

**ENTREPRENEURIAL TEAM DEVELOPMENT IN ACADEMIC SPIN-OUTS:
AN EXAMINATION OF TEAM HETEROGENEITY**

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ABSTRACT

This paper examines the dynamics of entrepreneurial teams as they evolve through the different stages of a spin-out process. Using a unique, hand-collected set of data covering all team members in 10 cases, an in-depth analysis of the heterogeneity of team members' experience and perception of the strategic orientation needed to attain different milestones in the spin-out process was performed. Our findings suggest that teams evolve over time and change in composition, and therefore, they cannot be studied as immutable entities. At the start of the venture formation, we introduce a new team role, the privileged witness, potentially specific for spin-outs. Analysis of the teams indicates that the team's heterogeneity changes as it evolves through the different stages of the spin-out process. In particular, we found that new team members brought in different kinds of experience; however, they did not introduce a different view on doing business from the initial team members.

1. INTRODUCTION

Academic spin-outs emerge out of a university or a research institute (Clarysse et al., 2005). At the core of every spin-out lies research and know-how that can be commercialized through the creation of a new venture. The decision to create a spin-out challenges the researchers since they have to enter a business community which is different from the scientific one in which they have been active. Many papers that deal with university-industry relations have already emphasized the different rules and norms that prevail in business and academic or research environments (Van Dierdonck et al., 1990). A first step in the decision to start-up a spin-out is usually the screening of the different resources needed for a successful launch of the venture (Vohora et al., 2004 ; Clarysse & Moray, 2004). Financial and human resources often seem to be the most critical (Moray & Clarysse, 2005), while the technological resources are usually in place. As shown by Heirman and Clarysse (2004), financial and human resources tend to be closely interrelated. When new ventures apply for early stage venture capital funds, the question of a well-balanced team with sufficient business experience is often raised by the potential investors to evaluate a project (MacMillan et al., 1985,1987; Muzyka et al., 1996). Based on the venture capital literature, we might therefore conclude that teams are an important factor in decisive entrepreneurial events such as raising venture capital. Venture capitalists place considerable emphasis on founding teams. But is there scientific support for a relationship between teams and firm performance?

The relationship between teams and firm performance has been examined in the literature on the “upper-echelon perspective” (Hambrick & Mason, 1984). We build on the upper-echelon perspective to analyze the effects of team dynamics on new venture performance of academic spin-outs. A key difference between the large firms, where much of the upper-echelon research has been conducted, and spin-outs is that the former are already established firms, whereas the latter are emerging ventures passing through the various stages to becoming an established entity. Although some have noted that in entrepreneurial team building, the founding core may have difficulties accommodating

later arrivals, who often feel excluded from the founding group, (Ratcheva & Vyakarnam, 2001), little research has systematically examined the dynamics of new venture teams in general (Ucbasaran et al., 2003), and there is an absence of such analysis in the context of academic spin-outs. Filling this research gap is important in helping to address policy and research questions concerning the ability of academic spin-outs to create wealth (Lambert, 2003). Therefore, our research question is: *how* do entrepreneurial teams evolve over the different stages of a spin-out process? The contribution of our research, therefore, lies in the fact that we take a dynamic team perspective, allowing for the identification of the effects of team heterogeneity on new venture performance, in the specific case of the development process of academic spin-outs. In this paper, venture performance is described in terms of reaching well-defined entrepreneurial events in the spin-out process and differs from research that considers venture performance as a static concept, defined it in terms of “success” or “growth” at a certain moment in time.

This paper proceeds along the following lines. First, we outline the theoretical background to the paper in relation to teams, spin-out processes and shared cognition. Second, we discuss the research design data method of data collection that we employed in the study. Third, we present an analysis of the cases. Finally, we conclude and discuss our findings.

2. THEORETICAL BACKGROUND

In this section we present our definition of entrepreneurial teams and consider the link between team structure and performance.

2.1 Defining entrepreneurial teams

There has been considerable debate as to what exactly is meant by an “entrepreneurial team”. Kamm et al. (1990) define entrepreneurial teams as “two or more individuals who jointly establish a firm in which they have a financial interest” (Kamm et al., 1990: 7). Gartner et al. (1994) broadened this definition to cover those individuals who have direct influence on strategic choice. Ensley et al. (1998) combine both delineations by stating that an individual has to fulfill three criteria in order to be considered a member of the entrepreneurial team (1) jointly establish a firm; (2) have a financial interest; and (3) have a direct influence on the strategic choice of the firm. Other researchers have made the equity stake condition stricter and impose a minimum equity stake before some one can be considered a member of the entrepreneurial team (Ucbasaran et al., 2003).

Part of the definitional confusion is related to the fact that entrepreneurial teams are too often investigated within a static framework. Determining equity stakes and management positions is typically very much focused around the time of formal incorporation of the venture. These studies therefore often implicitly neglect the evolutionary aspects of entrepreneurial team formation and development. Recent research has attempted to tackle this problem and has studied team entry and exit (Ucbasaran et al., 2003). Along the lines of this research, our study originates from the hypothesis that the concept “team” is evolving rather than static. In this respect, teams in spin-outs differ markedly from those in established businesses.

To introduce the dynamic component in spin-out teams, we draw on the work of Vohora et al. (2004) and Clarysse and Moray (2004), who investigated the entrepreneurial events of the spin-out process in detail. In particular, these authors found that creating a spin-out is a long process. Often, the legal start-up of the spin-out happens quite late in the

development of the firm since parent institutes tend to incubate these companies over a considerable period. As this legal foundation is postponed until all elements such as external capital, customer identification, team, etc. are in place, the legal incorporation is often an important entrepreneurial event. We thus differentiate between the teams of spin-outs that were not yet legally established, which we identify as pre-start-up teams, and teams of spin-outs that were already legally established, which we refer to as post-start-up teams. Despite the differences in teams we expect to find in these two phases of venture formation, we are interested in a common team denominator, which is the involvement of the team members in the core strategic decisions of the venture.

For the pre-start-up teams, we operationalize the entrepreneurial team definition by asking the leading researcher to identify the individuals taking the core strategic decisions in the creation of the spin-out. By definition, the core researchers are part of this strategic decision-making process. However, in addition to the researchers, representatives of the parent institute are involved in the creation of the spin-out. In most cases, this role is performed by their technology transfer officers (TTO). In some cases, outsiders with no formal link to the parent institute can also be attracted to actively pursue the creation of the spin-out. Often these external parties are attracted to the creation of the spin-out because they have business experience. Previous research (Franklin et al., 2001, Lockett et al., 2003) termed these external actors as “surrogate entrepreneurs”. According to these authors, a surrogate entrepreneur is an outsider with commercial experience, who may be attracted to work together with the researchers to develop the venture. Usually, in our study, the entrepreneurial pre-start-up teams consist of the key researchers and the surrogate entrepreneurs.

