreneurs contributed to the establishment of new academic spin-offs (Colombo & Grilli, 2009; Gimmon & Levie, 2010). However, the findings by Teixeira and Castro (2015) suggested that high levels of education and existence of complementary technical education were statistically non-significant for the establishment of university spin-offs. Besides that, complementary business/administration education affected the creation of new spin-offs negatively. Additionally, a study by Sinell et al. (2015) indicated that typical postdoctoral students considered business sector as a risky activity that implied a significant career change for them. Hence, this study seeks to identify the causes and reasons for this contradictory role of high levels of founder's education on their entrepreneurial motivations. For this purpose, a qualitative study was developed on six case studies to explore and discuss the effects of formal and informal education on entrepreneurial motivations. This study considered six university spin-offs operating in Portugal. The companies belong to three clusters, namely IT sector, biotechnology, and health. Accordingly, three research questions are formulated as follows:

• RQ1 – What is the impact of advanced education levels (e.g., master and doctoral degrees) on entrepreneurial motivations?
• RQ2 – What is the impact of professional and technical advanced courses on entrepreneurial motivations?
• RQ3 – What is the impact of master business administration courses and other advanced courses in the management field on entrepreneurial motivations?
This paper is organised as follows. Initially, it presents a review of the literature on human capital and its role in academic spin-offs. Next, the study methodology presents the adopted methods and the process of conducting case studies. Then, the study results are analysed and discussed. Finally, the conclusions are drawn and some suggestions for future work are provided.

2. LITERATURE REVIEW

The knowledge and skills of individuals are as important as the physical capital of the companies which deserve the same attention and analysis. The theory of human capital states that companies should encourage investment in human capital to achieve higher levels of productivity (Shultz, 1961). Human capital is a set of knowledge and skills that individuals use in their activities to stimulate economic growth and it is considered as a stimulus for innovation in companies (Pasban & Nojedeh, 2016; Samad, 2013). Popescu and Diaconu (2008) mentioned there are three types of human capital: (i) company-specific human capital; (ii) industry-specific human capital; and (iii) individual-specific human capital. Human capital in its three multiple dimensions is perceived as a strategic resource. This vision is confirmed by Mariz-Pérez et al. (2012) that human capital is the key driver for innovation in both large and medium-sized businesses. Consequently, human capital should be strategically managed by companies to have entrepreneurially oriented goals such as being more proactive and risk-taking besides encouraging innovativeness (Boon et al., 2018; Zehir et al., 2016).

Education is a major component of human capital and is linked to a company's capacity for innovation. Teixeira (1999) considered an individual with a high level of education can contribute to the occurrence of innovations and present better conditions to respond to evolutions and technological changes. Colombo and Grilli (2005) stated the importance of university education in specific areas such as management and economics by considering them as a driver of corporate growth. Magoutas et al. (2012) reported an empirical study in Greek companies that high levels of education are more relevant in competitive industries to gain competitive advantage through new and innovative ideas by highly skilled staff.

Education is also a determining factor in the sustainable growth of a new venture. The findings by Davidsson and Honing (2003) and Alvarez and Rodriguez (2011) revealed that spin-offs with high human capital levels have greater capabilities in the discovery of new business opportunities. It is believed that formal education helps founders to have more expertise to create and manage their businesses. Additionally, other dimensions like experience and soft skills are the determining elements to discover business opportunities (Ganotakis, 2012; Middleton & Nowell, 2018).

Despite the importance of formal education in the entrepreneurial process, it cannot be concluded that individuals with higher qualification levels have a high entrepreneurial propensity. Several studies argued that research focused on individuals who have a low propensity to face new business risk and create their ventures (Esfandiar et al., 2019; Kerr et al., 2017; Yan, 2010). Researchers and entrepreneurs have different profiles as researchers are valued based on academic propensity while entrepreneurs are more oriented on market results. Not all individuals have the same propensity to become entrepreneurs. Bulut and Sayin (2010) mentioned that people with the internal focus of control and the desire to become independent have more abilities to become
entrepreneurs in the future. Tacit knowledge such as the ability to help a colleague to start a business is a factor that influences employees’ start-up propensity (Karlsson & Wigren, 2012; Zhu et al., 2019). However, Karlsson and Wigren (2012) found that the academic position of an individual had a negative correlation with the entrepreneurial motivation to create a new venture, which is particularly relevant to individuals with a Ph.D. degree or working on a post-doc project. There were also disparities in the entrepreneurial propensity between full-time and part-time students (Staniewski & Szopinski, 2015). In a study on approximately 500 students attending university in Poland, there was a greater propensity for part-time students to set up their business. Paltasingh (2012) and Staniewski and Szopinski (2015) argued that entrepreneurship knowledge and skills must be offered to all students without considering their academic major.

