How do universities shape founding teams? Social proximity and informal mechanisms of knowledge transfer in student entrepreneurship

How do universities shape founding teams?

Social proximity and informal mechanisms of knowledge transfer in student entrepreneurship

Francesco Maria Barbini[1], Marco Corsino[2], Paola Giuri[3]
Department of Management, University of Bologna
Via Capo di Lucca, 34 40126 Bologna, Italy
[1] francesco.barbini@unibo.it, [2] marco.corsino@unibo.it (corresponding author), [3] paola.giuri@unibo.it

Abstract:

This paper investigates informal mechanisms of knowledge transfer (KT) from a local university to entrepreneurial teams comprising students and recent graduates. While the extant literature on university-industry KT largely focuses on formal mechanisms aimed at stimulating entrepreneurial initiatives in high-tech (HT) sectors, it overlooks the effect of university-industry KT on nascent entrepreneurship in low-medium tech (LMT) sectors. To fill this gap in the literature, we carry out a mixed-method analysis that exploits a dataset of 154 new business ideas (and 535 team members) presented at a business plan competition in Rimini from 2010 to 2017. Our findings highlight a robust relationship between educational field and the R&D intensity of entrepreneurial projects: students take advantage of the knowledge acquired at university to develop entrepreneurial projects with higher technological content than those planned by non-graduates. Furthermore, the empirical evidence shows that the local university nurtures the formation of ties among students and recent graduates enrolled in the same courses and fosters their efforts to launch new ventures. Finally, the qualitative analysis identifies relevant and non-traditional mechanisms of KT that are being exploited by nascent entrepreneurs to develop their business ideas in the LMT and HT sectors.

Keywords: Student entrepreneurship; Graduate entrepreneurship; Technology transfer; New firms, Founding teams

JEL classification: L26 (entrepreneurship); M13 (new firms, start-ups); I23 (higher education).

1. Introduction

For the last thirty years, universities have been making efforts to tear down the walls of their “ivory towers” (Etzkowitz et al. 2000). These efforts have pursued the "third mission", with a particular focus on the establishment of an entrepreneurship-supportive academic environment (Audretsch 2014). This environment translated into entrepreneurship-related degree programmes as well as systems and mechanisms for accelerating and incubating new business ideas and for fostering the transmission of academic innovations to businesses (Grimaldi et al. 2011).

These trends have been amplified by the growing recognition that policy makers have shown towards entrepreneurship, which is depicted as an efficient means for creating new jobs, fostering economic and social innovation, and recovering from economic crisis. Hence, public institutions have stimulated and funded university-based initiatives aimed at enabling entrepreneurship (European Commission 2012; European Commission 2013; OECD 2017).

Relevant literature has studied the strategies, analysed the data, and assessed the outcomes of these initiatives. Most of these studies focused on high-tech (HT) start-ups, created as a consequence of knowledge spillovers from universities. However, two important phenomena do not fall under this domain: (1) universities stimulate entrepreneurship not only through third-mission initiatives but also through their traditional mission of education and through the institutionalization and socialization of cultures and values favourable to entrepreneurship; and (2) most of the entrepreneurial initiatives developed in countries around the world fall into low/medium-technology (LMT) industries and do not involve innovations or radical changes in the sector of reference.

With respect to the first topic, it is necessary to highlight how non-entrepreneurial but domain-specific competencies (such as those stimulated by arts and humanities and scientific disciplines) engender the creation of new enterprises. In fact, the vast majority of new firms connected to universities are created by graduates who have never taken courses focused on or related to entrepreneurship (Fini et al. 2016; Teixeira and Forte 2017). In addition, the majority of knowledge transfers from universities to new firms occur through informal social relations between faculty and students and among students.

With respect to the second topic, evidence shows that in absolute numbers, low/medium tech start-ups largely outnumber high-tech ones and, consequently, their direct economic and occupational impact is strategic for the immediate competitiveness of any economic system (Hirsch-Kreinsen 2008; GEM 2017).

As a consequence, the extant literature, while greatly enhancing our understanding of the role universities play in stimulating the birth of high-tech and high-potential firms, underestimates the

overall contribution of universities to new-firm creation through the entrepreneurial initiatives of their students and graduates.

Indeed, a great deal of literature on university-industry knowledge transfer (KT) focuses on the role of technology transfer offices (TTOs) and incubators for supporting the commercial exploitation of research discoveries through patenting activities, licensing or spin-offs by faculty or in some cases graduates, mainly in high tech and science-based fields (Baldini et al. 2006; Cesaroni and Piccaluga 2016). However, nascent entrepreneurship is often inspired by incremental innovative ideas for services or manufacturing processes. In a panel study of entrepreneurial dynamics in the US, more than 95% of nascent entrepreneurship represents incremental changes in business activities (Reynolds and Curtins 2008).

In this entrepreneurial context, universities can nurture entrepreneurial spirit and opportunities by providing education useful to starting a new firm and through initiatives and informal mechanisms encouraging entrepreneurial attitudes and the transformation of entrepreneurial intentions into reality (Adekiya and Ibrahim 2016; Shirokova et al. 2016). Such mechanisms include peer advice among fellow students (Lerner and Malmendier 2011), faculty mentoring for the development of business ideas, entrepreneurship courses (Åstebro et al. 2012), positive local norms among students and faculty, and specific programmes for stimulating entrepreneurial behaviour (Maresch et al. 2016).

Proximity to relevant local resources also spurs innovation and entrepreneurial processes (Autio et al. 2014). Past studies have discussed mechanisms that facilitate innovation in geographically localized territories (Boschma 2005, Giuri and Mariani 2013). Local linkages can be especially relevant in provinces and low- and middle-tech sectors, while highly skilled people developing science-based innovations are more likely to use distant interactions.

In these milieus, the presence of local universities (Lazzeroni and Piccaluga 2015) and the emergence and promotion of non-traditional mechanisms of university KT (Giuliani and Bell 2005; D'Este et al. 2012) may complement local, territorially specific resources for spurring entrepreneurship and the economic development of territories. More specifically, the university also plays a role in the formation process of founding teams. Although the literature has investigated the diversity of educational level and disciplines in the composition of entrepreneurial teams of students and graduates (e.g.., Foo et al. 2005; Kaiser and Muller 2015), the contribution of the local character of the university to the homogeneity or heterogeneity of founding teams has been somewhat neglected. Indeed, the university may represent an effective institutional context acting as an aggregative force that facilitates the creation of founding teams.

Drawing on this literature, this paper focuses on local innovation systems characterized by a substantial presence of traditional, low tech, manufacturing and service sectors. The paper aims to

investigate how a university contributes to nascent student entrepreneurship and to identify the specific knowledge-transfer mechanisms that favour the development of entrepreneurial ideas and the creation of founding teams. More specifically, we investigate the extent to which the university creates conditions or social contexts that affect the homogeneous or heterogeneous composition of entrepreneurial teams of students and recent graduates.

The empirical analysis uses data on 154 entrepreneurial ideas presented at an annual business plan competition in the province of Rimini from 2010 to 2017, organized by a local association involving territorial institutions, industrial and business associations representing local companies, and the university. The majority of business ideas are in low- to medium-tech sectors, including agriculture, food, fashion, business services, and tourism. Business plans are presented by a team of at least three founders of the new companies. At the end of the competition, winning projects receive a financial award conditioned on the creation of a new firm in the local territory. Rimini is home to one of the campuses of Bologna University, and more than half of the founders of entrepreneurial teams received their education and training at the local university. These individuals are potentially exposed to knowledge-transfer mechanisms through university services and to resources from local territorial institutions.

Within this empirical context, we first develop a quantitative descriptive analysis of the characteristics of student and graduate entrepreneurs and of their teams in low-medium tech (LMT) and high-tech (HT) sectors. Using different measures of diversity, we study whether the university context facilitates the emergence of more homogeneous/heterogeneous teams. We also conduct a qualitative analysis of informal KT mechanisms based on interviews with 13 founders of 11 start-ups in LMT sectors and two startups in HT sectors selected from our sample.

Our findings highlight a robust relationship between educational field and the R&D intensity of entrepreneurial projects: students take advantage of the knowledge acquired at university to develop entrepreneurial projects with higher technological content than those planned by non-graduates. Furthermore, the empirical evidence shows that the local university nurtures the formation of ties among students and recent graduates enrolled in the same courses and fosters their efforts to launch new ventures. Finally, the qualitative analysis identifies relevant and non-traditional mechanisms of KT that are being exploited by nascent entrepreneurs in order to develop their business ideas in the LMT and HT sectors.

The remainder of the paper is organized as follows. Section 2 discusses the literature on informal technology transfer and on student and graduate entrepreneurship. Section 3 describes the empirical context, data and variables. Section 4 presents and discusses the findings of the descriptive statistics and of the qualitative analysis. Section 5 concludes the paper.

2. Theoretical background

This section discusses different studies on formal and informal mechanisms of technology transfer for entrepreneurship.

Within the literature on technology transfer mechanisms for sustaining entrepreneurship, most studies have examined formal mechanisms, such as the role of patenting and licensing university inventions that can be commercially exploited by starting a new firm, or the incubation of university spin-offs (see Rothaermel et al. 2007 for a survey of the literature). The propensity toward university licensing is higher when inventions are patent-protected, and spin offs for commercializing technologies are also more likely with patenting and licensing (Shane 2002a, 2002b; Thursby and Thursby 2002; Markman et al. 2005a, 2005b). Empirical evidence often relies on samples of patented university inventions and on universities with formal TTOs and TT managers, often in science and technology-based disciplines. The empirical context and results of the literature seem to indicate that in LMT sectors, there is a smaller share of actors using formal university TT initiatives.

Formal mechanisms are more appropriate for patent-based entrepreneurial ideas, and the share of university patents is higher in science and technology disciplines (Mowery et al. 2001). Traditionally, TTOs tend to provide opportunities for incubation by giving priority to ideas developed by university scientists who have already patented or licensed their technologies; TTOs also sustain innovative ideas in HT sectors. A smaller effort is devoted to incubating start-ups in LMT sectors, unless they originate from more recent and less widespread programmes designed to encourage student or graduate entrepreneurship.

However, a few diverse papers in the literature have explored less-formal channels for transferring useful knowledge from university to industry (Link et al. 2007; Grimpe and Fier 2010), which we broadly define as informal mechanisms of KT.

In line with the goals of this paper, we also draw on the literature that contributes to the understanding of the influence of university KT on the entrepreneurial behaviour of students and graduates and on the composition of founding teams.

2.1 Universities in local geographical areas and interactions with industry

A first set of informal mechanisms for KT is based on the role played by universities in local territories. These mechanisms may complement local, territorially specific resources, spurring the entrepreneurship and economic development of provinces and regions. Giuliani and Bell (2005) investigated the channels of KT in a LT sector, the wine industry in a Chilean cluster, and found that local investments in specialized knowledge workers with university education in technical fields

facilitated the application of new methods of production and experimentation with innovative ideas in the business environment. People with specific knowledge are more likely to absorb external useful knowledge by reducing cognitive distance (Cohen and Levinthal 1990) and to interact with peers who share common knowledge and language. These individuals also seek external consulting, share advice and develop relevant networking practices. Geographical proximity may also facilitate inter-personal knowledge flows within formal university-industry linkages such as research collaborations (D'Este et al. 2012). However, D'Este et al. (2012) find that when knowledge is transferred in dense clusters of knowledge-intensive and technologically complementary firms, university-industry research collaborations are a substitute for spatial proximity. This finding suggests that in areas with a lower agglomeration of knowledge-based actors, linkages with universities are indeed more relevant. Moreover, educated and specialized actors are more likely to absorb distant university knowledge spillovers (for a discussion, see also Giuri and Mariani 2013).