For the post-start-up spin-outs, we follow the argument of Fama and Jensen (1983) that the separation of decision and risk-bearing functions observed in large corporations is common to other organizations. Moreover, an organization’s decision process consists of decision management (initiation and implementation) and decision control (ratification and monitoring). The common apex of the decision control systems of organizations, in which decision agents do not bear a major share of the wealth effects of their decisions, is a board of directors that ratifies and monitors important decisions and chooses, dismisses, and rewards important decision agents. Therefore, we operationalized the entrepreneurial

team definition by asking the CEO or founder to identify the important decision agents. Usually, team members of the post-start-up spin-out, as indicated by the CEO as taking the core strategic decisions, were members of the management committee and the founders.

2.2 Team structure and performance

Existing research, as previously indicated, has linked teams to firm performance under the upper-echelon perspective. In the upper-echelon perspective, top management team characteristics such as psychological characteristics, cognitive base, and observable characteristics, like age and functional expertise, determine strategic choices. The environmental factors surrounding the firm, upper-echelon characteristics, and the strategic choices made by the top management team interact to determine organizational performance levels (Hambrick & Mason, 1984). Translated to entrepreneurial teams, these findings suggest that changes in the composition and hence, characteristics of the team, may have an impact on the strategic choices made by the entrepreneurial team and ultimately, on the venture performance.

Ensley and Pearce (2001) build on this upper-echelon perspective to develop a theoretical framework that links shared strategic cognition in top management teams to group process and new venture performance. They define shared cognition in top management teams as the extent to which strategic mental models held in the hearts and minds of the top management team members overlap or agree. Their theoretical model suggests that cohesion impacts conflict, that conflict impacts shared strategic cognition and shared strategic cognition impacts firm performance. According to these authors, conflict is a process that teams go through to make decisions, take action and create cognitive schema. They argue that conflict is the process of creating the overlap in strategic cognitive maps and therefore a key group process in the development of shared strategic cognition. As group processes most directly relate to shared cognition, Ensley and Pearce (2001) examine cognitive and affective conflict in top management teams. According to Amason and Sapienza (1997) cognitive conflict is task-oriented disagreement arising from differences in perspective and may be beneficial. In contrast, affective conflict is individual-oriented disagreement arising from personal disaffection

and may be detrimental to the development of the venture. Eisenhardt et al. (1997) also analyze the key elements of managing constructive conflict to create collaboration between top management teams. The results of Ensley and Pearce (2001) indicate that the group processes leading to the development of shared strategic cognition, cognitive and affective conflict, are more important than the outcome of shared strategic cognition in terms of predicting organizational performance.

Another stream of research, positioned within the literature on organizational culture, has, in a parallel way, analyzed the underlying dimensions of what Ensley and Pearce (2001) have referred to as shared cognition. This work is based on Quinn's (1988) competing values model (1988). In particular, Van Muijen et al. (1999) identify four extreme types of orientation towards how a team should ideally work. Each team member individually has his own perception on how a team should ideally operate in order to realize its goals. The sum of each team member's individual orientation can be seen as the "organizational culture" of the entire team. The four different extremes are based upon two underlying dimensions: the opposite poles of flexibility versus control form the first dimension. The second dimension represents the internal versus external focus of the team members (van Muijen et al., 1999). A combination of these two dimensions results in four different types of orientation. Team members who are internal oriented but very flexible are identified as mainly *support oriented*. They find concepts such as participation, cooperation, people based, mutual trust, team spirit, and individual growth very important. Communication is often verbal and informal. Employees are encouraged to bring ideas about their work and feelings about each other forward. Decisions are often made through informal contacts. Team loyalty is very much appreciated by these team members. However, team members who are internal oriented, but tend to focus on control, are *rules oriented*. They find respect for authority, rationality of procedures, and division of work important. Communication is often written and top-down. The structure is hierarchical and power is based on formal authority. Team members who tend to focus on control, but are external oriented are mainly *goals oriented*. They find concepts as rationality, performance indicators, accomplishment, accountability, and contingent reward very important. Team members who are external oriented but are flexible are considered to be mainly *innovation oriented*. Searching for new information in the

environment, creativity, openness to change, experimentation and anticipation are much appreciated by these team members. Control from above is neither possible nor required, and management expects commitment and involvement of employees.

3. RESEARCH DESIGN

The concepts outlined in the previous section provide the framework for the analysis of team dynamics in academic spin-out companies. Since entrepreneurial team formation and development remains a complex and largely under-explored area, we were unable to formulate clear-cut hypotheses *ex ante*. Instead, we adopt an inductive multiple-case research design. This enables a replication logic in which the cases are treated as a series of independent experiments (Yin, 1994). Multiple cases are generally regarded as more robust than single case studies, in that comparisons across cases allow for a higher validity in the development of findings and a consideration of their context dependency (Yin, 1994). The level of analysis is the spin-out process and the unit of analysis is the entrepreneurial team, as people enter and exit the project/new venture at different stages.

3.1 Case selection

The research comprises a detailed field study of 10 academic spin-out projects located in Flanders. Flanders is a small, export-intensive economy located in the northern part of Belgium. It is considered to be an emerging high-tech region, experiencing a fast process of convergence between old and new technologies and thereby improving its competitive position (Cantwell & Iammarino, 2001).

Flanders has a population of 6 million and about 2 researchers per 1000 inhabitants (OECD, 2003). In total, there are nine public research organizations of which three are research institutes (IMEC, VIB and VITO)¹ and six are universities (UG, VUB, KUL, LUC, UA and KUB)². In total, 93 companies emerged from Flemish Public Research

¹ IMEC, Inter University Micro-Electronics Center; VIB, Flemish Institute for Biotechnology; VITO, Flemish Institute for Technological Research.