Informal education is a learning methodology based on the interaction between the individual and concrete situations. According to Lin and Lee (2014), informal education promotes the development of skills and values through an educational process that does not follow the formal standards of education. The competencies include teamwork, leadership, and communication among others. Keith et al. (2016) advocated that informal learning contributes to the success of entrepreneurial activity, particularly for small and medium enterprises (SMEs). The impact of informal education has a distinct impact. The findings obtained by Jiménez et al. (2015) indicated that the impact of informal education is particularly relevant in tertiary education as individuals are more likely to create their own businesses through the development of self-confidence behaviour and lower perceived risk. However, this correlation is not confirmed for all levels of education. Teixeira and Castro (2015) stated that complementary training in management is a negative indicator of the establishment of new academic spin-offs. However, a study by Teixeira and Castro (2015) revealed that business expertise is acquired through informal paths such as the sharing of knowledge about target markets and marketing knowledge that has a positive impact on entrepreneurial intentions.

3. Methodology of Study

This study conducted six case studies of Portuguese academic spin-offs operating in different sectors to explore the contradictory role of the founder's education on entrepreneurial motivations. Crowe et al. (2011) affirmed that case studies allow in-depth and multi-faceted explorations of complex issues in real-life environments. The case study methodology has allowed researchers to discover a phenomenon, address unexplored issues, and explain the cause-effect relationships from a theory (Queirós et al., 2017). Additionally, Gerring (2016) mentioned that case studies are useful in situations where the available theories are contradictory or not adequate.

The protocol is a fundamental phase in a case study as it defines and describes the procedures. Rowley (2002) stated that a protocol should contain an overview of the case study design, field procedures, specific questions, and a guide to the case study report. Yin (2017) suggested the use of a case study protocol that has five phases: (i) case study design; (ii) data collection preparation; (iii) collecting evidence; (iv) analysing evidence; and (v) report writing. The description of the adopted protocol in this study is shown in Table 1.
Table 1. Protocol for case studies

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<th>Tasks</th>
<th>Performed activities</th>
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<tr>
<td>Case study design</td>
<td>Six case studies from different fields were considered. Case study I is a company that provides a software solution for personal trainers. Case study II is a company that offers consulting services on web and mobile platforms. Case studies III and IV are two spin-offs in the biotechnology sector. Case study V develops software solutions in clinical areas. Finally, Case study VI provides support services for patients with chronic diseases. The case studies are organised into three clusters: (i) IT sector; (ii) biotechnology; and (iii) health. The interviews were organised into four phases: (i) analysis of the background of each company, considering the activity sector and the founders’ profile simultaneously; (ii) analysis the impact of advanced education levels on entrepreneurial motivations; (iii) analysis of the impact of professional and technical advanced courses on entrepreneurial motivations; and (iv) analysis of the impact of master business administration courses and other advanced courses in the management field on entrepreneurial motivations.</td>
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<tr>
<td>Data collection preparation</td>
<td>The interviews were conducted whenever possible with all the founders’ members. When it was not possible to get everyone involved, this study interviewed the CEO of the company or one of the founders’ members. Each interview had an estimated duration of 30 minutes. The semi-structured interviews were conducted in which the order of formulated questions varies according to the characteristics of each interviewee and they facilitate the normal flow of the conversation.</td>
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<tr>
<td>Collecting evidence</td>
<td>The key points of the answers to all the questions are pointed out. At the end of each interview, the key points are discussed and validated with each interviewee. The researcher had collected permission to use the interview material.</td>
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<td>Analysing evidence</td>
<td>The interviews were analysed to find common and divergent points of view to analyse the evaluation. Finally, an analysis grid was elaborated based on the reading of the interviews and hypotheses formulated in synthesising the main evidence in the case studies.</td>
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<tr>
<td>Report writing</td>
<td>A final report for each case study was prepared. The report is structured into four parts: (i) description of the problem; (ii) presentation of the procedure; (iii) obtained results; and (iv) conclusions.</td>
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Finally, it is important to consider compliance with the quality conditions which are applied to the case study approach. Yin (2017) proposed the adoption of four conditions: (i) construct validity; (ii) internal validity; (iii) external validity; and (iv) reliability. The procedures adopted in conducting the case studies are described in Table 2.