Recent works note the role of local universities in the territorial development of small provinces in Italy and Canada (Addie et al. 2014; Lazzeroni & Piccaluga 2015), which have adapted the ivory tower model of successful areas such as Silicon Valley. Addie et al. (2014) note that universities, in addition to providing innovation infrastructure and well-educated workers, produce lower monetary value but high social innovation impact, particularly in less technologically intense activities.

Other studies, especially those dedicated to informal mechanisms of university KT and entrepreneurship, highlight some specific channels of interaction between university actors and startups or industry personnel. Informal technology transfer mostly involves varied forms of personal interactions and informal communication processes (Grimpe and Fier 2010).

Link et al. (2007) empirically analyse the characteristics of informal technology transfer mechanisms in a sample of university scientists and engineers holding PhDs at Carnegie doctoral/research universities by focusing on the transfer of commercial technology, joint publications with industry personnel and consulting. Grimpe and Fier (2010) analyse the same mechanisms in a sample of university scientists with PhDs in Germany. The authors add dummies for disciplines and find that engineering scientists are more likely to use all three forms of informal technology transfer compared to the baseline dummy of social scientists.

These mechanisms often complement formal mechanisms of technology transfer (Link et al. 2007, Perkmann and Walsh 2007; Grimpe and Hussinger 2008; Bruneel et al. 2010). However, they may also be a substitute when formal mechanisms are more difficult to use or are less appropriate. Indeed, most of these studies focus on samples of university scientists with a PhD in science and engineering, where formal technology transfer mechanisms are more likely to be used. However, the evidence is less clear on the use of informal mechanisms in fields with lower degrees of science and technology

intensity. The study by Meyer-Krahmer and Schmoch (1998) compares university-industry interactions in different science-based industries. Within these industries, the authors find that in mechanical engineering, which is characterized as less science-based than other fields, university-industry interactions are very frequent, which can also be attributed to the intense use of formal mechanisms such as university patenting.

Another important channel of technology transfer is the movement of people and specifically the hiring of students. However, Berkovitz and Feldman (2004) recall that the placement of students requires more informal channels and effort by entrepreneurial universities, which need to provide scientific apprenticeships and intensive professorial mentoring to their students.

In summary, different informal mechanisms result from the presence of a university in local territories; these mechanisms range from the provision of specialized knowledge workers with university education to the creation of opportunities for networking among peers sharing common knowledge and language, to networking with start-ups or business and institutional actors. We contribute to this literature by deepening the investigation of specific informal mechanisms and social and territorial contexts spurring entrepreneurial ideas.

As far as sectoral coverage is concerned, the empirical evidence in this literature is mixed. Previous contributions investigate various informal KT mechanisms in diverse contexts, such as university scientists holding a PhD, science-based industries, or specific low-tech sectors. Moreover, differences in the characteristics or relevance of KT mechanisms are not the main goals of this research. To fill this gap, the first research question of this paper aims to investigate to what extent different informal mechanisms of university KT are relevant to LMT sectors. We expect that informal mechanisms are relatively more important than formal mechanisms for KT in LMT sectors than in HT sectors.

2.2 The university as a breeding ground for student and graduate entrepreneurs

A more transversal contribution that the university provides through different mechanisms, which is potentially relevant for both HT and LMT sectors, is the provision of education and of a context that stimulates the development of entrepreneurial ideas by university students and graduates.

Student entrepreneurship is a relatively new research topic and is currently studied from different perspectives. One set of studies examined the individual intentions of student entrepreneurs. For instance, the Global University Entrepreneurial Spirit Students' Survey (GUESSS) was established in 2003 to investigate the entrepreneurial intentions of university students; since then, it has gathered more than 120,000 questionnaires from students attending more than 1,000 universities. This initiative has facilitated research activities aimed at understanding the entrepreneurial intentions of students from different countries (Adekiya and Ibrahim 2016; Bergmann et al. 2016; Morris et al.

2017), different universities (Franke and Lüthje 2004; Jansen et al. 2015; Maresch et al. 2016), different types of firms (Carey et al. 2010), and different disciplines (Teixeira and Forte 2017).

However, "the 'gap' between intentions and behavior is not negligible" (Sheeran 2002: 29), and intention-based investigations cannot generalize their results to encompass actual behaviours aimed at establishing new firms; such investigations thus risk over-estimation of the phenomenon (Marchand and Hermens 2015; Shirokova et al. 2016).

Other studies (Galloway and Brown 2002; Hsu et al. 2007; Lange et al. 2011; Roberts and Eesley 2011; Ferrante et al. 2018) have investigated individual entrepreneurial behaviours by university alumni. In this case, the focus is on actual behaviour, not on intentions. Nevertheless (as noted by Åstebro et al. 2012), sampling alumni often implies not differentiating on the basis of the time elapsed between the date of graduation and the date of new firm creation: in situations in which considerable time has passed, it becomes difficult to identify the impact of the university on entrepreneurial choices. Furthermore, the strand of literature investigating recent-graduate alumni usually addresses university spinoffs and formal technology transfer mechanisms (Hsu et al. 2007; Boh et al. 2016; Hayter et al. 2017).

Åstebro et al. (2012) analyse and compare new firms created by recent graduates in science or engineering with those created by faculty. While the results clearly show that the new-venture-creation potential of students is far higher than that of their professors, Åstebro and colleagues narrowed their analysis to students belonging to disciplines that are commonly associated with new firm creation in HT industries.

Beyhan and Findik (2017) study technology-based new firms created by university students in Turkey. They base their analysis on official indicators, which measure the performances of Turkish universities in terms of the creation of new technology firms, and on the Turkish entrepreneurial and innovative university index. The results of their research, although meaningful, are university-centred and based only on technology firms.

In fact, the extant literature on student entrepreneurship addresses either student intentions or entrepreneurial behaviour in HT industries and the related formal mechanisms for technology transfer. Phenomena related to student-entrepreneurial behaviour in LMT industries and to the mechanisms (mostly informal) adopted by universities for transferring knowledge in these domains remain overlooked.

A relevant topic for explaining the dynamics of nascent student and recent graduate (SRG) entrepreneurship relates to the nature of skills and competences held by teams of SRGs. The characteristics (mostly in terms of homogeneity or diversity) of the entrepreneur's skills have been widely analysed by the extant literature (Lazear 2005; Silva 2007; Åstebro and Thompson 2011;

Stuetzer et al. 2013). However, this literature overlooks situations in which nascent firms are created by more than one founder. In particular, in line with the goals of this paper, it is important to consider whether the SRGs who are cofounding a nascent firm usually share homogeneous competences (e.g., by studying or having studied the same disciplines) or are more likely to have diverse academic backgrounds.

The traditional literature mainly proposes that the heterogeneity of team members has a positive impact on the performance of entrepreneurial ventures and is thus based on the assumption that individuals self-select by searching for heterogeneous members.

However, evidence on this assumption is mixed. Foo et al. (2005) observed that the diversity of task-related characteristics, such as the educational level of founding team members, has a positive impact on the external evaluation of the business idea, while the diversity of non-task characteristics, i.e., employment status, has a negative effect. The hypothesis of a positive relation between diversity of educational background and performance is also not supported. Foo et al. (2006) further explored the characteristics of team diversity and effectiveness and found that educational diversity is positively related to the perception of team viability, but it is not related to members' satisfaction, even in socially integrated teams. In a subsequent paper, Foo (2011) does not find support for the positive relationship between task diversity and member-rated effectiveness of teams and finds only partial support for the positive impact of non-task diversity on team effectiveness. Similarly, Amason et al. (2006) do not confirm the hypothesis of a positive relationship between the diversity of top management team characteristics and new venture performances. Vogel et al. (2014) observed different results in an experimental study in which participants in the experiment had to make decisions about providing external capital to founding teams with different levels and types of diversity. In their study, both task and non-task team diversity were positively related to the probability of obtaining early-stage funding.

In summary, these papers investigated different types of diversity among team members and showed varied outcomes. The relationship between heterogeneity of founding teams and performance is in some cases positive; in others, it is small or non-significant, or the results are inconclusive (see also Bowers et al. 2000; Henneke and Luthje 2007; Bell et al. 2011).

To better understand the role of heterogeneity in teams, other works investigate the factors affecting team compositions (Ruef et al. 2003) and how team heterogeneity evolves over time (Kaiser and Muller 2015). A starting point is that founding team members in nascent start-ups may initially self-select themselves because they share social contexts or similar backgrounds and competences, enhancing common languages and trust. Ruef et al. (2003) analysed five different mechanisms of founding-team composition and found that homophily of individuals, that is, social similarity in

ascribed characteristics such as age, race or gender, and the presence of prior network ties, are more important than functionality, that is, similarity in achieved characteristics such as education, occupational competencies, and income.

In their empirical study, Kaiser and Muller (2015) show that heterogeneous teams are more likely to result from a dynamic process in which individuals are initially more homogeneous, especially in non-task characteristics such as age. Over time, as other workforce members are added, the heterogeneity of the workforce increases.

The above two papers indicate that in the initial stages of entrepreneurial processes, social similarity mainly results in team homogeneity, particularly in demographic characteristics such as age or parental relations; homogeneity can also derive from sharing common social contexts or network ties. We aim to contribute to this line of research by investigating the extent to which the university has a role in shaping entrepreneurial teams by creating a favourable social context for aggregating people and sharing ideas.

Our research introduces an important novelty in the literature on the role of the university as an informal mechanism spurring student entrepreneurship. To account for diversity in education, previous papers mainly measured the levels and disciplines of the university education of team members. Empirical analyses were conducted either by investigating student entrepreneurship at a single university (e.g., Foo et al. 2005, 2006; Foo 2011), without variability in the social context, or in larger samples of entrepreneurial teams composed of members who graduated from different universities. In these cases, the heterogeneity of the social context was not considered (e.g., Henneke and Luthje 2007; Kaiser and Muller 2015).

In our paper, we are able to identify the proximity of the social context, which is represented by the enrolment of team members in programmes in the same or different disciplines of the local university. These cases are compared to cases of team members who graduated from different universities or did not graduate.

We expect that proximity among students is more likely to produce homophily in teams, which are more likely to be composed of people from the same university and with homogeneous disciplinary backgrounds. As suggested by Ruef et al. (2003), founding members tend to share social ties. Therefore, in the absence of specific actions or social contexts stimulating heterogeneity in the disciplines of founding teams, we are more likely to observe more homogeneous teams.

3. Research design

3.1 Research context and sample

The empirical analysis is based on data about proponents and entrepreneurial ideas submitted to *Nuove Idee Nuove Imprese* (NINI), a business plan competition organized by an association comprising local Chambers of Commerce, industrial associations, bank foundations, and universities located in the Province of Rimini[1] and the Republic of San Marino.

