EO’s Proactiveness as a Catalyst for International Expansion: An Analysis of Italian USOs.

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Abstract

This paper explores the role of Entrepreneurial Orientation (EO) as an antecedent of early internationalisation in the context of University Spin-Out companies (USOs); in particular, the paper focuses on a single, second-order dimension of EO: Entrepreneurial Proactiveness (EP). USOs are an interesting context as, beyond frequently internationalising early, they tend to be highly innovative and risk-averse, enabling the research to capture the individual role of EP as a catalyst for internationalisation. Moreover, USOs tend to have long gestation periods, thus providing the study with the opportunity to extend its focus to include the pre-foundation period of the firm and add a temporal dimension to proactiveness. To achieve this, we employ a qualitative case study methodology of two Italian universities. Thematic analysis of the data shows that early internationalising USOs differ in the way they identify and pursue opportunities during pre-foundation. Additionally, the timing of proactive behaviours emerges as bearing critical implications for early internationalisation.
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1. Introduction

Just over two decades ago, the emergence of early internationalising firms\(^1\) was a novel phenomenon. Today, following the widespread emergence of New Technology-Based Ventures (NTBVs), early internationalisers are found in abundance across the world (Cavusgil and Knight, 2015); however, questions still arise around why some firms internationalise early while others do so incrementally, and others still remain within their domestic markets (Cavusgil and Knight, 2015). Some scholars have operationalised Entrepreneurial Orientation (EO) as a potential driver of early internationalisation (Coviello et al., 2011; Covin and Miller, 2014; Matthews and Zander, 2007), where EO represents a firm’s strategic posture that is conducive to new market entry and involves proactive, risk-taking and innovative behaviour aimed at outcompeting rivals (Felzensztein et al., 2015). The process by which EO accelerates internationalisation is, however, still poorly understood (Calabrò et al., 2017). It is the aim of this paper to examine this process.

This investigation is particularly timely, given the increasing efforts being devoted to extending EO to the international business domain and linking it with higher international scope (Boso et al., 2017), international performance (Brouthers et al., 2015; Thanos et al., 2017), international preparation (Knight, 2001), and degree of internationalisation (Jantunen et al., 2005).

Most studies employ EO as a reflective, uni-dimensional construct, whereby the dimensions of proactiveness, risk-taking and innovativeness are viewed to co-vary and equally contribute to overall levels of EO (Miller, 1983). However, some authors have employed a formative, multi-dimensional view of EO (Lumpkin and Dess, 1996), demonstrating that EO components can vary independently (Linton and Kask, 2017) and that firms may simultaneously present high-levels of innovativeness and/or proactiveness and low-levels of risk-taking (Lisboa et al., 2016). The unique influence of the
dimensions has motivated this study to explore the role of Entrepreneurial Proactiveness (EP) as a driver of early internationalisation.

EP is defined as a “forward-looking and opportunity-seeking perspective that provides the firm an advantage over competitors’ actions by anticipating future market demands” (Gupta and Wales, 2017:54), and has been positively linked with internationalisation efforts in numerous studies (e.g. Martin and Javalgi, 2016; Autio, 2005). A shortcoming of existing studies, which have been predominantly quantitative, lies in their inability to capture the variety and idiosyncrasies of the processes (Randerson, 2016) involved in proactiveness, and uncover and explain their timing (McMullen and Dimov, 2013; Wales et al., 2011). Indeed, EP likely involves a succession of complex and diverse actions to get ahead of competition, actions that may be influenced by institutional, organisational and individual factors (Gartner,1985). By employing a qualitative approach, this study aims to capture the “detailed and contextualized content of the dimension(s)” (Randerson, 2016:591), and examine how the proactiveness process influences early internationalisation.

The paper examines proactiveness in a context where risk-taking is traditionally low (Fryges and Wright, 2014) and innovativeness is typically high (Lejpras, 2014): University Spin-Out companies (USOs). USOs are a unique category of NTBVs aimed at commercialising academic research and have been found to frequently internationalise early (Teixeira and Coimbra, 2014). Interestingly, USOs tend to have long pre-foundation periods (Teixeira and Coimbra, 2014), a characteristic which is likely to influence their subsequent internationalisation behaviour (Zahra, 2005) but whose role has remained largely unexplored.

By exploring USOs, this study seizes several opportunities to contribute to EO literature. First, this context enables examination of EP while assuming that risk-taking is low and innovativeness is high, thereby enabling the research to better understand the influence of EP on firm outcomes. Second, it offers the opportunity to capture the variety of NTBV behaviours involved in the proactiveness process (Randerson, 2016) that anticipate early internationalisation. Third, the context offers the opportunity to
add a temporal dimension to EO (McMullen and Dimov, 2013; Wales et al., 2011) by capturing how proactive behaviours evolve over time, during the pre-foundation period, and emphasising the pivotal role of this phase in accelerating international market entry.

The remainder of this paper is structured as follows. In section 2 the theoretical background of the study is discussed, placing particular emphasis on the EO, EP and USO literatures. The qualitative methodology employed is then outlined in Section 3, followed by a presentation and discussion of the findings in Sections 4 and 5. The paper then concludes with the study’s practical implications, limitations and avenues for future research.

2. Theoretical Background

2.1 Entrepreneurial Orientation

Some studies, albeit limited, have emphasised the tendency of early internationalisers to behave in a proactive, risk-taking and innovative manner, thereby placing EO at the centre of their internationalisation behaviour (Kuivalainen et al., 2007; Martin and Javalgi, 2016). Since EO refers to the “processes, practices and decision making activities that lead to new entry” (Lumpkin and Dess, 1996:136) ahead of competition, the influence of EO on the timing of international market entry is unsurprising. Yet, limited research has investigated the process through which this occurs.

To explore this process, this paper employs a firm-level, multi-dimensional, formative view of EO and views market entry as an outcome of EO (Lumpkin and Dess, 1996) that is sequentially separate from the construct (Wales et al., 2015). Furthermore, while we acknowledge that EO captures a “family” of constructs whose core is represented by the three dimensions (George and Marino, 2011; Wales, 2016), the paper addresses Miller’s (2011) call to appreciate the differences between second-order components and note their independent consequences. Accordingly, the paper conducts a qualitative examination of early internationalisation in a context where innovativeness is typically high (Lejpras, 2014) and
risk-taking is traditionally low (Fryges and Wright, 2014), seizing the opportunity to explore the influence of one particular dimension: proactiveness.

**2.2 Proactiveness and Early Internationalisation**

Entrepreneurship scholars have often assumed that opportunities are identified and pursued through the proactive actions and interactions of alert entrepreneurs (Hannibal et al., 2016; McMullen and Shephard, 2006). Proactiveness has been variously defined across the literature, with Shirokova et al. (2016:705) defining it as “a tendency of the firm to act on future needs by seeking new business opportunities and introducing new products and services ahead of competition, striving for first-mover advantages”, thereby emphasising the role of competition as a critical reference point of EP.