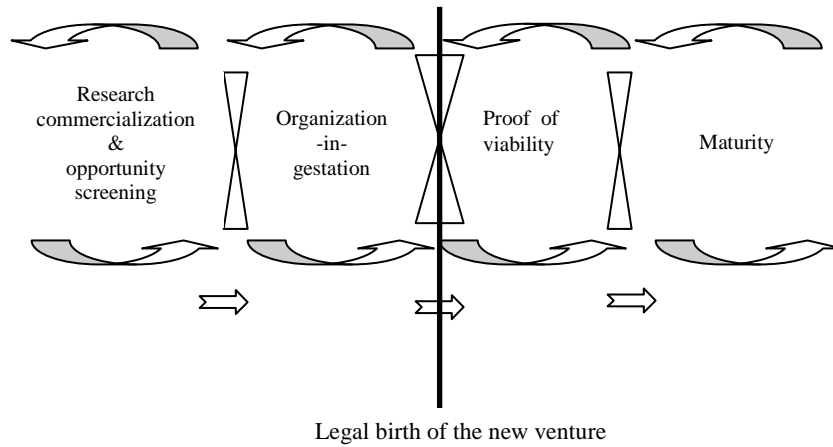
² UG, Ghent University; VUB, Vrije Universiteit Brussel; KUL, Katholieke Universiteit Leuven; LUC, Limburgs Universitair Centrum; UA, Universiteit Antwerpen; KUB, Katholieke Universiteit Brussel.

Organizations from 1991 to 2002. The majority of the population of academic ventures, are pure spin-outs (56% or 52 companies), i.e., companies that started their activities on the basis of a formal transfer of technology from the parent institute. The academic start-ups that started their activities on the basis of university research, but without formal transfer of technology at time of founding, represent almost 41% of the total (n=38). Of the 93 starters, almost 70% emerged from the universities (Moray, 2004).

The commercialization of research through the creation of a spin-out takes a long time (Vohora et al., 2004; Clarysse & Moray, 2004). A longitudinal study of spin-out processes was, however, beyond the available resources of our study. Instead a longitudinal-processual approach was adopted (Pettigrew, 1979; Burgelman, 1983). We selected 10 projects or new ventures to be included in our analysis that were stratified in particular stages of their development in the spin-out process. Vohora et al. (2004) identify five phases which spin-outs encounter in their development: (1) research phase; (2) opportunity framing phase; (3) preorganization phase; (4) reorientation phase; and (5) sustainable returns phase. At the interstices between the different phases of development, they identify four critical junctures that spin-out companies need to overcome if they are to succeed: opportunity recognition, entrepreneurial commitment, credibility, and sustainability. Clarysse and Moray (2004) came to a similar classification of stages: a research phase, a phase during which the project prepares itself to formally incorporate into a spin-out, and a stage during which external capitalization takes place. Vohora et al. (2004) add a phase, including the time frame during which second and third capital injections take place. We operationalized their delineation of the different stages in the spin-out process by taking their research phase and opportunity framing phase together as the first phase in the spin-out process, while using a comparable delineation for the other successive developmental phases. More in particular, we identified the following four phases: (1) research commercialization and opportunity screening; (2) the organization-in-gestation phase; (3) proof of viability of the newly established venture; and (4) the maturity phase, as depicted in Figure 1. Following Vohora et al. (2004) we stress that each venture must pass through the previous phase in order to progress to the next one, but each phase involves an iterative, non-linear process of development in which there may be a need to revisit some of the earlier decisions and activities. This is consistent

with other recent research by Druilhe and Garnsey (2004) which suggests that the phases that a spin-out passes through are characterized by the modification of business models in the light of the maturity of the entrepreneurs' initial resources and their improving knowledge of resources and opportunities.

Figure 2.1: Phases in the spin-out process



Cases were selected based on these four predefined stages, with at least two cases selected for each stage (Eisenhardt, 1989). The projects in the first two stages were selected based on contacts with technology transfer offices, which helped us to obtain some understanding of which projects seemed to be potential spin-out opportunities. The companies in the last two stages were selected based on a listing of spin-outs in Flanders.³ To discern whether the new ventures showed proof of viability or had reached maturity the founders/CEOs were contacted. Table 2.1 gives an overview of the sample used for our study.

³ Steunpunt Ondernemingen, Ondernemerschap en Innovatie, 2004.

Table 2.1: Case description summary

Phase in spin-out process at present	Spin-out project/ venture name	Start up	Technology	Starting capital	Parent Organization	Link with parent
Research commercialization & Opportunity screening	Project 1	Not yet	Fast fluids	Not available yet.	VUB ⁴	Still at university Patent filed
	Project 2	Not yet	Snails	Not available yet.	UG	Still at university Patent filed
Organization-in-gestation	Project 3	Not yet	Plasma technology	Not available yet.	UG	Still at university Patent
	Project 4	Not yet	Chip integrated circuit	Not available yet	VUB	Still at university Patent filed
Proof of viability	Firm 1	2001	Toxins detection in food	375.000€	UG	Patent brought in
	Firm 2	2001	Inorganic phosphate cement production	62.000€	VUB	Exclusive license & Royalties payment
	Firm 3	2002	In vitro bioassay systems	450.000€	VUB	Exclusive License
	Firm 4	2002	Identification of novel active molecules	600.000€	IMEC	Patents brought in
Maturity	Firm 5	1992	Simulations of streams of substances	62.000€	VUB	Royalties payment
	Firm 6	2000	Develops infrared image sensors	3.75mio€	IMEC	Exclusive license

⁴ VUB, Vrije Universiteit Brussel; UG, Ghent University; IMEC, Inter University Micro-Electronics Center.

For the first phase, we selected teams that were working on a research project and saw a market opportunity. Teams were selected that had got in touch with the technology transfer officer (TTO) in order to protect their intellectual property and had recently filed or obtained a patent. At the time of the study, these teams were considering the options they had to commercialize their intellectual property. Pursuing a spin-out trajectory was only one option being considered.

The cases used to analyze the second phase have identified a market opportunity and have decided to create a spin-out. In the third phase, teams are considered that have legally founded a new venture and have brought together the necessary resources to develop it. Attracting financial resources is a central issue in this phase.

Ventures showing persistence were identified as cases in the maturity phase. The teams in this phase have proven their viability and moved to building up maturity and sustainability. These ventures have built up credibility outside the scientific community and have been able to attract additional resources, amongst others financial ones, to carry out their growth.

3.2 Data collection

Data were collected using different methods and tools. For each selected team, the contacts were highly personalized, leading to first-hand data on the team and ensuring a high response rate (Nicolaou & Birley, 2003). First, for the projects still located at the university, the head of the research team was contacted to provide data on the research and the team involved. Our questionnaire was handed to the head of the research team and appointments were made to collect the questionnaires. For each selected formally incorporated venture, either the founder or CEO was asked about the start-up history of the firm and particularly how the team evolved over time. This helped us to understand the context of how teams were formed and evolved. During these interviews we also asked for the exit / entry dates of individuals involved (Ucbasaran et al., 2003). The founder or CEO was handed the questionnaire and appointments were made to collect the questionnaires.