Every year, people interested in establishing new firms are invited to submit their preliminary business ideas to NINI. The business ideas must be submitted by a group of at least 3 persons. Individuals who have established a new firm that is not yet economically self-sufficient and has existed for no longer than twelve months can also participate in the competition. The number of business ideas included in the competition is not defined in advance; it usually ranges from 60 to 90. All members of the groups are then invited to attend a first course on entrepreneurship and to meet investors and founders of successful start-ups. This course consists of 30 hours of lectures and is aimed at providing participants with skills related to the definition of the business model, the competitive environment, and the marketing strategy of the new venture. After completing the course, groups are required to submit a ten-page description of their business idea, which is evaluated by an external technical-scientific committee[2].

The committee selects the most innovative and feasible ideas. The selected entrepreneurial teams are then invited to participate in a second course on entrepreneurship and business planning. In particular, the course (35 hours) focuses on organization and human resources management, accounting and finance, fundraising strategies, and legal and fiscal issues related to the establishment of new firms. Once they have completed the second course, participants submit a detailed business plan together with their full curriculum vitae (CV). The technical-scientific committee analyses the business plans, convenes the proponents for a pitch speech, and selects the three best business ideas, which are entitled to an economic prize (under the condition that they formally establish a new firm in the Rimini province or in San Marino within the following twelve months). Business plans are evaluated by assessing the completeness of the information provided, the originality of the business idea, the quality of the market analysis (in terms of customers and competitors), the economic sustainability

[1] The province of Rimini is in the Emilia Romagna region and has a population of 337,000. While it is world-renowned for its tourism industry, the Province also hosts important firms operating in many other economic sectors, such as textile and fashion, buildings, electronics, and services. The Republic of San Marino is an enclaved microstate, surrounded by the Province of Rimini and the Province of Pesaro-Urbino, with a population of 33,000. Its economy is mostly based on banks and financial services.

[2] The scientific-technical committee is composed of 13 experts: the President and the Vice President of the Association, two representatives from the Chambers of Commerce of Rimini and San Marino, one entrepreneur from the Rimini branch of the Italian Industrial Association, one entrepreneur from the San Marino Industrial Association, two representatives from the most important local bank, three scholars from the local university, and two business consultants.

of the project, the potential and the scalability of the business, the composition of the founding team (in terms of skills and experience), the rapidity of the launch, and the consistency with the local economic structure. Some of the other projects are invited to join the San Marino incubator or to take advantage of the supporting activities offered by the Rimini Innovation Square (an innovation forum permanently hosted by the Municipality of Rimini).

Since its foundation in 2002, NINI has gathered 340 business plans and awarded more than €500,000 to 43 projects. In this paper, we narrow our analysis to the period 2010-2017, a time span during which the rules governing the application stage, the selection of teams for the training section, and the awarding of prizes to teams remain quite stable[3]. During this period, 161 projects were submitted by 560 individuals. Given that for 7 teams, we do not have data on the variables of interest for any member, we restrict the working sample to 154 projects that involve a total of 535 individuals.

Participation in the business plan competition does not require university education, but most team members are university students or graduates, mainly from Bologna University, which is the local university campus in the Rimini province. In particular, the University of Bologna has traditionally stimulated student entrepreneurship through formal mechanisms of KT, such as TTOs and incubators. In recent years, within the framework of a new strategic approach to student entrepreneurship, TTOs and incubators have been complemented with innovative services aimed at exploiting informal mechanisms of KT. Hence, business plan competitions and consultancy services have been established for the purpose of scouting and creating new business ideas. Furthermore, the University of Bologna provides students with vocational courses on entrepreneurship and new-firm creation and with events to support cross-pollination and to exchange experiences and good practices. An alumni network has also been established.

For the purposes of this paper, we first conduct a quantitative analysis using data about the entrepreneurial idea retrieved from the accompanying business plan submitted at the end of the second course; we also use data on the demographic characteristics of the proponents codified from their CVs. Drawing on the Global Entrepreneurship Monitor (Reynolds et al. 2005) and the Panel Study on Entrepreneurial Dynamics (Reynolds 2000), we define these individuals as nascent entrepreneurs. Specifically, a nascent entrepreneur represents "a person who is trying to start a new business, who expects to be the owner or part owner of the new firm, who has been active in trying to start the new firm in the past twelve months and whose start-up did not have a positive monthly

[3] Descriptive statistics of our main variables also do not change significantly from 2010 to 2017. We therefore pooled the data for the empirical analysis of this paper. We also run a one-way analysis of variance for the main variables discussed in our paper using the years of competition as the factor variable. The results of this analysis, available from the authors, do not reveal statistically significant differences across years.

cash flow that covers the expenses and the owner-manager salaries for more than three months" (Wagner 2006: 16).

Second, we conduct a qualitative analysis to deepen our understanding of whether and how informal mechanisms of KT from universities influence the formation of new ventures. We conducted interviews with thirteen former participants. Interviews consisted of semi-structured questions aimed at identifying the most relevant channels of knowledge transmission from university to nascent entrepreneurs. The interviews took place between April and November 2018 and were conducted by at least two members of the research team either in person or by phone or Skype. Interviewees were informed about the goal and the scope of the research and asked to speak freely on every question. Interviews have been transcribed and analysed according to the thematic analysis method (Guest et al. 2012).

3.2 Variables and descriptive statistics

The empirical investigations of this paper rely on variables at two levels of analysis: *i)* individual and *ii)* project.

At the individual level (upper panel in Table 1), we collect data on demographic characteristics such as gender, age, and education. Specifically, the variable GENDER shows that women make up nearly one third (31.8%) of all participants in our sample. The variable AGE shows that, on average, team members were 35 years old at the time of the business plan competition. We use an ordinal categorical variable, EDUCATIONAL ATTAINMENT, to report the highest educational level of each participant. The five levels of this variable correspond to the following degrees: *i)* secondary school; *ii)* high school; *iii)* bachelor; *iv)* master; v) PhD. Most individuals in our sample (49.1%) hold a master's degree; 14.4% have a bachelor's degree; 5.7% have a PhD. Overall, more than two-thirds of subjects (i.e., 365 individuals) have a university background. The remaining share of individuals (30.9%) have a level of education corresponding, at most, to high school.

Drawing on Beyhan and Findik (2017), we define student entrepreneur as someone who is the owner or part owner of a firm while she is enrolled in a university degree programme, and we define recent graduate as a person who becomes the owner or part owner of a firm within five years since the attainment of her highest university degree. In line with Beyhan and Findik (2017), we also decided to take five years as a meaningful time frame in order to highlight behaviours (and informal mechanisms adopted for transferring knowledge) that are directly connected with the academic experience of the graduate. This does not mean that university experience becomes irrelevant after five years but, after that point, other drivers (such as work experience) are more likely to play fundamental roles in the formation of the entrepreneurial idea. We combine the two categories

mentioned above into a single group comprising SRG nascent entrepreneurs. The variable STURE_GRADUATE in Table 1 indicates that 35.4% of participants qualify as SRGs. Among them, 80.8% graduated at most 5 years before the competition, 14.9% graduated the year after, and the remaining 4.3% graduated two years after. Table 1 also reveals that proponents with a university degree obtained more than 5 years before the competition, identified as OLD_GRADUATE, account for 33.7% of all participants. Finally, the residual category of subjects without a university degree, NO_GRADUATE, encompasses 30.9% of members.

For participants holding a university degree, we construct a nominal, categorical variable, EDUCATIONAL FIELD, that singles out the discipline of the highest university degree. This variable involves the fields at the first level of the International Standard Classification of Education (UNESCO-UIS, 2014): Engineering, manufacturing & construction (32.1%); Business, administration & law (26.6); Arts & humanities (14.5%); Social sciences, journalism & information (10.1%); Natural sciences, mathematics & statistics (6.8%); Health & welfare (4.1%); ICTs (3.6%); Services (1.1%); Education (0.5%); Agriculture, forestry, fisheries & veterinary (0.5%).

Finally, we consider the university where the highest degree was obtained and specifically distinguish cases where such a degree was awarded by the local university (i.e., University of Bologna) from circumstances where the individual graduated from a different university. The variable LOCAL_GRADUATE in Table 1 clarifies that 53.2% of subjects with a university degree come from the local university.

Please insert Table 1 about here

The lower panel of Table 1 shows descriptive statistics for variables measured at the project level. The variable SIZE counts the number of team members. Due to the guidelines of the business plan competition, teams that submit a project must comprise at least three members. Thereafter, in our sample, we do not have solo founder's projects or dyadic entrepreneurial teams. Indeed, 106 teams (68.8%) in our sample comprise 3 members, while the remaining teams include 4 members (19.5%), 5 members (8.4%), 6 members (2.6%), and 8 members (one team only).

To answer the research questions of this paper, we construct four measures of within-team diversity that are based on the following attributes: *i)* age; *ii)* educational attainment; *iii)* holding of a university degree and time since graduation; and *iv)* field of education. First, we compute the coefficient of variation of the age of the team members at the time of participation in the business plan competition (DIVERSITY_AGE). Second, drawing on the educational attainment of team members, we compute an entropy index (DIVERSITY_EDU) that gauges the within-group diversity with respect to this demographic attribute. Third, we use the variables STURE_GRADUATE, OLD_GRADUATE, and NO_GRADUATE to compute an entropy index (DIVERSITY_EDU-TIME) that gauges the within-group

diversity in terms of education level and time elapsed since educational attainment. Fourth, for teams comprising at least two members with a university degree (i.e., 117 teams), we compute an entropy index (DIVERSITY_ISCED) that gauges the within-group diversity with respect to the discipline of the highest academic degree. In the next section, we use these variables to analyse how the local university (i.e., University of Bologna) influences the composition of the entrepreneurial teams.

Drawing on extant research (Kaiser and Muller 2015), we categorize the 154 projects into industries characterized by varying levels of R&D intensity. To allocate projects to each industry, we rely upon the taxonomy of economic activity published by the Italian National Statistical Office (ISTAT 2009) and the OECD classification of economic activities based on R&D intensity (Galindo-Rueda and Verger 2016)[4]. The assignment procedure is described below.

We start by assigning a 6-digit code of economic activities (ISTAT 2009) to entrepreneurial projects submitted with the business plans. The assignment of a specific 6-digit code is based on three criteria. First, if the proponents of a project formally registered a company with the chamber of commerce, we take the industry code they declared in the registration form; using this criterion, we classified 49 projects. Second, when no firm was established, we read the business plan to check whether proponents listed other companies as competitors. Whenever they did, we search for data about the mentioned companies and assign to the project the industry code of those entities that the proponents label as direct competitors. Based on this criterion, we classified 25 projects. Third, if no firm was founded and the business plan does not refer to any competing firms, we carried out a thorough reading of the text describing the business idea and matched this description with the industry code that fits the description. Based on this criterion, we classified the remaining 80 projects.

Given that the taxonomy of economic activity adopted by ISTAT and the OECD classification are both based on the International Standard Industrial Classification (ISIC, Rev 4), we can create a correspondence between each 6-digit industry with the following degrees of R&D intensity: 1) low; 2) medium-low; 3) medium; 4) medium-high; and 5) high. For this study, we further aggregate the 5 groups into two clusters and define the binary variable SECTOR_R&D, which equals 1 if the project accrues to a medium-high or high R&D intensity (41.6%) and 0 if the project targets a sector displaying a low, medium-low, or medium R&D intensity.