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<th>Condition</th>
<th>Objective</th>
<th>Procedure</th>
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<td>Construct validity</td>
<td>Establish a correct operationalisation of the concepts being studied.</td>
<td>This study used multiple sources of evidence. The first phase of the interview is done to get an overview of the background and the founders’ profile. The second, third, and fourth phases of interviews may not occur sequentially since none of them have precedence.</td>
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<tr>
<td>Internal validity</td>
<td>Establish a causal relationship between the elements.</td>
<td>An explanatory model was formulated for each case study. Subsequently, this model identified results that were discussed and validated with the interviewees.</td>
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<tr>
<td>External validity</td>
<td>Establish the domain in which the study results can be generalised.</td>
<td>The interviews were conducted after the identification and analysis of the relevant theory on human capital, entrepreneurial motivations, and performance of academic spin-offs. A replication approach using multiple case studies was also adopted.</td>
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<tr>
<td>Reliability</td>
<td>Demonstrate that the study operations can be repeated with the same results.</td>
<td>The protocol was used in data collection and the process of conducting case studies as described in Table 1.</td>
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4. Findings and Discussion

4.1. RQ1 – What is the impact of advanced education levels (e.g., master’s and doctoral degrees) on entrepreneurial motivations?

Master and doctoral qualifications are two different types of qualification levels, particularly after the adoption of the Bologna declaration in 1999 by European universities. From that year onward, integrated master's programmes began to emerge at university institutions. In many situations, a master’s integrated level is assimilated to undergraduate degrees. Previous studies that supported the emergence of this question did not make this distinction, and this study focused on the analysis of doctoral qualifications.

From the 17 founders identified for the six spin-offs, only three of them have a Ph.D. degree. The three founders with Ph.D. were unanimous in considering that the skills acquired for Ph.D.
programmes were more useful for the development of technical and scientific competencies. In terms of management competencies, this level of qualification had no positive effects. One of the founders indicated that during his five years of doctorate, he had a greater distance from the management processes since his studies were very demanding and absorbing. During that time, he felt a great distance from the mechanisms to support start-ups and legal obligations associated with the management process of a company. This situation is reported in the literature as an inhibiting factor to entrepreneurship. The lack of managerial knowledge and difficulties in perceiving the financial rules of each country are two obstacles to the creation of new ventures (Zarefard & Cho, 2017; Mamabolo et al., 2017).

It was also mentioned that there is a lack of propensity for Ph.D. students to set up their own company. The typical path that these students follow is continuing their research activities through postdoctoral projects or getting a full-time position as a teacher. This situation is reported by Kirchherr (2018) who mentioned that most research in the universities are conducted at insular academic circles and advocated that the place of Ph.D. should be on improving the society and not exclusively concerned with obtaining academic notarisation. All the founders with Ph.D. mentioned that they generally consider doctoral students as less likely to take risks and create their venture, which is in line with the results by Kerr et al. (2017) and Yan (2010).

It should be noted that there are common elements between Ph.D. formation and the process of creating and developing a start-up. Yoon and Han (2015) advocate that the process of creating a new business is based on an original idea similar to a researcher who builds the thesis according to a hypothesis. Similarly, Tajonar (2014) mentions that the process of creating a start-up has common milestones from birth to growth and success where various stages are not straightforward. The process of creating a new venture is risky which is something that an individual with a Ph.D. considers as very insecure that leads to the choice of a career path with less risk.