Second, for those teams still in the project stage, all members of the research team were asked to fill out the questionnaire. Each member of the management team of the formally

incorporated ventures was asked to fill out the questionnaire. This individual questionnaire consisted of two parts. The first part asked for background information, such as education and experience. The second part was aimed at the identification of the personal orientation required to realize venture success. This questionnaire was based on the Focus questionnaire of Van Muijen et al. (1999).

Third, we collected background information on all individuals entering and exiting the team in terms of age, gender, education, experience, etc. This allowed us to evaluate the experiential diversity of the team at the different stages during the spin-out process.

The number of persons filling out this survey ranged from two to eight, depending on the phase in which the project / venture was positioned (a venture that has reached maturity, will be older and more prone to team turnover). It should be stressed, however, that instead of one representative responding on group features, all the members of the entrepreneurial team were involved in our study. In some cases the researchers' patience was put to the test in their efforts to urge the team members to fill in the questionnaire.

For the mature projects, we followed Burgelman's approach (1983) and reconstructed the life histories of the companies, focusing on team formation, development, and turnover. For each phase, we combined both cross-sectional analysis (experiential and cultural diversity) and retrospective analysis (cultural diversity and turnover), resulting in a higher external validity.

As previously noted, the starting point of our research is that teams are not immutable entities but evolve over time and over the different stages of the spin-out process. Changes in the composition of the teams will bring about changes in their characteristics. We conjecture that when individuals join a team at some stage in the spin-out process, they bring more heterogeneity to the team. Moreover, this increased heterogeneity occurs on two levels: the experience available in the team and the perception among the team members of the needed strategic orientation in order to realize new venture success.

Following Ucbasaran et al. (2003), Teachman's (1980) scale was used to measure heterogeneity of categorical variables: $(H) = -\sum P_i (\ln P_i)$. This measure takes into account how team members are distributed among the different categories of a variable. The total number of categories of a variable equals n , and P_i is the fraction of team members falling into each category. For experience heterogeneity, the categories taken into account were:

(1) research and development, (2) marketing, (3) management, (4) consulting and engineering, and (5) other experience (e.g., legal). In the case of heterogeneity of entrepreneurial experience, yes (1) and no (0) were used.

We assume that the further along the spin-out process a team is, the more heterogeneous the team's perceptions of the strategic orientation necessary to realize new venture success will be. It should, however, be stressed that we did not aim to identify the most optimal strategic orientation for venture success. For the identification of the heterogeneity in the perceived strategic orientation needed for new venture success, a questionnaire based on the research of van Muijen et al. (1999) was used.

The literature previously cited has taken a very simplistic view of venture performance, defining it as "success" or "growth" at a certain point in time. As such, a snapshot is taken of the team composition at that point, and a link is made with performance. However, as noted earlier, teams are not a static concept (Ucbasaran et al., 2003). Also, success is not a static concept. Heirman and Clarysse (2004) describe success of a venture in terms of reaching a well-defined number of "entrepreneurial events". The success of a start-up can, for instance, involve being able to attract venture capital, whereas the success of a three-year-old venture can mean reaching the break-even point. In this paper, success of a venture is described in terms of reaching well-defined entrepreneurial events in the spin-out process, i.e., each of the four phases of development identified earlier.

4. FINDINGS

This section analyzes how the entrepreneurial teams evolved over the different stages of the spin-out process. A detailed description of the different team features as they evolve through the different phases of the spin-out process can be found in Table 2.2. In taking a team focus in each phase in the development of a spin-out, the team dynamics were identified. Our research found that the composition of the team evolves as the different phases in the development of the spin-out are reached. Moreover, our study indicates that team turnover is linked with the different entrepreneurial events in the spin-out process. The dynamics of entry and exit are a result of the ambition of the team to attain the next milestone in the evolution of the venture. Before paying attention to the drivers of team

entry and exit, we first consider the evolution of the team through the different phases of the spin-out process and its implications for the concept “team”.

Table 2.2: Team turnover features in the different phases of the spin-out process

Case study	Research commercialization & opportunity screening	Organization in gestation	Proof of viability	Maturity
Project 1	<p>Team of eight researchers</p> <p>Privileged witness : TTO</p> <p>Contacts with potential industrial partners are positive, but main focus lies on strengthening research.</p>	<p>The spin-out has not yet entered this phase.</p>	<p>The spin-out has not yet entered this phase</p>	<p>The spin-out has not yet entered this phase</p>
Project 2	<p>Team of three researchers</p> <p>Privileged witness : TTO & coach</p> <p>Research commercialization through the creation of a spin-out was abandoned because of high perceived risk and limited market.</p>	<p>The spin-out has not yet entered this phase.</p>	<p>The spin-out has not yet entered this phase</p>	<p>The spin-out has not yet entered this phase</p>