[4] Whereas the adoption of this taxonomy allows comparability of the results in our study with empirical evidence originating in other settings at the international level, it is worth reminding the limitations that surround the use of R&D as an indicator of innovation (see Becheikh et al. 2006 for a review): *i)* R&D represents an input of the innovation process which does not necessarily leads to technologically new products or processes; *ii)* innovations can originate from serendipity or in response to a specific problem without any investment in basic or applied research; *iii)* R&D effort in small and medium sized enterprises (SMEs) is often informal and occasional: hence, it might be overlooked in industries and countries where SMEs account for a large share of business organizations.

Table 2 shows the distribution of projects by divisions of economic activities and levels of R&D intensity. Ninety projects in our sample (58,4%) belong to a low-medium R&D context (LMT). Among them, 23 projects involve professional, scientific and technical activities (e.g., management consultancy activities); 15 projects concern manufacturing (e.g., apparel; structural metal products and metal container-type objects); 12 projects refer to administrative and support service activities (e.g., travel agency, tour operator, reservation service and related activities). For the projects having a high R&D setting (HT), we find that more than two thirds (44) involve information and communication services (e.g., computer programming, consultancy, information service activities), whereas 15 projects pertain to manufacturing sectors (e.g., machinery and equipment; measuring, testing, navigating and control equipment).

Please insert Table 2 about here

The variable FIRM_FOUNDED reveals that 49 entrepreneurial projects (31.8%) were exploited through the establishment of a new firm (Table 1). Such an event typically occurs within a narrow time window with respect to the year in which the team submitted the project. A closer inspection of the data reveals that in 30.6% of the cases, the firm is established the same year of the contest; in 30.6 of the cases, the founding takes place the year after; in 26.5%, it occurs the year before. At the time of observation, spring 2018, most new ventures (36) are still active. Regarding the distribution of new firms by sectors of economic activity, we find that 26 ventures operate in an industry with a low-medium R&D intensity, and one third of ventures involve professional, scientific and technical activities. Within this group, the representative sectors are professional, scientific and technical activities, the manufacturing of wearing apparel and leather products, and the processing of fruit and vegetables. Among the 23 new firms belonging to an industry with a high R&D intensity, we find that more than one third offer information and communication services.

The entrepreneurial projects under scrutiny in this study do not rely extensively on the protection of their intellectual capital. The dichotomous variable IP_PROTECTION reveals that the creators of only 16 projects (10.4%) have sought to protect their business ideas primarily by filing a patent (11 projects) and, to a lesser extent, a trademark (6 projects) with the national authority. The investment in intellectual property protection is correlated with the emergence of a new organization: while one quarter of the teams that established a new venture also applied for at least one patent or trademark, only 3 out of the 105 teams for which a firm was not founded have applied for any mechanism of legal protection. Finally, we observe that teams proposing business ideas in HT contexts apply more often for patents or trademarks (15.6%) than do teams targeting LMT settings (6.7%).

3.3 Sample characteristics and the local economic system

In this section we evaluate the representativeness of the sample with respect to the current structure of the local economic system. In addition, we assess the growth potential of entrepreneurial ideas in our sample through a comparison of new firms born after the competition with a reference group of innovative startups.

Drawing on data from the national statistical office[5] (ISTAT) for year 2016, we can argue that the sectors of the projects in our sample are representative of the local economic system. For example, in the group of LMT manufacturing industries, structural metal products and the production of wearing apparel account respectively for 13.75% and 8.03% of all manufacturing firms operating in the province of Rimini, and they jointly account for 24.42% of manufacturing employment in the province. In the group of HT manufacturing industries, the production of machinery and equipment accounts for 7.85% of all manufacturing companies operating in the province of Rimini and 22.24% of manufacturing employment in the province. In the group of industries characterized by medium-low R&D intensity, management consultancy activities account for 8.8% of the firms and 8.52% of the employees involved in professional, scientific, & technical activities which, in turn, represent the 13.7% and 7% of the firms operating in the province of Rimini and their employees.

To explore the performance of new firms stimulated by NINI and to assess their impact on the local context, we compared a few characteristics of firms in our sample with those of a reference group comprising companies with a high growth potential. More precisely, we consider as a reference group 42 ventures established in the Rimini province, over the period 2014-2017, which are listed as innovative startups in the registry held by the Chambers of Commerce. The status of innovative startups, introduced by the Italian law 179/2012, identifies newly established ventures, which meet at least one of the following criteria: *i)* investing at least 15% of the turnover in R&D activities; *ii)* having a workforce comprising at least 1/3 of researchers, or 2/3 of students with a master degree; *iii)* holding (as owner or licensee) a patent. To the extent that firms in our sample display the typical characteristics of innovative startups, they might be alleged to bear a non-negligible impact on the local economic system.

We carried out this investigation on a subset of 23 firms in our sample, registered as limited liability companies: for the other firms, organized as general partnership or sole proprietorship, data aren't available because these entities are not obliged to disclose publicly any financial statement by the Italian law. In a first comparison between the subset of sampled firms and the 42 innovative startups, we concentrate on firm size measured either through total assets or turnover and compute the average

[5] Data retrieved from the portal http://dati.istat.it/Index.aspx?DataSetCode=DICA_ASIAUE1P

value of each variable in the two years after incorporation. On average, total assets amount to €169.4 thousands (Std. Dev. = €449.2 Th) and revenues equal €44.3 thousands (Std. Dev. = €68.9 Th) in the first group, while they correspond to €243.8 thousands (Std. Dev. = €471.8 Th) and €105.1 thousands (Std. Dev. = €201.2 Th), respectively, in the second group. Although these differences seem large, they are not statistically significant at the conventional 5% level: for total assets, we compute a *t-statistics* of -0.627 with an associated *p-value* of 0.534; for revenues, we compute a *t-statistics* of -1.7745 with an associated *p-value* of 0.081.

In a second comparison, we contrast the profits/losses reported in the two years after incorporation by firms in the two groups. The 23 firms in our sample report average losses of €4.6 thousands (Std. Dev. = €25.4 Th), while the 42 innovative startups experience average losses of €6.6 thousands (Std. Dev. = €28.5 Th). These differences are not statistically significant at the conventional 5% level: *t-statistics* of 0.2931 with an associated *p-value* of 0.771.

Hence, ventures established to exploit entrepreneurial ideas submitted by teams in our sample do not appear significantly different from innovative startups in the terms of size at founding and performance in the aftermath of their inception. As long as innovative startups are expected to positively impact the local economic system, due to their growth potential, we can reasonably conjecture that a similar impulse stems from the organizations in our sample. This notwithstanding, we are aware of the limitations affecting the comparison presented above and remain cautious in deriving any conclusion from this piece of evidence. Still, the findings of this explorative analysis are interesting and future research should dig deeper in them.

4. Findings

4.1 Educational background and the R&D intensity of the project

In line with the research questions of this paper, we first investigate the relationship between the educational level and specialization of team members and the R&D intensity of the entrepreneurial idea, with a primary focus on students and recent graduates.

Values shown in the upper panel of Table 3 point to the existence of a relationship between educational attainment and the technological content of the entrepreneurial idea. Indeed, two-thirds of team members with a PhD develop projects in high R&D sectors, whereas the share among those with a bachelor's degree declines to 44.74%, and it further shrinks to 37.5% among persons with at most a secondary school degree.

Please insert Table 3 about here

Values reported in the middle panel of Table 3 indicate that 187 individuals qualify as SRGs. The other two categories include 178 members who earned their highest university degree more than 5 years before the competition and 163 subjects without a university degree. SRGs (STURE_GRADUATE) distribute evenly between projects accruing to a low-medium R&D sector (51.87%) and those belonging to a high R&D sector (48.13%). In contrast, individuals without a university degree (NO_GRADUATE) concentrate more in low-medium R&D projects (61.96%). An intermediate result is observed for individuals with a university degree earned more than 5 years before the business competition (OLD_GRADUATE). This piece of evidence suggests that knowledge acquired at university leads SRGs to develop entrepreneurial ideas with higher technological content than projects proposed by individuals who cannot leverage this type of knowledge.

Figures in the lower panel of Table 3 shed light on the educational profile of SRGs. We can see that three quarters of the 187 SRGs in our sample hold a degree in the following fields: Engineering, manufacturing & construction (62); Business, administration & law (55); Education, arts & humanities (26). Individuals within these three groups display systematic differences in their propensity to target industries with varying degrees of R&D intensity. Approximately 66.13% of SRGs with an engineering degree are involved in high R&D contexts. On the other extreme, 73.08% of SRGs with a degree in education, arts & humanities participate in projects targeting low-medium R&D contexts. Finally, we find that SRGs with a specialization in business are overwhelmingly concentrated (67.27%) in low-medium R&D sectors. In summary, among SRGs, we uncover a link between educational fields and the R&D intensity of the entrepreneurial project.

The values reported in Table 4 highlight that SRGs from specific (aggregated) educational fields end up in teams with different degrees of variety as measured by DIVERSITY_ISCED. More precisely, the last column of Table 4 notes that SRGs in education, arts & humanities, and social sciences (0.97) belong to more heterogeneous teams in terms of educational fields than SRGs in natural sciences, ICTs, and engineering (0.69) and those in business, administration & law (0.74). The difference in both comparisons is statistically significant (first case: $t = 2.826$; p value = 0.006; second case: $t = 2.232$; p value = 0.028). The magnitude of these differences does not substantially change when we consider the R&D intensity of the submitted projects. However, we observe that SRGs in business, administration, and law who submit a project in low-medium R&D contexts are part of more homogeneous teams (0.64) than SRGs pursuing a venture in high R&D contexts (0.96); this difference is also statistically significant ($t = -2.458$; p value = 0.017).

Please insert Table 4 about here

In a subsequent analysis, we evaluate if teams which establish a firm differ from groups that did not foster their project until this stage, in terms of: *i)* the number of students and recent graduates; *ii)* the variety of the educational background among team members. As for the first dimension, we do not observe statistically significant differences between the two groups: the average number of SRGs is 1.27 among the 49 projects linked to a founding event and 1.19 in the other group (*p-value* = 0.759). As for the second dimension, instead, we notice that in terms of educational specialization of graduate teammates, teams involving at least one SRG which experience a founding event (25) are significantly more homogeneous than teams involving at least one SRG but did not transform their entrepreneurial idea into a real firm (52). Specifically, the average value of DIVERSITY_ISCED is 0.62 in the first group and 0.87 in the second group (*p-value* = 0.039). This result holds even when we consider all the 117 teams comprising at least two individuals with a university degree, regardless of the time elapsed since graduation.

In summary, we uncover a relationship between the educational attainment of team members and the R&D intensity of the entrepreneurial idea. Furthermore, our results suggest that SRGs leverage knowledge acquired at university to develop entrepreneurial ideas with a higher R&D content than the ideas proposed by individuals without a university degree. Also, SRGs with a background in education, arts & humanities, and those trained in business, administration & law more often submit projects involving economic activities with a low-medium R&D intensity. Finally, SRGs pursuing an entrepreneurial idea in a low-medium R&D sector build more homogeneous teams in terms of educational specialization than older graduates targeting the same context. Finally, more homogeneous teams in terms of educational specialization seem to be more often involved in the actual foundation of a new firm.

4.2 Local university context and the process of team composition

In this subsection, we analyse whether and how attending the University of Bologna (i.e., the local university) increases the chances that an SRG will form an entrepreneurial team that involves *i)* other SRGs from the same university; *ii)* other SRGs from the same university that specialized in the same discipline; *iii)* other SRGs from the University of Bologna of similar age.