In recent years, there has been an increase in the number of graduates with a Ph.D. degree in Europe (OECD, 2018). This situation has led to a change in the profile of individuals with a Ph.D. which currently has a more heterogeneous profile. Bouw (2018) conducted some interviews with students attending Ph.D. degrees to identify a profile of students that intended to create their own business, develop practical management skills, and socialise with people from different backgrounds. This situation may have positive impacts on capturing more individuals with a Ph.D. degree for entrepreneurial activities.

4.2. RQ2 – What is the impact of professional and technical advanced courses on entrepreneurial motivations?

Only 2 out of the 17 interviewees stated that they never attended professional or technical advanced courses. These courses were attended by the majority of interviewees during their professional and academic period at the university. Four categories of training were found as follows:

- Computer science and programming – courses in the field of programming languages, database, cloud computing, and big data;
- Marketing and multimedia design – digital marketing courses, SEO, and Web design;
• Languages – Business English, French, and Mandarin courses;
• Management – courses in quality management, accounting, and financial management.

It was impossible to identify the priority area of these courses. Their importance depends on the personal motivations of each promoter and strategic objectives of each company. However, it should be noted that the majority of respondents stated that their personal motivations are generally more relevant than the business needs in choosing these courses.

In recent years, these courses have ceased to be largely presentational to become online. The emergence of massive open online courses (MOOC) by top university courses are currently available. The advantage of these courses as mentioned by the interviewees is that they allow access to content in emerging knowledge fields in an asynchronous way for ease of access to lectures and managing their schedule.

The usefulness of these courses is emphasised in two areas: (i) increase of technical skills; and (ii) access to a networking area. The increase in technical skills is especially important in the design and refinement of products that contribute to both incremental innovation of products and services. The training courses also promote the emergence of new ideas, new approaches, and innovative production processes. The expansion of the knowledge network is another aspect emphasised by the interviewees, especially when the training courses are in different areas from the initial training of the promoters. Two of the interviewees pointed out that it was possible to find new collaborators to work on new projects from the courses.

The literature emphasised the role of employee’s training in organisational performance, and it is possible to conclude that training is a fundamental element to increase the level of productivity, improve the rate of innovation, and decrease the rate of employee turnover (Esteban-Lloret et al., 2016; McNamara et al., 2011; Sitzmann & Weinhardt, 2015). However, its impact on business founders was not addressed. Based on the interviews, it was impossible to quantify their direct impact. Most respondents stated that their benefits were mainly indirect and could only be perceived in the medium and long-term analysis. The opinions of the interviewees were unanimous in pointing out that the frequency of training by the founders allowed them to increase their perception about the importance of training among their employees as employees are often asked to attend training sessions that were previously attended by the founders.

4.3. RQ3 – What is the impact of master business administration courses and other advanced courses in the management field on entrepreneurial motivations?

Master Business Administration (MBA) cannot be seen as a traditional master's degree because it has its unique characteristics with a very practical and applied nature unlike most post-graduate studies. Hay and Hodgkinson (2006) advocated that MBA is not exactly an academic course, but it is a decision within a career process. Five out of the 17 interviewees attended MBA qualifications from European universities. Three reasons which are fundamental in their choice are as follows: (i) improve expertise and knowledge in business and financial domains; (ii) expand their business network; and (iii) personal development, particularly by interacting with new people and cultures.
None of them said that this choice was due to their intention to start their own business. Only two of them have the intention to create their own company when pursuing their MBA courses. Although the positive aspects were given by the five interviewees with MBA courses, it can be concluded that the practical advantages in business management could be applied to large companies. Additionally, the process of admission of MBA students is based on the GMAT and privileges of the professional experience by candidates in the management of large companies. This process tends not to consider the entrepreneurial mind-set of candidates. Shepherd et al. (2017) concluded that MBA students with higher GMAT have a greater aversion to work effort and risk. Consequently, there are not many candidates in MBA courses with a greater propensity for the entrepreneurship activity.