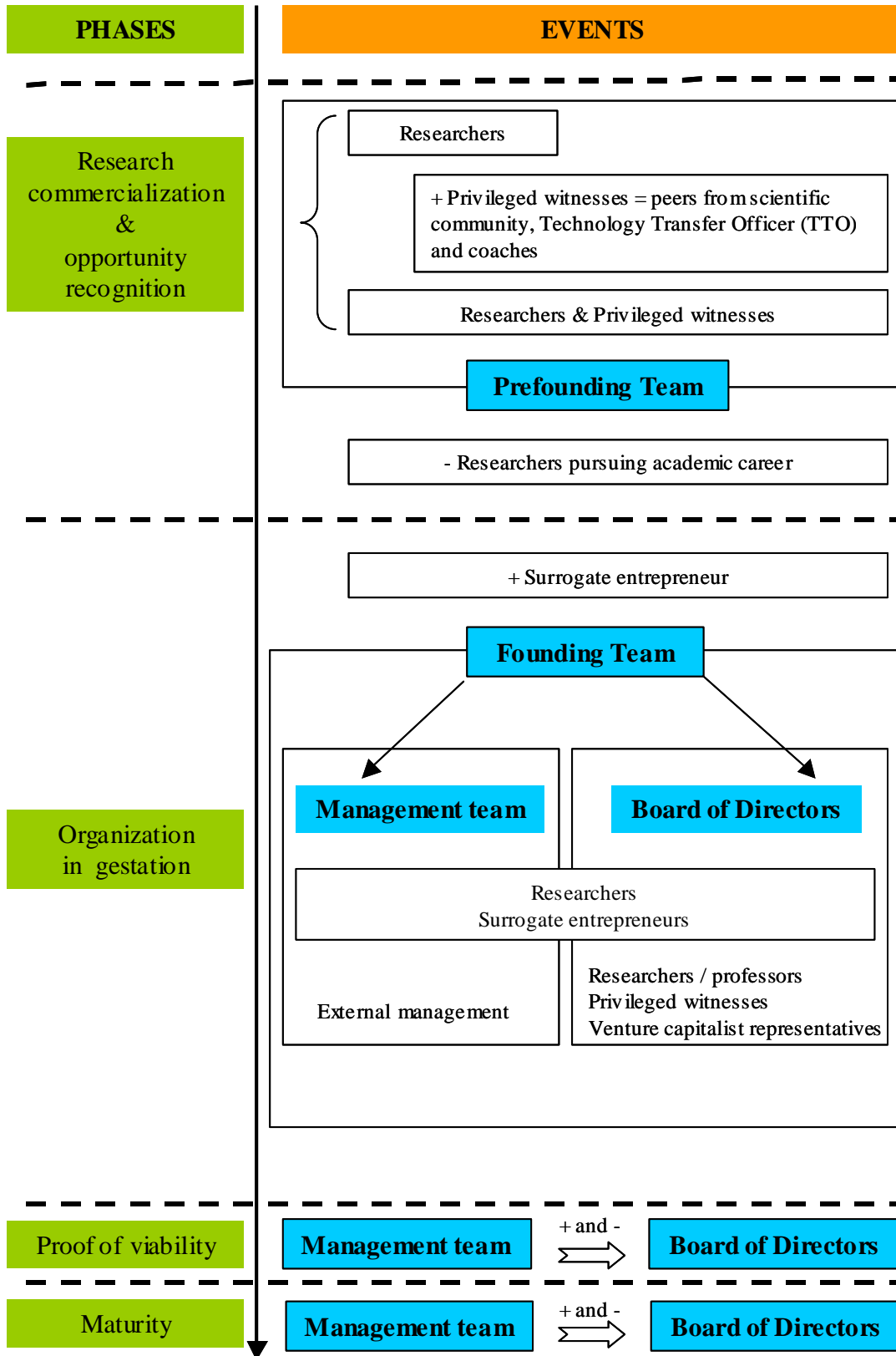
Project 3	<p>Team of two researchers</p> <p>Privileged witness : TTO & coach</p>	<p>A business developer entered the team, who would become the manager of the spin-out. The spin-out is still in gestation, as it was decided to perform more research in cooperation with the textile industry.</p>	<p>The spin-out has not yet entered this phase</p>	<p>The spin-out has not yet entered this phase</p>
Project 4	<p>Team of three researchers</p> <p>Privileged witness : TTO</p>	<p>Two part-time business developers were attracted to screen the market opportunity and prepare the business plan. Only one business developer formally entered the team yet. He will become the CEO of the new venture.</p>	<p>The spin-out has not yet entered this phase</p>	<p>The spin-out has not yet entered this phase</p>
Firm 1	<p>Team of three researchers</p> <p>Privileged witness : TTO & coach</p>	<p>A surrogate entrepreneur entered the team and was the driving force behind the creation of the new venture. He became the CEO.</p>	<p>The CEO exited the new venture. The original leader of the research team became the interim CEO. Shortly afterwards a new CEO entered the team. Besides, a business developer entered the team.</p>	<p>The spin-out has not yet entered this phase</p>
Firm 2	<p>Team of multiple researchers.</p> <p>Privileged witness : TTO</p>	<p>The head of the research department saw several market opportunities. He teamed up with a colleague researcher. Besides, a surrogate entrepreneur and business developer entered the team to pursue these opportunities.</p>	<p>One of the original founders exited the team shortly after the legal establishment of the new venture.</p>	<p>The spin-out has not yet entered this phase</p>

Firm 3	<p>Team of two researchers</p> <p>Privileged witness : TTO</p>	<p>A privileged witness, coach, was attracted to advice on the creation of the new venture.</p>	<p>One of the researchers became the CEO. The other researcher stayed at the university, is not a member of the management team, but is a member of the scientific advisory board. A business developer entered the team.</p>	<p>The spin-out has not yet entered this phase</p>
Firm 4	<p>Team of multiple researchers.</p> <p>Privileged witness : TTO & coach</p>	<p>Besides the main researcher, two more people are attracted by the parent institute to create an incubation venture. One team member exited before the spin-out became established as the current legal entity.</p>	<p>An extra manager entered the team to enforce the remaining two founders in the management team.</p>	<p>The spin-out has not yet entered this phase</p>
Firm 5	<p>Head of research department takes the lead in the screen market opportunities.</p>	<p>Head of research department takes the lead in the creation of the new venture.</p>	<p>The attraction of venture capital was translated into external management entering the team. Besides, the head of the research department became the president. An employee became the general manager.</p>	<p>Members of the management team obtain shares in the venture.</p>
Firm 6	<p>Team of multiple researchers at parent organization, who are still working as researchers at the parent institute.</p> <p>Privileged witness : TTO & coach</p>	<p>Parent organization driving force behind spin-out : attraction of four surrogate entrepreneurs to build spin-out organization</p>	<p>The four surrogate entrepreneurs form the management team.</p>	<p>One founder-surrogate entrepreneur has exited the team, his tasks are taken over by one of the remaining managers.</p>

4.1 Team evolution

In Figure 2.2, team evolution is identified for each of the different phases in the development of spin-outs. Figure 2 shows that the concept “team” evolves through the different entrepreneurial events in the spin-out process.

Figure 2.2: Team evolution



Phase 1: At the core of every spin-out lies research. Research activities are mostly performed within a department or research team. In order to strengthen their research, researchers get in touch with peers in their scientific community. This may even result in joint research projects. At some point, researchers may find it necessary to protect their intellectual property when they want to bring their research results to society as a whole. In order to do so, they will get in touch with the technology transfer officer (TTO) who guides the researchers through the procedures for filing patents. These contacts with the TTO are often a way to get information on how to commercialize the intellectual property built up within the research team. As mentioned earlier, establishing a spin-out is only one trajectory through which research can be commercialized. When a market opportunity is identified, the researchers are surrounded by peers, the TTO and coaches. For the screening of the market opportunity and in order to map out potential market opportunities, the researchers may rely on coaches or consultants. At this stage, these people take on an advisory function in the spin-out trajectory. We call these people *privileged witnesses* because their involvement in the creation of the spin-out implies a certain distance from the creation activities. The researchers and the privileged witnesses form together the *pre-founding team*. However, in this phase of the spin-out, the researchers play an active leading role in the team, while the privileged witnesses tend to perform a coaching role. In some cases, the TTO of the parent organization⁵ initiates the screening of the market opportunity and opts for a commercialization trajectory through a spin-out.