To accomplish this task, we draw on a methodology used by Ellison and Glaeser (1997) to analyse geographic industry concentration and adopted by Kaiser and Muller (2015) to study the composition of new venture teams. According to this approach, we compare the degree of heterogeneity computed for the actually observed teams in the sample with a benchmark, namely, a "random matching" generated through simulations, comprising a random assembly of startup teams among the participants we observe in our data. Such a comparison enables us to establish if "the observed degree

of heterogeneity is statistically significantly different from the degree of heterogeneity in a situation where teams are randomly assembled. Thus, our benchmark is a situation where founders do not systematically look for teammates" (Kaiser and Muller 2015: 793).

To carry out this exercise, we first classify the observed teams into three groups as shown in Table 5 under the Column "Observed": teams without SRGs (67), teams with only one SRG (34), and teams with two or more SRGs (53). Within the last cluster, we can compute diversity measures of the teams and further distinguish: *i)* 27 teams with two or more SRGs all from the University of Bologna (i.e., INSIDER_SRGs); *ii)* 9 teams with two or more SRGs all from other universities (i.e., OUTSIDER_SRGs); *iii)* 17 teams with both SRGs from the University of Bologna and other universities. For each sub-group, we compute the average number of SRGs, the average value of the variable DIVERSITY_ISCED, and the average value of the coefficient of variation of the age of the team members (DIVERSITY_AGE).

To generate a distribution for the random match, we select all participants submitting a business idea in a given year and randomly assign them to entrepreneurial teams while maintaining the observed distribution of team sizes for each year analysed in this study. Subsequently, we partition the simulated teams into sub-groups similar to those described for the observed data. Then, within sub-groups of simulated teams comprising two or more SRGs, we compute and store the average values for the number of SRGs and of the variables DIVERSITY_ISCED and DIVERSITY_AGE. This procedure is carried out 700 times. Finally, we compute the median value of the variables of interest for each sub-group of teams across the 700 simulation runs and term this benchmark "random match", as reported in Table 5.

Please insert Table 5 about here

The comparison between the observed distribution and the random match highlights that the local university context affects the process of team composition. We observe that the number of teams comprising two or more insider SRGs in the observed data (27) is 28.69% higher than the number of teams that we would get had participants looked for teammates in a random way (21). Furthermore, the average number of SRGs in homogeneous groups of insiders (2.85) is significantly larger than what we obtain for the random match (2.23): such a difference is statistically significant (*p-value* = 0.004). Hence, attending the University of Bologna does seem to create ties among SRGs that make them more likely to launch a new venture together.

Our results provide additional insights into the strength of such ties. We observe that the average value of DIVERSITY_ISCED, a measure of heterogeneity based on the educational specialty of the team

members, is 0.70 among homogeneous groups of SRGs from the University of Bologna, while it is significantly higher (1.01) in the corresponding random match of groups comprising only insider SRGs: the difference is statistically significant (*p-value* = 0.044). Therefore, this piece of evidence corroborates our expectations that being enrolled in the same educational specialty at the University of Bologna favours the formation of a network among SRGs and nurtures the launch of a new venture. The results for the variable AGE, however, portray a more nuanced picture. On the one hand, we do not find statistically significant differences between the average value of DIVERSITY_AGE computed for the group of observed teams with two or more SRGs from the University of Bologna (0.16) and the average value reported for the random match (0.21). On the other hand, we notice that observed teams with insider & outsider SRGs are less heterogeneous (0.12) than their counterparts in the random match (0.22). Overall, this piece of evidence suggests that when the network ties created by attending the same degree at the University of Bologna are absent, team members will look for similar others based on ascribed non-task characteristics such as age.

To further explore the type of knowledge that SRGs acquire from university and later exploit in entrepreneurial projects, we interviewed a few contestants who shared interesting insights on this issue. In the next section, we describe the methods and discuss the major findings of this qualitative analysis.

4.3 Interviews on informal mechanisms of knowledge transfer

4.3.1 Methods

The results of the quantitative analysis show that university attendance plays a role in fostering student entrepreneurship and in the process of team formation. To understand how and why (Yin, 1994) university attendance stimulates student entrepreneurship through informal and even unplanned or non-deliberate activities, we designed an exploratory research approach based on interviews. The qualitative analysis also aims to explore the use of a set of informal mechanisms of KT for entrepreneurship in LMT and HT sectors.

To this end, we identified 11 projects participating in NINI and largely composed of SRGs. Because our goal was to explore a very wide topic, we tried to emphasize the variety of the sample to gather a larger array of perceptions and behaviours: we did not try to identify a representative sample; instead, we identified a varied set of experiences and points of view that could shed light on some meaningful patterns. Hence, eight projects belonging to different industrial sectors relevant to the local economy (Agriculture, Tourism, Professional services, and Fashion) have been selected from various editions of the competition. We also selected three projects from HT sectors (Mechanics, Energy, Biomedical engineering) to investigate possible similarities and peculiarities.

Overall, the 11 projects involved 43 members (28 students and recent graduates, 9 older graduates, 6 non-graduates); among them, we selected one interviewee for each project; to ensure an additional check on the reliability of the interviews, we interviewed a second team member in two cases. The 13 interviewees were selected by taking into consideration their status at the moment of participation in NINI (10 SRGs and 3 older graduates), their field of study (management, chemistry, bioengineering, psychology, engineering, architecture, literature) and their provenance (11 were from the local university and 2 from non-local universities). Table 6 describes the varied composition of our sample.

Please insert Table 6 about here

Drawing on the results of the literature review and on the evidence emerging from the quantitative analysis, we developed an interview protocol composed of semi-structured questions. Questions have been sketched with the goal of understanding complex phenomena, such as KT processes, and interviewees were encouraged to speak freely and to express their feelings and perceptions.

The questions concerned the background of the respondent and her cofounders, the origin of the business idea, the process of forming the founding team, the process of developing the business idea towards the nascent enterprise, the perceptions of any direct and indirect impact the university had on the entrepreneurial process, the relevance of the knowledge acquired at the university, the overall assessment of the relevance of knowledge acquired at the university, and suggestions about additional support the university might provide.

We planned a review meeting after the first three interviews to amend, integrate, and fine-tune the structure of the interview and the specific questions. However, this review meeting did not identify any need for amendments, and the interview structure was not modified.

All the interviews were recorded and transcribed. We applied the thematic analysis method (Merton 1975; Boyatzis 1988) to analyse qualitative data (Braun & Clarke 2006): each researcher read and reread each and every verbatim transcript and identified some interesting features of the text that are relevant to the research question. We then segmented the verbatim transcripts by applying codes (summarizing the meaning of the segments of text previously identified). These codes identified by each researcher have been discussed, and a homogeneous list of codes has been developed. Based on these homogeneous codes, we reviewed the transcripts and agreed on a common segmentation.

Texts have been reorganized and assembled based on the different codes identified for each segment. Potential themes (a theme identifies a meaning patterned across the dataset, which is important for

illuminating the research question) arising from the codes have been discussed and reviewed. Eventually, we defined the themes and finalized the analysis.

The final themes identify the main formal and informal channels through which the university impacts SRG entrepreneurship:

- By supporting the gestation process;
- By providing knowledge;
- By opening networks of relationships;
- By providing formal support.

Each theme is detailed in terms of its relevant codes and, where available, sub-codes:

- Gestation-process support: Supporting idea generation (Business idea from: final dissertation / Proposed by teachers / As a consequence of internships and university-to-job initiatives / Scientific research); Team formation (Opportunity to meet cofounders / Opportunity to find people with specific skills);
- Knowledge provision: From formal education (Methodological knowledge / Domain-specific and technical knowledge / Specific knowledge with respect to entrepreneurship and startup development); From classmates (General discussion / Specific suggestions / Work groups); From faculty (General discussion with teachers / Suggestions from teachers / Collaboration with teachers);
- Networking: Relationships with local networks; Relationships with external networks;
- Formal support: Through incubators and TTOs; Through spin-offs.

4.3.2 Findings

Exploiting the results of the thematic analysis, we represented the impacts of the university on various entrepreneurial projects, as perceived by interviewees. Figure 1 represents these impacts.

Please insert Figure 1 about here

Gestation process

The university supports the gestation process of new firms through two main processes: it fosters the generation of new business ideas and allows nascent entrepreneurs to meet and coalesce into groups. With respect to the *generation of new ideas*, the university has played a fundamental role in three projects (A, C, I) by originating the idea and has played a critical role in two projects (E, F), whose ideas originated outside but developed inside the academic context. For projects A and C, the business idea originated within a university research centre through scientific research and PhD theses. The business idea of project I was stimulated by a university professor who organized fieldwork as part

of his course; then, it was developed through BSc and MSc dissertations written by the students involved in the fieldwork. The business idea of project E originated outside the university but has been developed in the academic context, in particular through MSc final dissertations. As stated by interviewee 19, "the business idea has been nurtured by the university". Finally, business idea F was facilitated by the university, which provided the student the opportunity to have an internship and to write a BSc final dissertation on the topic.
Six projects did not take advantage of the university, at least in terms of idea generation.

As for the *formation of the entrepreneurial team*, in five cases (A, B, C, E, I), the cofounders met at the university. Usually, they were classmates, then they became friends and, eventually, they decided to embark on a new-business challenge. The cofounders of project A met at a university research lab. Then, the founding team was enlarged on the occasion of an entrepreneurship-support event organized by the local university (member 3 joined the team). All the cofounders of project B met at the university: they were classmates, they became friends, and after completing their educational process, they decided to try to start a business. The founders of project C were part of a research team in a university lab. They embarked on their business together since "it has been the only way to ensure the continuity of our research group". The university professor, the lab director, also participated in the founding team. Most of the cofounders of project E were classmates who also coordinated a student association. One of the members met the others through the association. The members of the founding team of project I were students participating in fieldwork organized within the framework of a university course. Initially, the university professor participated in the project, but he eventually quit.
In cases G, H, J, K, the cofounders were friends before and in addition to their time together at the university; hence, their choice to group together and to launch a new firm was not impacted by the university.
Project D was developed by a team of medical doctors who met because of their work. Finally, the cofounders of project F met at an event organized by local institutions to nurture entrepreneurship, and they coalesced around a business idea they developed together.
In fact, teams stimulated by the university show a higher degree of homogeneity, while other teams show higher variety.

Provision of knowledge: formal education, classmates and teachers
With respect to the provision of knowledge the nascent entrepreneurs perceive as consistent with their business idea, the university acts through three main channels: formal education from its Bachelor,

Master, and PhD courses, knowledge provided by classmates, and knowledge that professors share directly with nascent entrepreneurs.

For three projects (A, E, F): *formal education* is considered critical to the startup process. At the university, the cofounders had the opportunity to develop both technical and entrepreneurial skills that they leveraged and used in the startup process. Formal education has been deemed important by four teams (C, D, I, K): at the university, cofounders had the opportunity to learn and develop domain-specific and technical skills related to their business ideas; but they did not develop skills related to entrepreneurship. For instance, interviewee 15 stated that the "university played a role in the development of my medical skills, not for my propensity towards entrepreneurship", while interviewee 42 thinks that "university has been more important for the development of skills related to my job in the new firm than for the formation of the business idea".