The idea that proactiveness has positive effects on firm internationalisation has been confirmed by scholars across the International Business literature. Beamish et al. (1999) show that firms with a stronger commitment to internationalise achieve higher average export revenues. Similarly, in their study of USOs, Styles and Genua (2008:155) find that “internationalizing firms acted more proactively than non-internationalizing firms”, as they were better able to predict, and adapt to, future problems, and participated in emerging markets. Others found that proactive firms plan ahead to allocate managerial and financial resources for internationalisation efforts (Diamantopoulos and Inglis, 1988), they are more sensitive to foreign market needs, and are better positioned to exploit foreign market opportunities that fit their capabilities (Morris et al., 2011).

Few studies, however, have specifically examined the proactiveness process in light of the early internationalisation question, with Pla-Barber and Escribà-Esteve's (2006) being a notable exception and finding that high levels of EP indeed accelerate internationalisation, and low levels of EP slow it down. This lack of investigation is surprising. Indeed, while the benefits of proactiveness to early international expansion might seem obvious, previous studies have emphasised the resource-intensive
and time-consuming nature of EP (Martin and Javalgi, 2016; Liu et al., 2017). Studies have found that, during their internationalisation efforts, highly proactive firms incur high up-front costs associated with new skill development, and a lengthy search for market knowledge (Sapienza et al., 2005). Such cost implications are critical in the context of resource-constrained SMEs, as they might prevent firms from sustaining high-levels of proactiveness throughout the pre-internationalisation process and, arguably, affect its outcomes. Nonetheless, many resource-poor firms are able to internationalise early, suggesting that high-levels of EP may not always be conducive to early internationalisation and may, in fact, “produce harmful […] returns in the context of resource-constrained firms” (Wales, 2016:9).

Accordingly, some studies have argued that while firms employing low proactiveness may “lack the intentionality and market knowledge needed to identify market opportunities abroad” (Dai et al., 2014:514), they may also rely on being “pulled” into international markets through existing networks (Coviello and Munro, 1997), thereby avoiding the high-costs of EP.

These findings shed light on the non-linear nature of EP and suggest that early internationalising, resource-constrained firms may strive to strike a balance between cost-efficient operations and purposeful, proactive behaviour in the face of competition. It may be that, given the time-bound nature of the process, proactiveness will be manifested at varying degrees at different points in time. Furthermore, behaviour may vary depending on the activities being performed throughout the process. Unfortunately, while definitions of EP generally refer to firm-level behaviour aimed at outcompeting rivals, the specific activities involved in this process are somewhat unclear.

Definitions of EP have associated the dimension with a variety of activities including opportunity identification (Chen et al., 2015), opportunity pursuit (Brettel et al., 2015; Ciravegna et al., 2014), the ability to shape the environment (Kreiser et al., 2010), entrepreneurial alertness (Covin and Miller, 2014), and entrepreneurial commitment (Felzensztein et al., 2015). Such diverging views on the content of EP render it difficult to determine which competitive behaviours fall within the boundaries of the
dimension, a critical step for this study to examine its process. Additionally, the measures employed by existing studies to capture EP provide little further clarity on this matter. Indeed, the majority of studies on EP – mostly contextualised within a wider examination of EO – have captured it by employing the widely accepted Miller/Covin and Slevin measures of proactiveness measuring firms’ tendency to initiate/respond to competitor actions, to be the first to introduce new products/services, and to employ a highly/lowly competitive stance (Covin and Slevin, 1991). While the Miller/Covin and Slevin measures have generated insightful findings on the outcomes of firm’s competitive behaviour, they do not reflect the activities outlined in theoretical definitions of EP, thereby contributing to the confusion on the boundaries of the dimension.

Due to the lack of clarity on the content of EP, this paper builds on both theoretical and operational definitions of proactiveness and examines which and how competitive behaviours influence the timing of international market entry. Moreover, by exploring firms’ pre-foundation period, the paper aims to identify when proactive behaviours take place, how they unfold over time, and how they might lead to early internationalisation, thereby adding a much needed temporal dimension to the process. The pre-foundation process will be examined in a context where this phase is known to be longer (Bell et al., 2003) and, therefore, more transparently observable: University Spin-Out Companies.

2.3 The Context of USOs
USOs are a unique category of NTBVs that emerge from university technology transfer processes, where research technologies are introduced to the market through the creation of a company. USOs share a number of similarities with the wider group of NTBVs, including high vulnerability and difficulties in achieving sustainable returns and financial profitability (Nikiforou et al., 2018). Furthermore, like other NTBVs, USOs are often found to internationalise early, with Fini and Grimaldi’s (2016) study of Italian USOs finding that 64% of firms were internationally active, and that 58% and 79% were international within 3 and 5 years of foundation, respectively.
Despite some similarities, USOs differ from NTBVs in critical ways. USOs face unique challenges as they transition from a scientific environment to a business context (Nikiforou et al., 2018), facing tensions in reconciling a knowledge-driven culture with a revenue-driven environment (Rasmussen and Wright, 2015). USOs are also usually founded by academic entrepreneurs whose business experience and knowledge are extremely limited (Lockett et al., 2005), thus leading USOs to typically adopt risk-averse behaviour in the pursuit of entrepreneurial opportunities (Fryges and Wright, 2014). Additionally, particularly during the initial phases of formation, USOs founders tend to devote significant attention to the innovativeness of their offering(s) and to the technical phases of the venture (prototype and product development) (Nikiforou et al., 2018), and only focus on market development in later stages of the formation process (Shane, 2004). This transition requires time and a continuous reconfiguration of firm capabilities and behaviours (Vanaelst et al., 2006) during the pre-foundation period, a characteristic that is of particular importance to this study.

A number of studies have shed light on the lengthy pre-foundation process of USOs and the phases involved within it (Clarysse and Moray, 2004; Vohora et al., 2004). USOs’ pre-foundation period, which on average lasts two years (Hewitt-Dundas, 2015) and can take as long as 15 years (Rasmussen et al., 2011), involves phases such as the research phase, when the commercial application of the technology is still unclear (Rasmussen et al., 2015), the opportunity framing phase, involving the identification and exploitation of the business opportunity (Vohora et al., 2004), up to the legal establishment of the USO. It has been argued that, due to their risk-aversion, many founders postpone the foundation of the firm until “all the necessary elements, including a team’s managerial and commercial capabilities, are in place” (Nikiforou et al., 2018), thereby rendering the pre-foundation process a critical “preparation” phase that influences their post-foundation development. The formation process has, indeed, been highlighted as “the most influential in terms of the path upon which the venture evolves” (Rasmussen et al., 2015:431), thus supporting the aim of this study to examine the
proactive behaviours employed by USOs during pre-foundation as drivers of post-foundation early internationalisation.