Phase 2: Once the decision is taken to create a new venture, the pre-founding team evolves to the second phase in the spin-out's development. In this phase, the researchers have made the decision to pursue the creation of a spin-out. However, not all researchers will actively aspire to spin-out a new venture and some will leave the pre-founding team, typically opting to pursue a full academic career. In some cases, the researchers or the TTOs may find it necessary to attract a surrogate entrepreneur. This surrogate entrepreneur plays an active and leading role in the legal establishment of the new

⁵ For an in depth analysis of IMEC, see Moray and Clarysse (2005).

venture. The researchers and the surrogate entrepreneurs actively pursue the establishment of the new venture and are therefore considered as the *founding team*.

Once the new venture is legally established, two major teams come into existence: the management team and the board of directors. The researchers may be a member of the management team or the board of directors, or both. In most cases, the researchers are members of the management team and the board. This situation is comparable for the surrogate entrepreneur. The privileged witnesses from the first phase, the TTO and the peers from the scientific community, may have a seat on the board but are less likely to be in the management team. In this phase, their role is more formalized since the interests they protect are more pronounced. The TTO represents the research institute or university who brought in intellectual property, and the peers may continue their advisory function as a member of the board of directors or the scientific board. Other members of the board of directors can be the coaches from the previous phase in the development, who bring in counseling in exchange for equity. However, the board of directors may include representatives from financial partners like venture capitalists or seed funds from the university or research institute.

Phase 3: In the third phase, the management team and the board strive together to strengthen the viability of the new venture. In order to do so, it may be necessary to attract additional external financial resources through venture capitalists. This may imply a change in the composition of the board. Also, a change in the composition of the management team may take place, as the venture capitalists may appoint a CEO or a business developer. However, some financial partners may withdraw from the new venture and, accordingly, their representatives leave the board. Furthermore, members of the management may obtain shares and may even take their seat on the board. Usually, these members are external people attracted into the venture, who initially have options or warrants to become shareholders after a while and then eventually even take up a seat in the board.

Phase 4: In order to grow into maturity, the new venture may have to attract additional financial resources through several rounds of venture capital. This may have implications for the board as well as the management as previously described.

When the evolution of the teams over the different phases of the spin-out process is considered and the different roles performed by the team members are analyzed in depth, our cases indicate that for post-start-up teams, the marking out of the different roles is more pronounced than for pre-start-up teams. This is reinforced by the fact in post-start-up teams, more formal terms are used to indicate the roles that are performed within the team: the pre-start-up researcher, who appeared to combine different roles at the same time, becomes the CEO, with (apparently) a clear-cut role. The role of the privileged witnesses maintains its advisory character throughout the spin-out process, but becomes formalized with the establishment of the board: TTOs take their seat on the board of directors, making their commitment to the spin-out formal.

To summarize, our in-depth case analysis shows that the dynamics of the team taking the new venture from research to a mature growing firm call for clear distinctive team concepts. In our study, the pre-founding team, being the researchers taking the lead in the spin-out process, guided by privileged witnesses (e.g., the TTO, peers and coaches) identify together the market opportunity. Afterwards, a surrogate entrepreneur may be attracted. Together with the researchers, they form the founding team and actively pursues the legal establishment of the firm. Once the firm is legally created, the boundaries of the founding team disappear and evolve into two other teams which may overlap: the management team and the board. Mostly, the researchers leading the spin-out trajectory have a position in the management team and a seat on the board of directors. Others, such as the privileged witnesses, usually become members of the board of directors. The latter joins together representatives of suppliers of all human, technological, and financial resources brought together to establish the new venture, like for instance the TTO and the venture capitalists. Proving its viability and further growth into maturity is often brought back to the attraction of external financial resources, imposing a change in the composition of the board of directors and potentially the management team.

A key issue relating to team evolution is whether the people attracted into the new team bring a different experience and way of looking at doing business to the start-up. This analysis is the subject of the next section.

4.2 Changes in team composition

We focus on the pre-start-up and the post-start-up stages as the legal founding of the new venture appears to be the most important milestone in team evolution.

Table 2.3: Heterogeneity analysis of the team^{6 7}

	Pre-start-up Mean Median Stdev	Post-start-up Mean Median Stdev
Size of team	4.5 3.5 2.3	3.5 3 1.2
Experiential heterogeneity	0.74 0.74 0.37	1.14 1.17 0.30
Entrepreneurial experience heterogeneity	0.33 0.32 0.38	0.31 0.25 0.35
Cognitive heterogeneity ⁸	1.24 1.25 0.02	1.27 1.28* 0.05
Innovation	28.13 28.02 1.06	30.04 29.67** 1.11
Support	28.77 28.88 0.63	28.33 28.67 1.79
Rules	19.45 19.25 2.01	21.23 23.40 4.68
Goals	27.45 27.79 1.83	29.14 30 2.52

Significance levels: $p < 0.1^*$; $p < 0.05^{**}$

⁶ Mann-Whitney U test was used to identify differences between pre- and post- start-up teams.

⁷ For the experience, entrepreneurial experience and cognitive heterogeneity Teachman's scale (1980) was used.

⁸ Detailed median data is included per orientation (Min = 7, Max = 35).

The size of the team does not change significantly before and after the legal founding of the new venture (Table 2.3). Detailed case analysis shows that some teams experience exit of team members, while other teams were reinforced by additional team members. Some teams start-up with what appears to be too many founders, and some leave the team. Others start-up with too few and attract some new members. Considering the impact of team changes on heterogeneity of team membership, we identify the following developments:

Experiential heterogeneity: Teams active in the first phase of the spin-out process appear to be unbalanced in terms of experience. Their experience is highly concentrated in research and development. Teams having decided to actively pursue the creation of a spin-out, however, show a broader range of experience. This is reinforced in later stages of the spin-out process. Moreover, we found that the experience of the team members is more balanced the further they move through the spin-out process, as expected.