In four cases (B, G, H, J), university education has been considered valuable only in methodological terms, as something useful for dealing with problems and decision-making processes; interviewee 35 says that "at the university, I learned a lot of generic knowledge… it has been useful but not fundamental".

Only two respondents (A, E) reported that they had the opportunity to leverage valuable knowledge and suggestions from *classmates* (other than those participating in the founding team). In the other two cases (G, I), respondents reported having had general discussions about their business ideas with some classmates. In general, this knowledge source seems to be largely unexploited.

The situation is richer with reference to the relationship between cofounders and *university professors*. In three cases (A, C, E), the university professors strongly supported the founding team in the elaboration of the business idea. In one case (D), one of the founders had valuable discussions with professors to frame the goal and the scope of the new firm. The founders of three other projects (D, I, K) had some generic but useful discussions with their professors.

In all cases, these discussions took place outside any formal framework: nascent entrepreneurs looked for suggestions from professors; some professors have been more supportive than others.

Local and global networks

As for the support activities related to accessing networks of relationships, universities act by providing access to local or global networks. Respondents from three projects (A, E, F) state that the university has played an important role in allowing them to interact with *local stakeholders*. In these cases, the cofounders had the opportunity to participate in university-led initiatives and competitions aimed at supporting entrepreneurship; the university also connected nascent entrepreneurs with angel investors and professional investors. The university has also supported projects G and I by informing

them about local initiatives aimed at supporting entrepreneurship, such as Nuove Idee Nuove Imprese.

The university has only enabled two projects to interact within *global networks of relationships*. In particular, project A has participated, thanks to the university's entrepreneurship services, in various national business plan competitions and has developed relationships with international investors. Finally, one of the cofounders of project F has participated in a university research team working on an EU research project on the topic of the business idea, thus establishing a network of international relationships.

It is worth noting that a third possible network of relationships to which the university may provide access is the alumni network. In our case, the local university did not begin providing its graduates with this service until just a couple of years ago. Hence, evidence of this third network activity will become available in the near future.

Formal support

Finally, universities may provide formal support to nascent enterprises. These formal activities are investigated by the extant literature and can take the form of incubation and acceleration services or of spinoffs. These services are targeted to high-tech ventures.

As for incubation services, project A has been supported by the university TTO, while project C has been supported by the university technopole.

Furthermore, both projects A and C are recognized as university spin offs. It is important to note that A and C are based on patents developed by university research labs and are high-tech projects.

Overall, it appears that in addition to the exploitation of formal support services (which are exclusively targeted at high-tech nascent firms), there are no substantial differences in the behaviour of LMT and HT founding teams.

In fact, the founding teams that have taken more advantage of the university's informal support services are A (HT), C (HT), E (LMT), F (LMT), and I (LMT). On the other hand, B (HT), D (LMT) and G (LMT) did not exploit the full potential of university support systems, while H (LMT) and J (LMT) did not leverage university support at all.

It is also evident that most of the activities carried out by the university to support entrepreneurship require proactive behaviour by SRGs: if SRGs do not act by collecting information, soliciting services and looking for suggestions, the majority of support may be lost. Hence, SRGs that did not pursue these relationships with their university may perceive a lack of support, as explained by interviewee 31: "once you leave the university, you are alone".

Discussion of evidence

With reference to the specific dimensions of the activities performed by the university to support entrepreneurship, some patterns can be highlighted.

Support for business idea generation acts through two main processes. The first is scientific research, which usually enables the creation of new innovative ventures to exploit patents and technologies invented or developed within university research centres. The second is the enabling behaviour of professors who, in their university courses (even at the undergraduate level), organize team-working activities and fieldwork that can boost the entrepreneurial intentions of participants.

As for the support of team formation, the university plays a very important role, which is connected to the development of social (in particular, friendship) relationships between students. These relations precede the generation of the business idea and may enable it. On the other hand, it appears that the selection of team members cannot be considered as a rational decision-making process aimed at producing a complete set of task competences consistent with the goal of the nascent enterprises. In our sample, team members coalesce because of existing social relationships, not because of their skills. Even with respect to team formation, the university does not provide a formal framework for establishing and nurturing relationships: relationships emerge spontaneously, in particular between classmates.

Knowledge from university education is always useful for nascent entrepreneurs. However, sometimes it is nothing more than methodological, generic knowledge. In other cases, SRGs find their university-acquired knowledge to be very important in technical and domain-specific terms. Sometimes, domain-specific knowledge is complemented by new-firm-creation skills. SRGs can acquire these skills by participating in vocational courses the university usually organizes for all students. However, students should be informed about these courses, and they should be willing to participate; otherwise, they will not be able to access this knowledge.

Knowledge acquired from classmates is much less relevant. This finding can be explained by referring to the process of team formation: usually, students develop strong social relationships with a small number of classmates; when they have the opportunity to start a new business, they are likely to involve these classmates as cofounders. Hence, other classmates are not in a close enough relationship with the founders to act as a source of knowledge.

Finally, professors can act as important sources of knowledge and suggestions. However, this support must be requested and pursued by SRGs (it appears to be a sort of "pull process") because there is no formal initiative aimed at connecting nascent entrepreneurs with professors.

As for networking activities the university may provide, it appears that these opportunities can be very important for SRG nascent entrepreneurs looking for relations with local and global stakeholders

and, sometimes, investors. The university is developing formal initiatives to this end; hence, it is expected that the perceived value of these strategic activities will improve in the next future.

Finally, formal support initiatives have long been the core of university behaviour aimed at enabling entrepreneurship. Of course, these initiatives are important and valuable, particularly for HT ventures. It is worth noting, however, that HT founding teams do not necessarily need these services, while they can benefit from previously mentioned (informal) activities.

5. Discussion and conclusions

The results of this analysis contribute to the literature on nascent and student entrepreneurship and on university-industry technology transfer by focusing on informal and non-traditional mechanisms of KT that appear appropriate not only for HT sectors but also for traditional LMT service and manufacturing industries.

The empirical analysis conducted on 154 entrepreneurial ideas highlighted the individual characteristics (with particular reference to academic background) of SRG nascent entrepreneurs and their entrepreneurial projects. In addition, comparisons have been presented to note the differences between individuals and projects belonging to low- and medium-tech industries and those belonging to high-tech industries.

Evidence of the quantitative analysis reveals a robust relationship between education field and the R&D intensity of entrepreneurial projects, with most of the SRGs in arts and humanities involved in LMT projects, SRGs in business mainly involved in LMT projects, and SRGs in engineering mostly involved in HT projects.

Educational fields seem to also be relevant with reference to the composition of teams, with engineering favouring homogeneous teams and arts and humanities favouring more heterogeneous teams, in both HT and LMT projects. For SRGs in business, administration and law, they tend to group together in homogeneous teams when developing LMT projects, while they participate in more heterogeneous teams when working on HT projects.

It is also worth noting that the results suggest that SRGs take advantage of the knowledge acquired at university to develop more innovative entrepreneurial projects than those planned by non-graduates.

These results reinforce the role of the traditional mission (that related to the education of students) of the university in supporting entrepreneurship, in both the HT and LMT industries. This role is complemented by formal KT mechanisms, mostly in the case of new firms aimed at HT industries.

An important contribution of this paper to the literature on student entrepreneurship and team formation concerns the role of the local university in the composition of founding teams. We find statistically significant evidence of the role of the university as a social context favouring the creation

of linkages among students in homogeneous contexts, which represent a fertile environment for the emergence of entrepreneurial ideas. We also contribute to the literature on social and geographical proximity, by identifying specific mechanisms favouring the aggregation of members with similar characteristics and common experiences in entrepreneurial teams.

Our paper also adds to the works on informal knowledge transfer by identifying specific mechanisms favouring entrepreneurship in the local university context. Our results on the team composition have been confirmed by the exploratory qualitative analysis that we conducted to further understand the informal KT mechanisms through which the university supports nascent entrepreneurs in LMT sectors. Friendship relations among classmates or being part of the same research lab or project represent social ties that played an important role in facilitating the development of the entrepreneurial idea and the decision to start a business. This analysis also shows that the university has the potential to support SRG entrepreneurial endeavours and that it actually performs many KT activities: educational activities related to entrepreneurship, projects and fieldwork, mentorship by teachers, and advising from other students and alumni, to cite only the most relevant examples.

We also find that in HT sectors, informal mechanisms are less evident, and their relevance is partially hidden by the use of formal KT mechanisms, at the initial or later stages of the entrepreneurial process. Informal mechanisms may trigger the development of entrepreneurial ideas, but in the medium-long term, a more important role in the startup creation process may be covered by formal mechanisms of KT. By contrast, in LMT sectors, informal mechanisms assume a prominent role, and their effects tend to be long-lasting.

Our results provide managerial and policy implications for the design of effective university programmes and KT initiatives, as well as for local policies supporting the local production and exploitation of useful knowledge from the university. Findings suggest that universities provide inputs that SGRs utilize as part of their pro-active behaviour in the entrepreneurial process. It is likely that more university initiatives specifically addressed to the development of entrepreneurial ideas would further encourage students and graduate involvement in startup creation. This also means that universities have plenty of opportunities to improve their impact on entrepreneurship, in particular with reference to LMT entrepreneurship. First, universities can propose courses on entrepreneurship that are targeted to students belonging to different disciplines, mainly targeting non-economic educational fields, and they can encourage professors to develop innovative teaching methods aimed at allowing students to experiment with entrepreneurial behaviours. Furthermore, universities can formalize mentorship programmes aimed at making the development of relationships between SRGs and professors easier and more structured. The establishment of an efficient network of past students is an additional strategy that can be very fruitful in terms of informal KT. Universities could also

provide SRGs with services to easily access information about local initiatives aimed at supporting entrepreneurship.

Finally, the various initiatives implemented by universities may additionally enhance opportunities for the aggregation of students who can potentially form entrepreneurial teams. In the absence of university actions aimed at favouring the emergence of entrepreneurial teams, our results indicated that students select each other to form a team if they are similar. To this end, universities may establish actions that increase awareness of the importance of heterogeneous competences in entrepreneurial teams and design a variety of interventions to expose potential founders to heterogeneous social contexts.

This paper investigated a provincial territory characterized by the presence of a local university and a large share of LMT sectors. Our quantitative analysis has highlighted some peculiar characteristics of local SRGs, with particular reference to team variety. Although the empirical context focuses on a single geographical area in Italy, the results can largely be generalized to other countries for several reasons. First, the research setting is based on theories, variables and methods grounded in previous international literature and that are not context or domain-specific. In addition, the economic structure of the Rimini province, composed of a multitude of small enterprises belonging to low-medium R&D intensity sectors, is quite common at the international level. Finally, the activities implemented by the University of Bologna to stimulate student entrepreneurship are being applied by a growing number of universities on a global scale. Hence, the research methods can be applied to other nations, and the findings regarding the Italian context can be interestingly compared with other contexts.

Our study presents some limitations that pave the way for future research. First, the quantitative analysis is focused on the educational backgrounds of SRGs; thus, it may lead to an underestimation of the impact of team members' work experiences. Further research should investigate this important variable and should also measure the consistency of the educational background of team members with respect to their role in the nascent firm. Second, with respect to the qualitative analysis, the limited number of interviews prevents the generalization of results. Additional interviews involving SRGs participating in HT ventures may allow us to define a set of informal mechanisms of KT that may be subsequently investigated through a systematic survey of team members and projects, thus providing relevant results for the theoretical conceptualization of these mechanisms.