3. Research Design

This study employs a detailed, qualitative field study of 22 USOs from two Northern Italian universities. In particular, the research design utilises an exploratory approach to yield rich insights into how the proactiveness process unfolds in the context of pre-foundation USOs that internationalise early. A qualitative approach is deemed appropriate as it is considered the preferred research method to answer “how”, “why” and “when” questions (Autio et al., 2014; Cunningham et al., 2017), such as how the proactiveness process unfolds during the pre-foundation period and influences USO early internationalisation.

USOs are the unit of analysis of this study and are defined as companies formed by faculty or doctoral students who leave the university to found the company, or who found the company while still affiliated with the university, and that involve a technology developed within the university (Clarysse et al., 2011). For the purpose of this study, we limit our focus to high-technology USOs deriving from technical university departments such as engineering and technology.

Italy was selected as the context for this study for two reasons. First, the Italian market is small and should therefore facilitate the early internationalisation of USOs compared to those based in larger markets (European Commission, 2015). Interestingly, it also presents unique challenges that may hinder the development and expansion of SMEs, thus rendering it a particularly interesting context to examine early internationalisation. Indeed, Italy faces severe problems related to complex and slow bureaucracy, political instability, a strong delay in adopting and supporting innovation (Colombo and Delmastro, 2002), and a highly underdeveloped seed and Venture Capital funding system. Collectively, these factors may undermine the development efforts of SMEs and increase the challenges faced by USOs targeting international markets from the outset. Second, there are almost no studies focusing on the evolution and internationalisation of Italian USOs, despite calls for studies to explore USOs in
Continental European countries (Ramaciotti and Rizzo, 2015), where the entrepreneurial and innovation ecosystems are notably less developed than in the UK and the US (Wright et al., 2007), where most USO studies are based.

The sample selection strategy for this study involved choosing target universities in Italy. Two universities were selected on the basis that they are world-leading in Engineering and Technology research, both ranking in the top 50 globally (QS World University Rankings, 2018) and top 5 nationally (Censis, 2017), and that they are among the most proficient institutions in the creation of USOs, collectively generating over 8% of all Italian USOs (NETVAL, 2016). This strategy was motivated by calls to explore EO in clearly defined institutional and geographic context (Miller, 2011; Linton and Kask, 2017) and to ensure that firms face similar macro-environmental conditions (Linton and Kask, 2017).

Data collection included both primary and secondary sources, for the purpose of triangulation and to facilitate the mapping of critical events and actions taken by USO founders during firm formation. Secondary data sources were consulted to gain an understanding about the universities’ Technology Transfer (TT) approach, as well as to gather background information on the USOs prior to interview; it became evident that, for both universities, TT was a key strategic priority. Primary data were collected by conducting semi-structured interviews, with questions informed by existing literature and centred on USO pre-foundation and internationalisation, with particular emphasis on proactive behaviour vis-à-vis competition.

Interviews were conducted face-to-face and by telephone and lasted from 30 minutes to 1 hour and 40 minutes; interviews were openly recorded. Several steps were followed to ensure data reliability: detailed field notes were taken throughout data collection; interviews were transcribed and translated verbatim to ensure transparency and replicability.
Interviews involved 22 USO founders – 5 gradual internationalisers, 5 domestic⁵, and 12 early internationalisers; one senior manager for each university’s incubator and each Technology Transfer Office (TTO); 4 market agency representatives; and 3 financiers. Details of interview respondents are provided in Table 1, 2 and 3.

-Insert Table 1, 2 and 3 Here-

In collecting the data, the approach outlined by Eisenhardt (1989) was followed. For each university, semi-structured interviews were conducted with a senior management representative of the TTO and of the university incubator. These interviews centred on the TT and USO support provided to USOs, with particular emphasis on internationalisation support. It emerged that most pre-foundation support revolved around Intellectual Property (IP) agreements, bureaucratic guidance for company creation, accessing office space, and external business and financial contacts. USO internationalisation did not constitute a strategic priority at the pre-foundation stage, a view also shared by the 4 market agency representatives. The interviews with financiers, conversely, shed light on the Italian seed and venture capital environment and echoed existing views on the weak funding infrastructure in Italy (Colombo and Delmastro, 2002). These interviews constituted the first phase of data collection and were instrumental in understanding the operational environment of USOs.

The second phase of data collection began with the compilation of a list of target USO respondents for each institution, focusing on USO founders. Respondent details were obtained using the “Spin-off Italia” database and official university and company websites; respondents were then contacted by email requesting availability for interview. For the two universities, we identified 103 USOs; 22 agreed to participate. Given the renowned ambiguity surrounding ‘appropriate sample size’ in qualitative research (Boddy, 2016), and given the challenging estimation of data saturation (Guest et al., 2006), we followed Marshall et al.’s (2013) recommendation to set a numerical guideline based on sample sizes
of previous comparable studies. Given this study’s focus on USO pre-foundation behaviour, we referred to Vohora et al.’s (2004) study on USO formation, which examined 9 UK-based USOs. For this study, we aimed to gather sufficient data on both early and gradually internationalising/domestic USOs; accordingly, we aimed to interview 9 USOs from each category. Contact and persuasion efforts were ceased once the minimum number was achieved. The final USO sample constituted 12 early internationalising USO, 5 gradually internationalising USOs, and 5 domestic USOs.

USO interviews involved asking respondents to describe how the USO creation process was initiated; who identified the commercial opportunity and how it came about; how and when the opportunity was exploited; how and when they ventured into international markets for the first time; who their main competitors were, how they interacted with rivals, and how such rivalry changed throughout the pre-foundation period; whether they were the first to market the particular technology and its differentiating characteristics from rival offerings. Following the recommendations of Miles and Huberman (1994), we developed a case study database that included table cells to record the summaries of the data. Inserting the data in the cells ensured that focus remained on the research question and that comparable information was being collected for all USOs.

### 3.1 Data Analysis

Data analysis was closely linked with existing literature and data collection, whereby emerging findings from the data were further investigated in the context of existing literature, and informed the direction of inquiry through the identification of new questions (Miles et al., 2014).

Upon completion of data collection, transcripts were coded following the coding technique outlined by Miles et al. (2014) with the support of NVIVO 11, followed by within and cross-case analysis to interpret the codes in light of the research question. The analysis process involved three stages.
First, the interview transcripts were openly coded, also known as “first-cycle coding” (Miles et al., 2014), resulting in a large number of descriptive categories and sub-categories that summarised sections of data.