Entrepreneurial experience heterogeneity: Teams in the first phase of the spin-out process, which are still deciding how to commercialize their knowledge, show a lack of entrepreneurial experience. Once the decision is taken to create a spin-out, team members are attracted to the team that may have entrepreneurial experience. After the legal establishment of the firm, no clear finding on the nature of entrepreneurial experience was identified. Both extreme situations, of highly experienced and complete novice teams, were found. It is perhaps counter intuitive that complete novice teams do not attract entrepreneurial experienced people. Fully experienced start-ups teams more often make the choice to attract a manager who does not necessarily have entrepreneurial experience. However, the results remain inconclusive.

Cognitive heterogeneity: We assumed that the further along the spin-out process a firm is, the larger would be cognitive heterogeneity of the team in terms of the perceived

necessary strategic orientation.⁹ Our assumption was that start-up teams would be homogeneous, but new members would introduce another perspective on how to do business. For instance, researchers tend to be support and innovation oriented, often lacking goal orientation and avoiding bureaucracy (rules orientation). We supposed, therefore, that when teams were formed further along in the process, the newly attracted members would bring in these different values. We did not, however, find that the team became more heterogeneous. Instead, post-start up teams seem to show significantly less cognitive heterogeneity than pre-start-up teams in contrast to what might be expected.

Looking at the individual orientation of the new members in the team after the legal start-up of the new venture, we observe that the newcomers are also significantly innovation oriented and therefore reinforce the cognitive homogeneity of the team. This may be related to the fact that researchers usually prefer to recruit those people whose way of looking at a business is very close to theirs. As they are often leading people in their own domains, they may find it difficult to appreciate the values of people looking at the business in a totally different way. Another explanation for the reinforcement of the cognitive homogeneity of the team might be found in the involvement of the TTO in the attraction of new members to the team. These newcomers are often recruited from the TTOs' personal network of people whose way of looking at a business is likely very close to their own.

When looking in detail at the strategic orientation of the additions to the team at the different stages of the spin-out process, we expected that these people, who were mostly business developers, would show a more pronounced goals orientation for their strategic orientation than the other team members. This was not supported by our cases. In most cases, their goals orientation was similar to the other team members. Indeed, in one case the business developer had even less goal orientation. We find that it is visionary people in particular who are attracted that get along well with the researchers at a cognitive and strategic level. However, cognitive conflict is assumed to have a positive effect on strategic decisions and performance (Amason and Sapienza, 1997; Ensley et al. 2002). The lack of cognitive conflict in spin-out teams may explain their long incubation time

⁹ We examined the strategic orientation of individual team members versus the teams' strategic orientation but no clear differences emerged; the results are therefore not reported here.

and the difficulties experienced in changing their business model to obtain sustainable growth levels.

To conclude, our cases show that people attracted to the teams had different experience from the original team members, but they showed a comparable strategic orientation, leading to more cognitive homogeneity in the team.

4.3 Drivers of team turnover

Our research shows that irrespective of the specific phase considered, there is a clear distinction between the drivers leading to team exit and entry. The reasons why people leave the team are related to conflict. A distinction can be made between intrapersonal and interpersonal conflict as drivers leading to team exit. Intrapersonal conflict concerns one individual person. Interpersonal conflict implies different persons, in our cases, the different team members. A team exit caused by the fact that the personal ambition of a team member cannot be reconciled with the ambition of the venture is an example of an intrapersonal conflict. Conversely, a team exit caused by conflict over the strategy regarding how the firm should realize its ambition and the implementation of the strategy is an example of interpersonal conflict. Interpersonal conflict, in its turn, comprises cognitive and affective conflict. Although previous research (Amason & Sapienza, 1997; Ensley et al., 2002) found cognitive and affective conflict to be positively related to one another, our case analysis suggests that affective conflict outweighed cognitive conflict and led to the decision to leave the team. Moreover, our case analysis indicated that when people left the team, negative aspects of conflict were a common denominator.

However, we do not suggest that the people remaining in the teams are free of any kind of conflict. Moreover, as indicated by Eisenhardt et al. (1997), conflict can be beneficial if effectively handled. We now highlight aspects of beneficial conflict in the teams. For instance, in the case of Firm 4, beneficial conflict in the team, expressed in several discussion rounds and disagreements as a result from differences in perspectives, has led to a major change in the firm's strategy. The original product was the delivery of tools that facilitate the research process in the pharmaceutical and biotech industries. However, the entrepreneurs learned that some pharmaceutical companies do not want to outsource their screening, so they decided to also sell the tool enabling firms to design their own

experimental designs. Recently, Firm 4 adjusted its business plan since it became clear that also, the food industry and the chemical market can use their tool. A detailed analysis of conflict in entrepreneurial teams is an interesting research path; however, it lies beyond the scope of this study.

The drivers leading to team entry have a need for resources in common. Team entry can be the result of the attraction of additional human, technological, or financial resources. The ambition to reach the next step in a firm's life-cycle may call for a reallocation of existing resources. However, the need to attract supplementary resources is far more common. For instance, when technological know-how is brought into the firm through a patent owned by the university, the TTO can become part of the team. The attraction of specific human resources, for instance a surrogate entrepreneur, leads to addition to the team. Additional financial resources may be found internally in the firm. However, mostly they call upon external financing. This is often found by attracting venture capital. Attracting venture capital has implications for the team since the venture capitalist takes a seat on the board of directors and often appoints a new member of the management team, for instance, a CEO.

Changes in the composition of the team have an impact on the different roles performed by the team members. When people are added to the team, existing roles can be split up, refined and performed by more people or new roles were identified and filled in by the additional team member. On the other hand when people leave the team their role is transferred to one or more of the remaining team members.

5. CONCLUSIONS AND DISCUSSION

Using novel, hand-collected data comprising all venture team members, this paper has built on the upper-echelon perspective to analyze the effects of team dynamics on new venture performance of academic spin-outs. In the literature under the upper-echelon perspective the relationship between teams and firm performance has been studied. Ensley and Pearce (2001) also build on this upper-echelon perspective to develop a theoretical framework that links shared strategic cognition in top management teams to group process and new venture performance. Another stream of research positioned within the literature on organizational culture has, in a parallel way, analyzed the underlying dimensions of what Ensley and Pearce (2001) referred to as shared strategic cognition. Based on Quinn's (1988) competing values model, Van Muijen et al. (1999) identify extreme types of orientation toward how a team should ideally work. Four different types of orientation were identified: the support, innovation, rules, and goals orientation. We use Van Muijen et al.'s. (1999) four orientations to measure heterogeneity in the perceived strategic orientation needed for new venture success.