Finally, this paper does not measure the impact of education-specific variables on the performance of new firms in the LMT and HT sectors. From the analysis of this paper, we are not able to assess the relationship between the heterogeneity of new venture teams (e.g., educational level and educational specialty) and entrepreneurial outcomes (e.g., the actual founding of a new firm). However, our descriptive results offer insights for this debate that deserve further investigation. In

line with previous research (Klotz et al. 2014), our findings are consistent with the idea that a complex relationship exists between these two factors. On the one hand, we observe that SRGs build more homogeneous teams in terms of educational specialties compared with older graduates who might have accumulated experience in the job market. On the other hand, we see that teams that proceed to the stage of firm founding are more homogeneous in terms of educational specialties than teams that do not experience a founding event. Although we cannot propose any definitive interpretation of these patterns, at this stage of our analysis, we believe it is important for future research to investigate the hypothesis that universities provide SRGs with shared language and methods that, under certain conditions, ease the emergence of new firms.

Despite these limitations, the results of this paper shed light on the subtle and overlooked mechanisms of KT through which a university fosters and supports student entrepreneurship in LMT sectors.

References

Addie, J.-P.D., Keil, R., & Olds, K. (2014). Beyond town and gown: universities, territoriality and the mobilization of new urban structures in Canada. *Territory, Politics, Governance*, 3(1), 27-50.

Adekiya, A.A., & Ibrahim, F. (2016). Entrepreneurship intention among students. The antecedent role of culture and entrepreneurship training and development. *International Journal of Management Education*, 14(2): 116-132.

Amason, A., Shrader, R.C., & Thompson, G.H. (2006), Newness and novelty: relating top management team composition to new venture performance. *Journal of Business Venturing*, 21, 125-148.

Åstebro, T., & Thompson, P. (2011). Entrepreneurs: jacks of all trades or hobos? *Research Policy*, 40(5), 637-649.

Åstebro, T., Bazzazian, N., & Braguinsky, S. (2012). Start-ups by recent university graduates and their faculty: Implications for university entrepreneurship policy. *Research Policy*, 41(4), 663–677.

Audretsch, D. (2014). From the entrepreneurial university to the university of entrepreneurial society. *Journal of Technology Transfer*, 39, 313–321.

Autio, E., Kenney, M., Mustar, P., Siegel, D., & Wright, M. (2014). Entrepreneurial innovation: The importance of context. *Research Policy*, 43(7), 1097-1108.

Beyhan, B., & Findik, D. (2017). Student and graduate entrepreneurship: ambidextrous universities create more nascent entrepreneurs. *Journal of Technology Transfer*, 43(5), 1346-1374.

Baldini, N., Grimaldi, R., & Sobrero, M. (2006). Institutional changes and the commercialization of academic knowledge: A study of Italian universities' patenting activities between 1965 and 2002. *Research Policy,* 35(4): 518-532.

Becheikh, N, Landry, R, & Amara, N. (2006). Lessons from innovation empirical studies in the manufacturing sector: A systematic review of the literature from 1993–2003. *Technovation*, 26(5-6): 644-664.

Bell, S.T., Villado, A.J., Lukasik, M.A., Belau, L., & Briggs, A.L. (2011). Getting specific about demographic diversity variable and team performance relationships: A meta-analysis. *Journal of management*, 37(3), 709-743.

Bergmann, H., Hundt, C., & Sternberg, R. (2016). What makes student entrepreneurs? On the relevance (and irrelevance) of the university and the regional context for student start-ups. *Small Business Economics*, 47: 53–76.

Berkovitz, J., & Feldman, M. (2004). *Academic entrepreneurs: social learning and participation in university technology transfer*. Toronto, Mimeo, University of Toronto.

Boh, W.F., De Haan, U., & Strom, R. (2016). University technology transfer through entrepreneurship: faculty and students in spinoffs. *Journal of Technology Transfer*, 41(4), 661–669.

Boschma, R. 2005. Proximity and innovation: a critical assessment. *Regional Studies*, 39(1), 61-74.

Bowers, C.A., Pharmer, J.A., & Salas, E. (2000). When member homogeneity is needed in work teams: A meta-analysis. *Small Group Research*, 31(3), 305-326.

Boyatzis, R.E. (1998). *Transforming qualitative information: Thematic analysis and code development*. Thousand Oaks, CA: Sage.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.

Bruneel, J., D'Este, P., & Salter, A. (2010). Investigating the factors that diminish the barriers to university–industry collaboration. *Research Policy*, 39, 858-868.

Carey, T.A., Flanagan, D.J., & Palmer, T.B. (2010). An examination of university student entrepreneurial intentions by type of venture. *Journal of Developmental Entrepreneurship*, 15(4), 503-517.

Cesaroni, F., & Piccaluga, A. (2016). The activities of university knowledge transfer offices: Towards the third mission in Italy. *International Journal of Technology Transfer,* 41(4), 753-777.

Cohen, W.M., & Levinthal, D.A. (1990). Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, 35, 128-152.

D'Este, P., Guy, F., & Iammarino, S. (2012). Shaping the formation of university–industry research collaborations: What type of proximity does really matter? *Journal of Economic Geography,* 13(4), 537-558.

Ellison, G., & Glaeser, E.L. (1997). Geographic concentration in US manufacturing industries: a dartboard approach. *Journal of Political Economy*, 105(5), 889-927.

Etzkowitz, H.A., Webster, A., Gebhardt, C., & Terra, B.R.C. (2000). The future of the university and the university of the future: Evolution of ivory tower to entrepreneurial paradigm. *Research Policy*, 29(2), 313–330.

European Commission. (2012). *Effects and impact of entrepreneurship programmes in higher education*. Brussels: European Commission.

European Commission. (2013). *Entrepreneurship 2020 Action Plan: rethinking the entrepreneurial spirit in Europe*. Brussels: European Commission.

Ferrante, F., Federici, D. & Parisi, V. (2018). The entrepreneurial engagement of Italian university students: some insights from a population-based survey. *Studies in Higher Education*, 1-24.

Fini, R., Meoli, A., Sobrero, M., Ghiselli, S., & Ferrante, F. (2016). *Student entrepreneurship: demographics, competences and obstacles*. Bologna, AlmaLaurea Consortium.

Foo, M. (2011). Teams developing business ideas: How member characteristics and conflict affect member-rated team effectiveness. *Small Business Economics*, 36, 33–46.

Foo, M., Sin, H., & Yiong, L. (2006). Effects of team inputs and intrateam processes on new venture team effectiveness. *Strategic Management Journal*, 27, 389–399.

Foo, M., Wong, P., & Ong, A. (2005). Do others think you have a viable business idea? Team diversity and judges' evaluation of ideas in a business plan competition. *Journal of Business Venturing*, 20, 385–402.

Franke, N., & Lüthje, C. (2004). Entrepreneurial intentions of business students - a benchmarking study. *International Journal of Innovation and Technology Management*, 1(3): 269-288.

Galindo-Rueda, F., & Verger, F. (2016). OECD Taxonomy of Economic Activities Based on R&D Intensity. *OECD Science, Technology and Industry Working Papers*, 2016/04, Paris, OECD Publishing.

Galloway, L., & Brown, W. (2002). Entrepreneurship education at university: a driver in the creation of high growth firms? *Education+Training*, 44(8/9), 398-405.

GEM (2017). *Global Entrepreneurship Monitor Report 2016/17*. Babson College (MA): Global Entrepreneurship Research Association.

Giuliani, E., & Bell, M. (2005). The micro-determinants of meso-level learning and innovation: Evidence from a Chilean wine cluster. *Research Policy*, 34(1): 47-68.

Giuri, P., & Mariani, M. 2013. When distance disappears: Inventors, education, and the locus of knowledge spillovers, *Review of Economics and Statistics*, 2013 (95), 449-463.

Grimaldi, R., Kenney, M., Siegel, D.S., & Wright, M. (2011). 30 years after Bayh–Dole: Reassessing academic entrepreneurship. *Research Policy*, 40(8), 1045–1057.

Grimpe, C., & Fier, H. (2010). Informal university technology transfer: a comparison between the United States and Germany. *Journal of Technology Transfer*, 35, 637-650.

Grimpe, C., & Hussinger, K. (2008). Formal and informal technology transfer from academia to industry: complementarity effects and innovation performance. *ZEW Discussion Papers* 08-080.

Guest, G., MacQueen, K.M., & Namey, E.E. (2012). *Applied thematic analysis*. London, Sage.

Hayter, C.S., Lubynsky, R., & Maroulis, S. (2017). Who is the academic entrepreneur? The role of graduate students in the development of university spinoffs. *Journal of Technology Transfer*, 42(6), 1237-1254.

Henneke, D., & Lüthje, C. (2007). Interdisciplinary heterogeneity as a catalyst for product innovativeness of entrepreneurial teams. *Creativity and Innovation Management*, 16(2), 121-132.

Hirsch-Kreinsen, H. (2008). 'Low-technology': a forgotten sector in innovation policy. *Journal of Technology Management & Innovation*, 3(3): 11-20.

Hsu, D.H., Roberts, E.B., & Eesley, C.E. (2007). Entrepreneurs from technology-based universities: evidence from MIT. *Research Policy*, 36, 768–788.

ISTAT (2009). *Classificazione delle attività economiche: Ateco 2007*. Metodi e Norme n. 40, Roma, ISTAT.

Jansen, S., van de Zande, T., Brinkkemper, S., Stam, E., & Varma, V. (2015). How education, stimulation, and incubation encourage student entrepreneurship: observations from MIT, IIIT, and Utrecht University. *The International Journal of Management Education*, 13: 170-181.

Kaiser, U., & Müller, B. (2015). Skill heterogeneity in startups and its development over time. *Small Business Economics*, 45(4), 787-804

Klotz, A.C., Hmieleski, K.M., Bradley, B.H., Busenitz, L.W. (2014). New Venture Teams: A Review of the Literature and Roadmap for Future Research. *Journal of Management*, 40(1): 226-255.

Lange, J.E., Marram, E., Jawahar, A.S., Yong, W., & Bygrave, W. (2011). Does an entrepreneurship education have lasting value? a study of careers of 4,000 alumni. *Frontiers of Entrepreneurship Research*, 31(6), 210-224.

Lazear, E.P. (2005). Entrepreneurship. *Journal of Labor Economics*, 23, 649-680.

Lazzeroni, M., & Piccaluga, A. (2015). Beyond 'town and gown': The role of the university in small and medium-sized cities. *Industry and Higher Education*, 29(1), 11-23.

Lerner, J., & Malmendier, U. (2011). With a little Help from My (random) Friends: Success and Failure in Post-business School Entrepreneurship. *NBER Working Paper*.

Link, A.N., Siegel, D.S., &. Bozeman, B. (2007). An empirical analysis of the propensity of academics to engage in informal university technology transfer. *Industrial & Corporate Change*, 16(4), 641-655.

Marchand, J., & Hermens, A. (2015). Student entrepreneurship: a research agenda. *The International Journal of Organizational Innovation*, 8(2): 266-281.

Maresch, D., Harms, R., Kailer, N., & Wimmer-Wurm, B. (2016). The impact of entrepreneurship education on the entrepreneurial intentions of students in science and engineering versus business studies university programs. *Technological Forecasting & Social Change*, 104(C): 172-179.