The second phase involved a process of second-cycle coding (Miles et al., 2014), entailing a search for patterns across first-cycle codes and resulting in fewer, more comprehensive themes emerging from the data. In order to align the themes with the theoretical lens of proactiveness, the empirical themes were mapped to existing conceptualisations of EP in the literature. Due to the lack of conceptual consensus among scholars as to what constitutes proactiveness, we carried out a review of existing studies and identified the commonalities and the differences in definitions of EP. First, we focused on the widely used Miller/Covin and Slevin operationalisations of proactiveness, which depict proactive behaviour as one that initiates competitive moves, and reactive behaviour as one that responds to competitive moves. Subsequently, we reviewed past studies and identified a range of factors being associated with the theoretical concept of EP, including opportunity pursuit (Brettel et al., 2015; Kreiser et al., 2010; Ciravegna et al., 2014), opportunity discovery or identification (Brettel et al., 2015; Chen et al., 2015; Wach, 2015), competition (Dickel, 2017; Kreiser et al., 2010; Frishammar and Andersson, 2009), opportunity search (Gabrielsson et al., 2014), commitment (Felzensztein et al., 2015), alertness (Covin and Miller, 2014), ability to shape the environment (Kreiser et al., 2010), and participating in emerging markets (Lumpkin and Dess, 1996). In light of the divergence between conceptual and operational definitions, we captured EP by contextualising conceptual definitions in reference to competition. For instance, a proactive USO would devote efforts to identifying opportunities (Brettel et al., 2015) ahead of competition (Miller, 1983; Covin and Slevin, 1991).

In mapping the literature-derived definitions of EP to the second-cycle codes emerging from the analysis, we identified “aggregate dimensions” (Gioia et al., 2013) of proactiveness that constituted the overarching empirical themes of this study: Opportunity Identification and Opportunity Pursuit, referring to the pre-foundation processes employed by USOs to, respectively, identify and pursue the
market opportunity ahead of competition. Additionally, given the emergence of themes pertaining to the temporal dimension of the process, we identified an additional aggregate dimension of EP: *The Phasing of Proactiveness.*

These three dimensions of proactiveness, namely opportunity identification, opportunity pursuit, and the phasing of proactiveness, then formed the basis for further, cross-case examination.

The third phase of analysis involved a process of within and cross-case analysis (Miles et al., 2014) to capture the similarities and differences across USOs, and ensure that “the events and processes described are not wholly idiosyncratic” (Miles et al., 2014:101). This was achieved by, firstly, examining the proactiveness process in each individual case. Secondly, by clustering firms (Morse and Bottorff, 1992) into two categories based on their pace of internationalisation: early internationalising USOs in Group A, and gradually internationalising/domestic USOs in Group B. Each aggregate dimension of EP - opportunity identification, opportunity pursuit, and the phasing of proactiveness - was then examined within each category, placing particular emphasis on identifying the differentiating patterns between the contrasting categories of USOs.

Ultimately, this process unlocked findings on how pre-foundation proactiveness influenced the pace of USO international market entry.

4. Findings

4.1 Opportunity Identification

The first aggregate dimension of proactiveness is Opportunity Identification, referring to the process through which the entrepreneurs identified the market opportunity associated with their technology. By comparing USOs in Group A (early internationalisers) with those in Group B, a number of key differences emerged. Group A entrepreneurs appeared to be more alert\(^5\) to business opportunities and tended to *discover* the market gap associated with their technology; conversely, Group B tended to engage in a process of opportunity *creation.*
4.1.1 Opportunity Discovery versus Opportunity Creation

All Group A USOs discovered the venture opportunity associated with their technology, in that they recognised an exogenous need in the market (Alvarez et al., 2013). Opportunity discovery occurred in two main ways: directly and indirectly.

It occurred directly in USOs where the founders independently noticed an increasing market demand for the research-driven technology, and consequently founded the venture. Such direct discovery occurred for example in CaseA:N, where the academic entrepreneurs, through heightened alertness, detected a market gap in the bicycle sector that could be met through their existing, research-driven prototype for an e-bike motor. On the basis of this match, they decided to create an academic venture.

“At a certain point we noticed that, on the market, our technology-driven invention started to make sense, as [...] the e-bike market had surpassed the motorbike market in Europe... 2013 was the year in which an inversion of market trends occurred, and so we decided to create a company.” (USO Founder, CaseA:N).

Direct opportunity discovery also occurred following extensive search efforts on behalf of USO founders, efforts which resulted in the identification of a market gap and the subsequent development of the relevant technology, particularly evident in CasesA:E and AGb.

Opportunity discovery also took place indirectly, not through entrepreneurial alertness, but following specific requests on behalf of external parties that approached the research group. This occurred in several USOs, such as CasesA:B, A:H, A:M and A:K. In CaseA:H, the founders had developed an instrument based on mems sensors which attracted the attention of, and was subsequently requested by, a market party. This enabled the founders to discover the unmet market need and incentivised them to create a company.
“This technology was noticed by a company that we had previously worked with [as a research group] and they asked us ‘why don’t you show us how it works, we would actually need it as well.’ [...] And obviously, a company always prefers to work with another company, rather than a university, so that’s why we created the spin-out.” (USO founder, CaseA:H)

Interestingly, in all Group A USOs, the process of opportunity identification began and ended during the pre-foundation period, enabling founders to rapidly move onto subsequent firm development phases.

Conversely, all Group B USOs – with the exception of CaseB:U - engaged in a process of opportunity creation, where created opportunities refer to opportunities that are endogenously formed and that do not exist independently of entrepreneurs’ perceptions and human actions (Alvarez et al., 2013). This process involved entrepreneurs identifying possible market applications for their existing research-driven technologies, without emphasising (during the interview) the revenue-generating potential of such applications. Rather, it emerged that many Group B USOs were driven by the mere desire to create a business venture, rather than by growth aspirations, and showed little regard for profit-making or, in fact, competitive advantage. Interestingly, many Group B USOs were found to still be refining their opportunity post-foundation, which consequently delayed the progression to subsequent stages of proactiveness and, inevitably, delayed market entry.

This pattern became particularly evident in CaseB:I and B:D, whose founders were driven by the desire to apply the new technology to the market, showing limited awareness of the attractiveness of the opportunity and their competitive advantage. In the case of CaseB:D, the founder admitted to still being in the process of refining the opportunity 4 years after foundation.

“So, really, it was a matter of providing continuity to a funded research project that generated good results and that developed people, competencies and know-how that we did not want to
lose. We wanted to follow up on the research results, so that’s why this venture was born.” (Surrogate Entrepreneur, CaseB:I).

“We could be an attractive option because we have a very wide range of market possibilities, but at the same time we might be viewed as a bit underdeveloped because we haven’t chosen our specific path yet.” (USO Founder, Case B:D).

In some, extreme cases – such as CasesB:F, B:I and B:S - the founders admitted to creating their firms mainly to generate employment for themselves or for fellow researchers.

“In actual fact, the drive came from… well, I’ll be honest. [...] It was because we all had a rather academic cv and background, and the likelihood of getting career opportunities within the Italian university system were very low. [So] we started thinking “Perhaps we could create a spin-out”, and that’s how it was born.” (USO Founder, CaseB:F).