Other vulnerabilities associated with MBA courses were explored in the interviews such as the gradual transformation by MBA courses that focus on research. The process of acquiring skills to create leaders to face the globalisation challenge and the lack of content related to ethics and sustainability (Daley, 2012). Only two of the interviewees mentioned that the MBA courses have an excessive theoretical component and not much on practical emphasis. However, another difficulty was not reported in the literature since the practical analysis is based on case studies that focus on past situations critically and constructively. However, hardly the same situation will emerge within the same context. There are gaps in MBA training including truly innovative case studies that can include the complexities of global society, innovative management processes, and emergent technologies.

Interviewees unanimously considered that MBA courses are not appealing to entrepreneurs. The interviewees stated that the content covered in the MBA is only useful when the company reaches stability and maturity in the market. The challenges encountered by entrepreneurs include creating a new process, finding funding, selling their business idea, and making decisions with a high level of uncertainty which are competencies that are not addressed in an MBA course.

Academic institutions responded to this challenge by creating advanced training and masters in the area of management which is slightly different from an MBA. Some examples of these courses include MSc in Innovation and Entrepreneurship from ESADE, MSc Innovation, Entrepreneurship and Management from Imperial College, and Master in Innovation and Technological Entrepreneurship from University of Porto. These courses include disciplines in the fields of innovation, strategic management, design thinking or development of new products and services, which are more appealing to entrepreneurs in starting their own business. These formations have a more practical approach and foster the creation in the academic context of new companies involving multidisciplinary teams. Four out of the 17 interviewees had this type of training and all of them highlighted two immediate benefits of the courses: (i) timely perception of the difficulties in creating a new business which does not lie exclusively in the management component; and (ii) establishment of a broad network of contacts that allows them to leverage the launch of their companies. However, only 2 interviewees pointed out that business idea launched when attending these courses effectively reached the market due mainly to the lack of financial or technical feasibility of the proposed solutions.
Another gap was identified from the interviews. The courses focused on training people to become founders. However, founders only make up a small part of the start-ups. Working in a start-up company presents challenges of working in a large organisation, and this training focuses on the process of creating a business plan, decision making, and search for funding, leaving aside the process of training students in the methodologies and processes that they will find when working at a start-up environment.

5. Conclusion

Human capital is one of the most valuable dimensions for academic spin-offs as it has a key role in business management processes and performance. It is revealed that the role of academic qualifications on entrepreneurial motivations is contradictory. Hence, this study conducted a qualitative study to perceive and explore the existence of these contradictions by considering advanced education levels, professional and technical advanced courses, and master business administration courses.

It is proven that Ph.D. degrees are the most suitable for individuals that pursue teaching and research careers. There is a low propensity of Ph.D. students to establish new ventures. Additionally, individuals with Ph.D. degrees are less willing to take risks, which make them less motivated to create new ventures. However, there are more Ph.D. students who are interested in creating their own business.

At the level of the professional and technical advanced courses, there are founders with complementary courses in the field of computer science and programming, marketing, multimedia design, and management. There are also MOOC courses that offer an asynchronous monitoring model and facilitate the process of monitoring the lessons by the founders. The motivations for attending MOOC courses are personal motivations and strategic objectives of each spin-off. It is possible to identify that the courses allow increasing the technical skills and access to a networking area that in many cases are not within the fundamental formation of the founders.

MBA courses are proven to be unappealing to entrepreneurs. The knowledge addressed in the courses are aimed and applied in large companies. This approach appears to be poorly suited to the key challenges faced by entrepreneurs in setting up their business such as the process of building a business plan, making a decision, and seeking funding. There are new specialised training courses in the areas of innovation and entrepreneurship that propose a more practical and multidisciplinary training approach.

Finally, some proposals for future work are highlighted. One of the working topics is the exploration of the benefits of the courses with an emphasis on the innovation and entrepreneurship fields. It would be relevant to analyse it if this type of training encourages the students to create their business. It would be relevant to analyse the impact of the courses on the performance of the academic spin-offs. A quantitative study can be conducted to analyse the impact of academic qualifications on the financial performance of academic spin-offs. Finally, it is also relevant to understand the main motivations and challenges of working in an academic spin-off in proposing a
conceptual model of training in this field. This suggestion can determine the challenges and needs of academic spin-offs.

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