We built upon these insights to perform an in-depth analysis of different spin-out teams. This analysis has led to several new insights on *how* entrepreneurship is infused into ventures through the evolution of teams as they take the spin-out from research to an independent venture. At the start of the venture formation, we proposed that a new team role, which we describe as the *privileged witness*, is important in affecting the successful development of the venture. This role might be specific for spin-outs, which are coached by dedicated persons at their parent organization. In line with previous studies, our research shows that not all researchers involved in the original research activities and identification of the market opportunity are actively involved in the spin-out today. Indeed, the members of the team change as the spin-out evolves. Our findings led us to propose that some researchers that are actively involved in the first phase of the spin-out process, where the market opportunity is identified, do not show the entrepreneurial commitment to create the spin-out and leave this spin-out process before the formal creation of the spin-out. That is, they make a career choice to stay with the parent

organization. The decision to stay with the parent organization may be the result of the philosophy of the parent institute since the combination of full academic tenure and a position in a venture are restricted by the parent institute. Alternatively, our findings also led us to propose that researchers may leave the spin-out during the phase in which the spin-out has to prove its viability since they found it was taking too long. With our cases, we were able to propose that once the spin-out has survived this third phase, the researchers stay and take the spin-out to maturity. In other cases, surrogate entrepreneurs are attracted to set up the venture.

Second, we provide an important extension to previous research, which has tended to view team development in a static framework, in that different teams are considered in a certain moment in time, whereas we take into consideration the same teams at different moments in time, and by doing so we take a dynamic perspective that covers different phases in the venture's development. Next to teams, success is not a static concept. We describe success in terms of reaching well-defined entrepreneurial events in the spin-out process. In particular, we analyze the team structure before and after formal start-up of the venture. In line with expectations, we found that new team members brought in different kinds of experience. Especially, recruits with commercial background are appreciated. However, contrary to our expectations, these newcomers did not have a different view on doing business from the initial founders of the new venture. Hence, these findings lead us to propose that new entrants to spin-outs will reinforce shared cognition. This is surprising since the degree of shared cognition has been shown elsewhere in the literature to have mixed effects on performance. In other words, cognitive conflict is sometimes necessary to make strategic decisions and increase venture performance.

This study suggests a number of areas for further research which derive from some of its limitations. The selection of the cases included in our study was based on the stage in which they are active in the spin-out process. Druilhe and Garnsey (2004) identify three types of spin-outs which may evolve through a range of business models: (1) companies based on novel scientific breakthroughs where resource creation and opportunity recognition are interdependent, (2) product companies involving opportunity recognition that builds on the scientist's knowledge and connections, and (3) software companies.

These different configurations and evolutionary paths may have implications for the evolution of the entrepreneurial teams involved. As we have noted, this study focused on the first category. Given the nature of the firms in our sample, our cases represent a continuum. The micro-electronic firms (Firm 4 and Firm 6) and the technological test equipment firm (Firm 1), which represent the two ends of this continuum, lead us to conclude that the lead time is determined by the technology transfer officers. They have the tendency to speed up the spin-out trajectory for complex projects. However, they seem to slow down the spin-out trajectory of less complex projects since they impose the same procedures as for complex projects. Further research may usefully perform a cross-sectoral analysis using both qualitative data and statistical analysis in a large sample of spin-outs. A further potential feature of spin-out development concerns regression resulting from the 'reinvention' or reorientation of the venture along the way, or the possibility of merger of two ventures into one organization. These aspects were not covered in this paper but offer a further avenue for in-depth analysis.

We have focused on spin-out development in one geographical area. Different institutional environments that may be more or less munificent in terms of both the university context and the area surrounding a particular university may have different impacts on the availability of potential incoming team members as well as the alternative options available for academics. For example, Clarysse et al. (2005) identify different incubator models that may be applied in different contexts and may be associated with different types of spin-out. Team dynamics differ between these incubator models. There is, therefore, a need for further research that examines the development of teams in different institutional contexts. With the small number of cases examined and the focus on a limited set of issues, we were also unable to examine the relationship between financial aspects and expertise and team size. Further case studies may be used to address this issue. By examining a small number of cases, we have emphasized conceptual development rather than general empirical testing. There would appear to be scope for more large-scale testing of the insights generated in this paper.

The study examined different aspects of the spin-out development process, but the spin-outs involved were at different stages in their development. Although we adopted an approach that addressed this issue, there is a need for longitudinal studies that trace the

development of teams over time. However, obtaining access in such cases may present major barriers for research.

Finally, in terms of further research, our study has focused solely on academic spin-outs. There is, therefore, a need for studies that compare directly the development of academic spin-outs with the trajectory of similar non academic spin-outs. To what extent do differences in heterogeneity occur in such cases? To what extent does the availability of different networks and social capital affect the changing nature of heterogeneity in the team?

With respect to managerial implications, the study provides a number of insights into optimizing the management of the spin-out process and the spin-out ventures themselves. Primarily, we have shown the existence of “*privileged witnesses*”. They are involved in the start-up process of the company and have a very important stake in the subsequent composition of the founding team. They are often substitutes for the founder/entrepreneur and play an important role as sounding board for the entrepreneurs involved in the start-up process. Their presence and impact in the early stage of company development has both good and bad consequences. The good thing is that they make sure things happen. The bad thing is that by definition they are involved in starting up venture capital-backed start-ups. The privileged witness tends to look for a manager or business developer to introduce into the start-up. However, this kind of top-down approach usually requires some form of starting capital to enable these individuals to be recruited. Moreover, the privileged witness also regulates the IP (intellectual property) involvement of the university, which again makes a valuation and external capital injection necessary. The emerging question is whether bottom-up stimulation of entrepreneurship associated with organizational and cultural changes may be a more appropriate alternative way of creating spin-outs.

We also observe that in the early stages of spin-out formation, the composition of the founding team tends to undergo drastic changes. Surprisingly, while it may be expected that the changes will embody team diversity, they do not. In terms of “attitude” in particular, the team newcomers tend to be similar to the surrogate entrepreneurs-practitioners that are already in place. This recruitment of similar personalities may be inspired by the consensus building which takes place between the surrogate

entrepreneurs, who want to bring the technology onto the market, and the privileged witnesses, who usually have some power over the technology that they have developed. The privileged witnesses have to legitimize their own position and can seldom realistically propose somebody whom the entrepreneur does not like. The entrepreneur, however, does not evaluate the proposed person based upon purely economic arguments, but also takes more interpersonal aspects into account such as their ability to get along with the person or their personality. The latter seem to weigh more heavily than the economic arguments.

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