In sum, during the process of opportunity identification, Group A discovered an unmet market demand ahead of competition, either through alertness or through social network intervention. Conversely, Group B created endogenous market opportunities with limited awareness of market attractiveness and competition. Critically, Group A tended to end the opportunity identification phase during pre-foundation, thereby accelerating the firms progression through its development phases; Group B continued to refine their opportunity post-foundation, delaying further firm progression and market entry.

4.2 Opportunity Pursuit

Opportunity Pursuit is the second aggregate dimension of proactiveness and refers to the process employed by entrepreneurs to prepare for and exploit the market opportunity ahead of competition.
Indeed, after opportunity identification, entrepreneurs must perform a series of actions to prepare for market entry, including business plan development, searching for and targeting clients, and securing external funding and industrial partners.

By comparing Groups A and B, several patterns emerged: Group A appeared to be better prepared and have stronger business skills, greater devotion to the venture, and greater competitive awareness prior to opportunity pursuit than Group B.

Most of Group A USOs either already knew how to behave in a commercial setting, or were able to develop the required skills during pre-foundation. Where the commercial skills existed, the key source were surrogate entrepreneurs with industry experience. These surrogate entrepreneurs rapidly drove the venture from opportunity identification to opportunity pursuit by developing the firm’s business plan, identifying and approaching clients, and seeking external funding, as evident in CaseA:E:

“My background mainly centred on technological markets. After several market analyses... I developed a business plan to be presented to the industrial partner, and they were delighted with the plan. So that’s when we started the whole process.” (Surrogate Entrepreneur, CaseA:E).

Where Group A entrepreneurs possessed limited industry experience and business skills, they were able to develop them during formation by leveraging the knowledge possessed by external parties, such as clients, industrial partners, TTOs and/or incubators. This was evident in CaseA:B, where the CEO developed product marketing skills through the support of initial clients, secured pre-foundation, who “through their own marketing, business management competencies, (they) made me understand how I should present my product”(USO Founder, CaseA:B).
The majority of Group B USOs, conversely, possessed low levels of business skills throughout firm formation, and appeared to view the marketplace as a very challenging environment to operate in. In particular, these USOs struggled with approaching clients and understanding their needs, and viewed the development of the business plan as a very “abstract” activity (CaseB:O).

“Creating a spin-out is a complex process from a bureaucratic point of view, and it entails the development of a business plan, which for engineers like us is something a bit... abstract, a bit removed from reality... [it] essentially means rolling the dice.” (USO Founder, CaseB:O)

An additional pattern that differentiated Group A from Group B in opportunity pursuit pertained to the levels of confidence, dedication, and competitive awareness manifested by the founders. Most academic entrepreneurs across the two categories made frequent reference to their “academic nature” and background as a source of insecurity, admitting that they “felt uncomfortable with the notion of being considered entrepreneurs” (USO Founder, CaseA:M). However, Group A entrepreneurs responded to such insecurity differently from Group B entrepreneurs. Group A displayed greater dedication to the venture by devoting extensive time to it, rendering it their professional priority - having left all academic responsibilities behind -, aiming to make profits and outcompete rivals, and demonstrating resilience in the face of adversity.

“In the end, with a lot of effort, I managed to become a CEO! ... In life, people need to be prepared and able to exploit certain opportunities, and certain trends, even if in that particular moment it seems to you that they are going in a direction that is completely different to what you would like. [...] However, as a general rule, it [the opportunity] should be something that allows you to become among the best in the world.” (USO Founder, CaseA:L).
Conversely, Group B appeared to be less devoted to the USO. They tended to behave more reactively to opportunity pursuit during pre-foundation by, for example, waiting for problems to resolve themselves, or delaying their resolution to a later stage, resulting in a more gradual approach to growth. This was the case in CaseB:C, where the founders admittedly struggled to define the market application for their technology, yet decided to found the USO and address the issue post-foundation.

A final, diverging pattern in pre-foundation opportunity pursuit pertains to competitive awareness. During pre-foundation, Group A appeared to gain more awareness of the domestic and global competitive landscapes, the market need they were addressing, and their competitive advantage vis-à-vis rivals; furthermore, many early internationalising firms identified themselves as being market leaders, with CaseA:N’s founder stating that “While all of them [our rivals] made central motors […] there are very few companies that target this particular niche in the market which was basically left to ourselves… we’re on our own”.

Group B appeared to be less aware of the competitive landscape during pre-foundation. In this regard, however, two separate patterns emerged characterising domestic and gradually internationalising firms, respectively. Domestic USOs were more focused on the technical characteristics of their technology, and frequently displayed uncertainty about the attractiveness of their offering to potential clients, at times admitting to facing severe international competition from similar technologies. This was the case in CaseB:C, who stated that “Our technology, or similar, is already available in other European countries… So, for this reason, we’re happy enough to focus on the Italian market.”

On the other hand, gradually internationalising USOs eventually gained competitive awareness and found their niche within the market. This, however, occurred post-foundation, which ultimately delayed market entry, both domestically and internationally.

This finding sheds light on, arguably, the most insightful theme emerging from this study: the phasing of proactiveness, a theme that emerged as critical in both opportunity identification and opportunity pursuit.
4.3 Phasing of Proactiveness

The third, and final, aggregate dimension of proactiveness is the Phasing of Proactiveness, which adds a temporal dimension to EP and emphasises how the process unfolds over time.

In the previous sections, we outlined various findings on how USOs identified and prepared to pursue opportunities. In this section, we place emphasis on their timing as bearing critical implications for the pace of USO internationalisation. By comparing the two categories of USOs, we identified a distinct divergence in terms of the length of the opportunity identification phase, the length of time taken by the founders to prepare for and engage in opportunity pursuit, and when these phases actually took place.

The opportunity identification phase began, in all cases, during the pre-foundation period and immediately followed the research phase. In Group A, however, this phase ended during the pre-foundation period, which enabled founders to have a more refined opportunity and move onto preparing for its pursuit prior to foundation. In Group B, the opportunity identification phase continued throughout the early phases of post-foundation, through continuous efforts of opportunity refinement. This process ultimately led to the foundation of firms in need of further development, and delayed founders’ preparation for and engagement in pursuit.

After having identified the opportunity, Group A USOs engaged in a process of venture preparation, which included activities such as business skill development, business planning, partner search, devotion, competitive awareness, searching for or securing clients etc. These activities took place during pre-foundation, and created the basis for immediate market entry post-foundation. Group B only engaged in this phase post-foundation, significantly postponing firms’ market entry and, ultimately, internationalisation.

A particularly strong illustration of this pattern is represented by the timing at which the first clients were secured by USOs of each category. Most Group A entrepreneurs stated that their first clients were
secured before the official foundation of the firm; this enabled them to immediately enter the market as soon as the firm was founded, thereby outcompeting rivals and resulting in an accelerated domestic and international market entry. Conversely, Group B USOs secured their first clients post-foundation, considerably delaying market entry, which tended to be domestic at first. This pattern is illustrated by the two contrasting quotes below.

“We had established rather stable contacts with clients at least a couple of years prior to foundation, as a consequence of the trial software we had launched. Thanks to these [contacts], we were able to sell almost immediately.” (USO Founder, CaseA:R).

“We certainly didn’t have a preordained process to follow [during formation]. Sure… once we founded the spin-out… at that point, we started planning the exact steps we needed to take. […] We officially sold our first product this year [2016 - 4 years post-foundation].” (USO Founder, CaseB:U).

A finding that, at least in part, explains why the majority of Group A were much better prepared, stable and ready for pursuit at the time of foundation is the fact that they tended to have much longer pre-foundation periods – on average 3.7 years and, in extreme cases, up to 13 years long (CaseA:E) - which enabled founders to examine the competitive landscape and address any challenges prior to venture foundation. For example, CaseA:M’s formation period lasted two years, during which the founders addressed their lack of business skills and refined their business plan.

“From the idea to the foundation of the firm, two years went by. Two years in which our business plan changed a lot, as a result of subsequent iterations of our idea. So we made our first business plan… then we had to “correct” [it]… And perhaps the fact that it took us two
years to develop an acceptable business plan also contributed to our growth.” (USO Founder, CaseA:M).

Group B USOs, by contrast, appeared to have shorter pre-foundation periods – usually 6 months - which contributed to their need to refine their project and prepare for opportunity pursuit after the foundation of the firm. This pattern was also confirmed by University 1’s TTO, who stated that “generally speaking, it [gestation] would take around 3-6 months... [However], sometimes the spin-out may not immediately be created. [...] The foundation of a spin-out may come after an initial phase that could be quite long”.

Based on these findings we developed the following depiction of Group A and Group B USO development and EP behaviour over time.

Figure 1– Phasing of Proactiveness in Group A and B USOs.
While our findings have shown considerable divergence across USO categories in terms of their pre-foundation proactive behaviour, by examining USOs’ progression from research phase through to opportunity pursuit, findings may suggest that observing foundation as the first event in a firm’s organisational life-cycle may provide an inaccurate reflection of the firm’s true stage of development and EP manifestations. Indeed, firms with longer pre-foundation periods appear to have behaved more proactively during gestation than firms with shorter pre-foundation periods; this, however, is likely due to the fact that the former group have had more time to examine and prepare for the competitive landscape. Accordingly, our findings on timing may suggest that it might be more appropriate to capture firm behaviour from the opportunity identification phase, regardless of the moment of foundation, to determine the presence of a behavioural divergence across categories of firms. It may well be that, in many cases, the timing of proactiveness, as opposed to whether proactive behaviour takes place, explains the pace of USO internationalisation.

5. Discussion

This paper has explored pre-foundation manifestations of proactiveness in early internationalising and domestic/gradually internationalising USOs, in an effort to map the behaviours that are conducive to early internationalisation. Three aggregate dimensions synthesise our findings: Opportunity Identification, Opportunity Pursuit, and the Phasing of Proactiveness. Each of these will now be discussed in light of existing literature.

5.1 Opportunity Identification and Early Internationalisation

Findings show that early internationalising USOs tended to engage in a process of exogenous opportunity discovery ahead of competition, which ended during pre-foundation; conversely, domestic/gradually internationalising USOs engaged in a process of endogenous opportunity creation which entailed high uncertainty, continuous opportunity refinement and continued throughout early post-foundation.
The processes of opportunity discovery and opportunity creation have been widely discussed in the literature, mostly as two separate perspectives on the identification of opportunities, where the former contends that opportunities are exogenous, objectively exist in society and await to be discovered (Shu et al., 2018), and the latter argues that they are endogenously formed by entrepreneurs and constitute social constructions that do not exist independently of entrepreneurs’ perceptions and human action (Aldrich and Kenworthy, 1999). However, studies have also pointed to the limitations of such mutually exclusive distinctions and that, in fact, they may be complementary modalities (Valliere, 2013; Chiasson and Saunders, 2005), as Vaghely and Julien (2010) empirically demonstrate. Furthermore, excessive focus on the ontological nature of opportunities has led studies to neglect the entrepreneurial processes involved in identifying them, and their outcomes (Foss and Klein, 2017). Indeed, Alvarez et al. (2013:311) state that “it may well be that the organizational processes that firms use in exploration to discover opportunities are not the same as those used in exploration to create opportunities”, and that each approach may require a different set of skills and different levels of risk.

In light of this research direction, we examined the process that led USO founders to identify their opportunity ahead of competition and identified a number of factors that would explain why the process of opportunity discovery accelerated internationalisation, while that of opportunity creation slowed it down. In particular, uncertainty and time were identified as being critical. The opportunity discovery process is thought to have fairly predictable outcomes in terms of revenue-generation (Alvarez et al., 2013); for instance, many Group A USOs knew market demand was present because they noticed it directly, or because they were contacted by external market parties. As such, the discovery process was associated with lower uncertainty and enabled founders to accurately estimate the levels of resources and time required to progress to opportunity pursuit, critical in the context of resource-constrained firms. Furthermore, discovery is thought to be associated with entrepreneurs possessing or accessing knowledge and information before others, thereby enabling them to gain first-mover advantages and at least temporary competitive advantage (Alvarez et al., 2013; Barney, 1995). This was confirmed by our findings, as the majority of Group A USOs stated their were first-to-market with their technology.
Ultimately, the low uncertainty, time-efficient and competitively advantageous nature of the discovery process enabled founders to complete the opportunity identification phase pre-foundation and accelerated progression to the opportunity pursuit phase.

Conversely, the process of opportunity creation has been associated with entrepreneurs’ own beliefs about the opportunities they might face combined with the resources they possess to pursue them (Baker and Nelson, 2005). Given the subjective perception of the opportunity and the highly uncertain outcomes in terms of revenue-generation, to the point where “the future is unknowable” (Mainela et al., 2014:108), entrepreneurs engage in a learning process marked by gradual investments (Mainela et al., 2014), where they wait for a response from the market, and then adjust their beliefs and commitments, and act again (Weick,1979; Alvarez et al., 2013). The high uncertainty and time-consuming nature of the process ultimately led to the opportunity identification being very long, continuing post-foundation and delayed the pursuit of the opportunity. Ultimately, this process postponed international market entry.

In the context of EP literature, these findings support assumptions that firms that identify opportunities ahead of competition internationalise earlier (Pla-Barber and Escribà-Esteve, 2006). Furthermore, findings suggest that the process employed by founders to identify the opportunity bears critical implications for the pace at which firms later internationalise. It emerged, in fact, that the nature of the discovery process enabled entrepreneurs to identify the opportunity in a timely manner, during the pre-foundation period, and ahead of competition; this timely process, ultimately, accelerated internationalisation. Insightfully, USOs employing the discovery process also avoided many of the costs typically associated with EP, contrary to prior assumptions on the resource-intensity of competitive behaviour (Dai et al., 2014). Indeed, Group A USOs marketed a technology whose costs were absorbed by the university, and avoided opportunity search costs either through alert behaviour or through social network intervention. Conversely, most Group B USOs were found to expend extensive efforts and
time to form and refine their opportunity and the associated technology. As such, USOs that acted ahead of competition were found to incur lower opportunity identification costs.

5.2 Opportunity Pursuit and Early Internationalisation

Our findings show that early internationalising USOs were better prepared for opportunity pursuit and displayed stronger business skills, greater devotion to the venture, and greater competitive awareness than domestic/gradually internationalising USOs.

In the context of the proactiveness literature, our findings support the assumption that proactive behaviour is conducive to early internationalisation (Pla-Barber and Escribà-Esteve’s, 2006), and that proactive firms are better able to predict and adapt to future problems (Styles and Genua, 2008). Indeed, early internationalising USOs were found to be more proactive in this study. By engaging in a lengthy process of preparation for opportunity pursuit during pre-foundation – involving business skill and business plan development, increasing devotion to the venture and awareness of the competitive landscape – Group A USOs were able to enter the market immediately after foundation, which ultimately accelerated internationalisation. Conversely, Group B appeared to be more reactive, unprepared for pursuit, more uncertain about their value offering and of competitive positioning, and once founded, they employed a gradual approach to development and growth. As such, their opportunity pursuit was postponed, as was their international market entry.

By unlocking insights into the variety of activities and processes involved in the proactiveness process, we also address Randerson’s (2016) call to explore the contextualised content of the dimension as well as providing insights into how entrepreneurs move towards opportunity pursuit. Furthermore, findings support Vanaelst et al.’s (2006) assumptions that USOs’ transition from idea conception to opportunity pursuit requires time and continuous reconfigurations of firm capabilities and behaviours; this was particularly evident in Group A. Findings suggest that early internationalising, proactive firms devoted greater efforts, time and resources to pursue the opportunity and outcompete rivals, thereby supporting existing assumptions on the resource-intensity of proactiveness (Dai et al., 2014). It also emerged,
however, that such costs were spread over a longer period of time prior to firm foundation, thereby rendering resource expenditure manageable, due to gradual progression, and limiting negative consequences on the pace of internationalisation. Group B, by contrast, were found to devote fewer efforts and resources to opportunity pursuit during the pre-foundation period, and incurred the majority of costs of post-foundation. This pattern was particularly evident in gradually internationalising firms, and forced USOs to decrease the pace of USO development post-foundation to spread the costs associated with pursuit, ultimately delaying domestic and international market entry.

These findings shed light on this study’s final theme pertaining to the phasing of proactiveness.

5.3 Phasing of Proactiveness

By examining the temporal dimension underpinning each EP process, it emerged that the length of time taken by each phase, as well as the timing at which they took place, strongly influenced the pace of internationalisation. It emerged that Group A experienced long pre-foundation periods in which they identified their opportunity and prepared for its pursuit, to the extent where first clients were already secured. This inevitably accelerated market entry post-foundation, and increased the pace of internationalisation. Conversely, Group B experienced much shorter pre-foundation periods and the opportunity identification phase continued through to post-foundation. Furthermore, preparation for opportunity pursuit took place after firm foundation, as did securing clients, which delayed market entry, usually domestic at first. There are several literature implications relating to this pattern.

In the context of USO literature, it is encouraging that long gestation (Hewitt-Dundas, 2015) and the stages within it (Vohora et al., 2004) were also identified in early internationalising USOs. Indeed, the project phase and the pre-startup phase (Clarysse and Moray, 2004), which included the research phase, the opportunity identification phase, and the opportunity pursuit phase, also emerged in the pre-foundation of Group A. In contrast to existing USO literature, however, it emerged that Group B tended to postpone such phases to after firm foundation, and therefore did not follow the process outlined by existing frameworks. Such a pattern confirms Nikiforou et al.’s (2018) suspicions that the idiosyncrasies
in USOs’ pre-foundation evolution may influence post-foundation development, warranting further studies in this direction.

In regards to the proactiveness literature, our findings add a much needed temporal dimension to EP (McMullen and Dimov, 2013; Wales et al., 2011), outlining how the process evolves over time and emphasising that when entrepreneurial behaviours take place influences outcomes. Research on the timing of entrepreneurial behaviours is, in fact, scarce across the entrepreneurship literature, with Choi et al.’s (2008) theoretical study on the timing of exploitation being a rare exception. In accordance with the authors, who argue that time reduces entrepreneurs’ levels of ignorance through knowledge accumulation, our findings suggest that early internationalising USOs had more time to prepare for market entry pre-foundation, reducing uncertainty and the time required for pursuit post-foundation. Conversely, the high uncertainty and lengthy preparation that occurred post-foundation in Group B delayed market entry and, inevitably, internationalisation. Importantly, such findings raise questions on the appropriateness of viewing foundation as the first event in a firm’s organisational life-cycle. Indeed, our findings suggest that, to truly capture the evolution and subsequent outcomes of proactive behaviours, authors should extend their focus to include the pre-foundation period as a critical phase of the organisational life-cycle.

A final contribution of our findings on timing pertains to the International Entrepreneurship literature. Indeed, our study confirms that behaviours taken during pre-foundation bear critical implications for subsequent internationalisation patterns (Zahra, 2005), and that early internationalisation efforts may begin before and during foundation, and not exclusively at or shortly after it (Hewerdine and Welch, 2013). In light of these findings, we support calls for further studies to examine the true “earliness” of firm internationalisation (Zhou and Wu, 2014).

6. Conclusion
This study explored the influence of proactive behaviours manifested during USOs’ pre-foundation on early internationalisation. By employing a qualitative methodology, the study shed light on the process through which early internationalisation USOs – emerging as being more proactive - were able to identify their opportunity ahead of competition, pursue their opportunity ahead of competition and, ultimately, internationalise early. Critically, the study adds a much needed temporal dimension to proactiveness and emphasises the importance of capturing when entrepreneurial behaviours take place, and how they evolve over time.

As well as theoretical implications, this study bears practical and policy implications. The identification of EP behaviours that nurture the early internationalisation of USOs can help policy-makers and business development agencies support USO founders in the development and maintenance of such strategic postures. Furthermore, the study signals a need for policy makers and business development entities to support internationalisation efforts much earlier, from the moment of idea conception. Findings signal the need for firms to refine the opportunity prior to firm foundation and begin their market entry preparation as soon as the opportunity is identified. This may be achieved by developing necessary business skills, devoting time and efforts to the venture, exploring the competitive landscape, and securing first clients prior to foundation.

The study has several limitations. A qualitative case study approach of two universities was chosen to yield rich theoretical insights; however, as it involved a limited number of interviews, generalisations of the findings to the wider USO population should be performed with caution. Future studies could test the generalisability of the findings on a larger population of USOs. Furthermore, the collection of data employed a retrospective longitudinal approach, which exposes the data to potential recollection bias. Future research could employ a longitudinal approach to explore the stages of USO development at different points in time. Finally, the influence of social capital and exogenous factors, such as market
structure, were beyond the scope of the study; however, they may strongly influence the international expansion of USOs, and represent fruitful avenues for future research.

1 In line with Knight and Cavusgil’s (2004) definition of Born Global firms, we define an early internationalising firm as a firm that begins exporting within 3 years from foundation.

2 While it is true that European SMEs are much more likely to internationalise than SMEs in larger markets like the US, with 25% of European SMEs engaged in exporting activities against 13% of US SMEs (European Commission, 2015), only 12% of Italian SMEs export (British Business Bank, 2018), pointing to the idiosyncratic, and likely challenging, nature of this particular context.

3 By domestic USOs we refer to USOs that exclusively operate within their home-country market.

4 Based on our review of 12 articles focusing on the topic of Entrepreneurial Orientation and Internationalisation and International Entrepreneurial Orientation, we found that Opportunity Identification (or Recognition, or Discovery) occurred in 8 definitions; Opportunity Pursuit (or Exploitation) was included in 9 definitions; Competitive Positioning (or Competition, ‘Ahead of competition’, or Competitive Aggressiveness) occurred 9 times. Other dimensions were also identified, e.g. Opportunity Search (6 times), Commitment (5 times), Information Scanning (3 times), shaping the environment (1 time), and Alertness (9 times), however they were not included in our operationalisation due to their lower frequency of occurrence, or due to their strong connection with other dimensions (e.g. Alertness – Opportunity Identification).

5 In line with Kirzner’s (1979) definition, alertness was viewed to be present when entrepreneurs were able to notice opportunities without actively searching for them; rather, they were identified opportunities by being receptive to overlooked opportunities (Kirzner, 1997).
Bibliography


NETVAL (2016) Ricerca, Valorizzazione dei Risultati e Impatto, Pavia: Netval - Network per la Valorizzazione della Ricerca Universitaria.


Randerson K (2016) Entrepreneurial Orientation: do we actually know as much as we think we do?. *Entrepreneurship & Regional Development* 28(7-8): 580–600.


<table>
<thead>
<tr>
<th>USO</th>
<th>Uni.</th>
<th>Field</th>
<th>Technology</th>
<th>Interview Respondent</th>
<th>Foundation Year</th>
<th>International Market Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: A</td>
<td>Uni1</td>
<td>Nuclear engineering</td>
<td>Algorithm and model development for the performance of industrial systems.</td>
<td>CEO/Co-founder</td>
<td>2012</td>
<td>&lt; 3 years</td>
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<td>Uni1</td>
<td>Electronics and ICT</td>
<td>Diagnostic device for industrial processes.</td>
<td>CEO/Co-founder</td>
<td>2014</td>
<td>&lt; 3 years</td>
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<td>Uni1</td>
<td>Energy</td>
<td>Technology for the remote supply of energy.</td>
<td>CEO/Co-founder</td>
<td>2009</td>
<td>&lt; 3 years</td>
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<td>Mechanics</td>
<td>Robots for Industrial automation in the pharmaceutical industry.</td>
<td>CEO/Co-founder</td>
<td>2014</td>
<td>&lt; 3 years</td>
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<td>A: H</td>
<td>Uni1</td>
<td>Electronics and ICT</td>
<td>Technology for the characterisation of MEMS sensors.</td>
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<td>2014</td>
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<td>Biomedical engineering</td>
<td>Diagnostic device for respiratory pathologies.</td>
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<td>2010</td>
<td>&lt; 3 years</td>
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<td>A: L</td>
<td>Uni1</td>
<td>Aerospace engineering</td>
<td>Algorithm for the millimetric measurement and monitoring of geophysical phenomena</td>
<td>CEO/Co-founder</td>
<td>2000</td>
<td>&lt; 3 years</td>
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<td>A: M</td>
<td>Uni1</td>
<td>Electronics</td>
<td>Technology for X-ray and Gamma-ray applications.</td>
<td>CEO/Co-founder</td>
<td>2009</td>
<td>&lt; 3 years</td>
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<td>A: N</td>
<td>Uni1</td>
<td>Electronics</td>
<td>Innovative e-Bike motor.</td>
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<td>2013</td>
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<td>A: P</td>
<td>Uni2</td>
<td>Fire engineering</td>
<td>Custom-made numerical solutions in the fields of fire engineering and thermal science.</td>
<td>CEO/Co-founder</td>
<td>2007</td>
<td>&lt; 3 years</td>
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<td>A: Q</td>
<td>Uni2</td>
<td>Energy</td>
<td>Storage systems for renewable energy.</td>
<td>CTO/Co-founder</td>
<td>2005</td>
<td>&lt; 3 years</td>
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<td>A: R</td>
<td>Uni2</td>
<td>Electronics</td>
<td>Innovative software for the resolution of modelling problems.</td>
<td>President/Co-founder</td>
<td>2007</td>
<td>&lt; 3 years</td>
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Table 1 - Group A Interview Respondents
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<tr>
<th>USO</th>
<th>Uni.</th>
<th>Field</th>
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<th>Interview Respondent</th>
<th>Foundation Year</th>
<th>International Market Entry</th>
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<td>Uni1</td>
<td>Mechanics</td>
<td>Robots for Industrial automation and bin picking.</td>
<td>Current CEO/Director of (potential) Industrial partner</td>
<td>2006</td>
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<td>Uni1</td>
<td>Energy</td>
<td>Consulting services in the field of renewable energy and power electronics.</td>
<td>Senior Partner Director of founding Industrial Partner</td>
<td>2006</td>
<td>&gt; 3 years</td>
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<td>Case B:J</td>
<td>Uni1</td>
<td>Mathematics</td>
<td>Custom-made solutions and software in a wide range of industries.</td>
<td>CEO/Co-founder</td>
<td>2010</td>
<td>&gt; 3 years</td>
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<td>CEO/Co-founder</td>
<td>2011</td>
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<td>Electronics</td>
<td>Intelligent LED lighting bulbs.</td>
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<td>Technology for the conversion of traditional vehicles into hybrid or electric vehicles.</td>
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<td>Chemistry</td>
<td>Custom-made solutions for surface coatings.</td>
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<td>Custom-made technologies for aerial surveillance.</td>
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Table 2 - Group B Interview Respondents
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Table 3 – Support Networks Interview Respondents