Markman, G.D., Gianiodis, P.T., Phan, P.H., & Balkin D.B. (2005a), Innovation speed: transferring university technology to market. *Research Policy*, 34 (7), 1058–1075.

Markman, G.D., Phan, P.H., Balkin, D.B., & Gianiodis, P.T. (2005b), Entrepreneurship and university-based technology transfer. *Journal of Business Venturing*, 20(2), 241–263.

Merton, R. K. (1975). Thematic analysis in science: Notes on Holton's concept. *Science*, 188(4186), 335–338.

Meyer-Krahmer, F., & Schmoch, U. (1998). Science-based technologies: university-industry interactions in four fields. *Research Policy*, 27, 835-851.

Morris, M., Shirokova, G., & Tsukanova, T. (2017). Student entrepreneurship and the university ecosystem: a multi-country empirical exploration. *European Journal of International Management*, 11(1), 65-85.

Mowery, D.C., Nelson, R.R, Sampat, B.N., & Ziedonis, A.A. (2001), The growth of patenting and licensing by the U.S. universities: an assessment of the effects of the Bayh-Dole act of 1980. *Research Policy*, 30(1), 99-119.

OECD. (2017). *Entrepreneurship at Glance 2017*. Paris, OECD Publishing.

Perkmann, M., & Walsh, K. (2007). University–industry relationships and open innovation: towards a research agenda. *International Journal of Management Reviews*, 9(4), 259-280.

Reynolds, P.D., & Curtin, R.T. (2008). Business Creation in the United States: Panel Study of Entrepreneurial Dynamics II. Initial Assessment. *Foundations and Trends in Entrepreneurship*, 4(3), 155-307.

Reynolds, P. D., Bosma, N., Autio, E., Hunt, S., De Bono, N., Servais, I., Lopez-Garcia P., & Chin, N. (2005). Global Entrepreneurship Monitor: Data collection design and implementation 1998-2003. *Small Business Economics*, 24, 205-231.

Reynolds, P.D. (2000). National Panel Study of U.S. Business Start-ups: Background and Methodology. In J.A. Katz (Ed.), *Databases for the Study of Entrepreneurship*, pp. 153–227, Amsterdam: JAI Press.

Roberts, E.B., & Eesley, C.E. (2011). Entrepreneurial impact: the role of MIT - an updated report. *Foundations and Trends in Entrepreneurship*, 7(1-2): 1-149.

Rothaermel, F.T., Agung, S.D., & Jiang, L. (2007). University entrepreneurship: A taxonomy of the literature. *Industrial and Corporate Change*, 16(4): 691-791.

Ruef, M., Aldrich, H.E., & Carter, N.M. (2003), The structure of founding teams: Homophily, strong ties, and isolation among U.S. entrepreneurs. *American Sociological Review*, 68(2), 195-222.

Shane, S. (2002a), Executive forum: university technology transfer to entrepreneurial companies. *Journal of Business Venturing*, 17 (6), 537-552.

Shane, S. (2002b), Selling university technology: patterns from MIT. *Management Science*, 48(1), 122-137.

Sheeran, P. (2002). Intention-behavior relations: a conceptual and empirical review. *European Review of Social Psychology*, 12(1), 1-36.

Shirokova, G., Osiyevskyy, O., & Bogatyreva, K. (2016). Exploring the intention-behavior link in student entrepreneurship: moderating effects of individual and environmental characteristics. *European Management Journal*, 34(4): 386-399.

Silva, O. (2007). The jack of all trades entrepreneur. Innate talent or acquired skills. *Economic Letters*, 97(2), 118-123.

Stuetzer, M., Obschon, M., & Schmitt-Rodermund, E. (2013). Balanced skills among nascent entrepreneurs. *Small Business Economics*, 41(1), 93-114.

Teixeira, A.A.C., & Forte (2017). Prior education and entrepreneurial intentions: the differential impact of a wide range of fields of study. *Review of Management Science*, 11: 253-394.

Thursby, J.G., & Thursby, M.C. (2002). Who is selling the Ivory tower? Sources of growth in university licensing. *Management Science*, 48(1), 90–104.

UNESCO Institute for Statistics (2014). *ISCED fields of education and training 2013* (ISCED-F 2013). Montreal, UNESCO.

Vogel, R., Puhan, T.X., Shehu, E., Kliger, D., & Beese, H. (2014). Funding decisions and entrepreneurial team diversity: A field study. *Journal of Economic Behavior & Organization*, 107, 595-613.

Wagner, J. (2006). Nascent entrepreneurs. In S.C. Parker, *The life cycle of entrepreneurial ventures*, 15-37, New York, Springer.

Yin, R.K. (1994). *Case study research: design and methods*. Newbury Park, CA: Sage.

Table 1. Descriptive statistics.

	Obs	Mean	Std. Dev.	Min	Max
			Individual level		
GENDER	535	0.318	0.466	0	1
AGE	528	34.994	9.601	18	66
SECONDARY SCHOOL	528	0.015	0.122	0	1
HIGH SCHOOL	528	0.294	0.456	0	1
BACHELOR	528	0.144	0.351	0	1
MASTER	528	0.491	0.500	0	1
PHD	528	0.057	0.232	0	1
NO_GRADUATE	528	0.309	0.462	0	1
STURE_GRADUATE	528	0.354	0.479	0	1
OLD_GRADUATE	528	0.337	0.473	0	1
EDUCATION	365	0.005	0.074	0	1
ARTS & HUMANITIES	365	0.145	0.353	0	1
SOCIAL SCIENCES	365	0.101	0.302	0	1
BUSINESS, ADMINISTRATION & LAW	365	0.266	0.442	0	1
NATURAL SCIENCES, MATH & STATISTICS	365	0.068	0.253	0	1
ICTS	365	0.036	0.186	0	1
ENGINEERING, MFG, CONSTR.	365	0.321	0.467	0	1
AGRI, FORESTRY, FISHERIES, VET.	365	0.005	0.074	0	1
HEALTH & WELFARE	365	0.041	0.199	0	1
SERVICES	365	0.011	0.104	0	1
LOCAL_GRADUATE	365	0.532	0.500	0	1
			Project level		
SIZE	154	3.474	0.842	3	8
SECTOR_R&D	154	0.416	0.494	0	1
FIRM_FOUNDED	154	0.318	0.467	0	1
IP_PROTECTION	154	0.104	0.306	0	1
DIVERSITY_AGE	154	0.140	0.124	0	0.554
DIVERSITY_EDU	154	0.809	0.513	0	1.665
DIVERSITY_EDU-TIME	154	0.694	0.513	0	1.648
DIVERSITY_ISCED	117	0.796	0.533	0	1.733

Table 2. Distribution of projects by R&D intensity and division of economic activity

Macro cluster	OECD group of R&D intensity	Division (ISIC, Rev 4)	Number of projects	Representative sector
Low-medium R&D	Low (N=48)	Agriculture, forestry and fishing	4	Growing of non-perennial crops
		Water supply & waste management	2	Waste collection, treatment and disposal activities
		Construction, trade, & transportation	10	Retail trade
		Accommodation & food service activities	7	Accommodation
		Information & communication	1	Sound recording and music publishing activities
		Real estate activities	1	Real estate activities
		Professional, scientific, & technical activities	1	Legal activities
		Administrative & support service activities	11	Travel agency, tour operator, reservation service and related activities
		Other activities	11	Sports activities and amusement and recreation activities
	Medium-low (N=40)	Manufacturing	13	Apparel; Structural metal products and metal container-type objects
		Information & communication	3	Publishing of books and periodicals
		Professional, scientific, & technical activities	22	Management consultancy activities
		Administrative & support service activities	1	Human resources provision
		Other activities	1	Human health activities
	Medium (N=2)	Manufacturing	2	Plastics products; Sports goods
High R&D	Medium-high (N=50)	Manufacturing	6	Machinery and equipment; Motor vehicles; Transport equipment
		Information & communication	44	Computer programming, consultancy; Information service activities
	High (N=14)	Manufacturing	9	Measuring, testing, navigating and control equipment
		Professional, scientific, & technical activities	5	Scientific R&D

Notes: Groups of economic activities within the same divisions can be linked with varying degrees of R&D intensity. See Galindo-Rueda and Verger (2016, 10) for details about groups accruing to each division. Details about the specific group-division linkages in our sample are available from the author upon request.

Table 3. Distribution of team members by education level, time since graduation, education field, and R&D intensity of the project.

		R&D intensity of the industry linked to the project		
EDUCATIONAL ATTAINMENT		Low-medium	High	Total
Secondary school	N	5	3	8
	%	*62.5*	*37.5*	*100*
High school	N	96	59	155
	%	*61.94*	*38.06*	*100*
Bachelor	N	42	34	76
	%	*55.26*	*44.74*	*100*
Master	N	147	112	259
	%	*56.76*	*43.24*	*100*
PhD	N	10	20	30
	%	*33.33*	*66.67*	*100*
Total	N	300	228	528
	%	*56.82*	*43.18*	*100*

GRADUATION & TIME ELAPSED		Low-medium	High	Total
NO_GRADUATE	N	101	62	163
	%	*61.96*	*38.04*	*100*
STURE_GRADUATE	N	97	90	187
	%	*51.87*	*48.13*	*100*
OLD_GRADUATE	N	102	76	178
	%	*57.3*	*42.7*	*100*

EDUCATIONAL FIELD *(SRGs)*		Low-medium	High	Total
Engineering, manufacturing & construction	N	21	41	62
	%	*33.87*	*66.13*	*100*
Business, administration & law	N	37	18	55
	%	*67.27*	*32.73*	*100*
Education, arts & humanities	N	19	7	26
	%	*73.08*	*26.92*	*100*
Natural sciences, mathematics & statistics	N	7	7	14
	%	*50*	*50*	*100*
Social sciences, journalism & information	N	8	4	12
	%	*66.67*	*33.33*	*100*
ICTs	N	1	10	11
	%	*9.09*	*90.91*	*100*
Other fields	N	4	3	7
	%	*57.14*	*42.86*	*100*
Total	N	97	90	187
	%	*51.87*	*48.13*	*100*

Table 4. Average value of variable DIVERSITY_ISCED by education field of SRGs and R&D intensity of the project.

SRGs field of graduation		*R&D intensity of the project*		Total
		Low-medium	High	
Education, Arts & Humanities, Social sciences	N	24	10	34
	Mean	0.94	1.05	0.97
Business, administration & law	N	36	18	54
	Mean	0.64	0.96	0.74
Natural sciences, ICTs, Engineering	N	27	56	83
	Mean	0.66	0.70	0.69
Other fields	N	3	3	6
	Mean	0.66	0.93	0.80
Total	N	90	87	177
	Mean	0.72	0.80	0.76

Table 5. The influence of university ties on team composition

		Observed	Random match (700 replications)	Difference in %	Statistical significance (p-value)
Teams without SRGs	**n**	**67**	**40**	**68.37**	
Teams with only 1 SRG	**n**	**34**	**60**	**-43.09**	
Teams with only 1 INSIDER SRG	n	14	37	-62.25	
Teams with only 1 OUTSIDER SRG	n	20	23	-11.73	
Teams with 2 or more SRGs	n	53	54	-2.69	
	SRGs	2.89	2.34	23.40	0.001
	DIVERSITY_ISCED	0.78	1.04	-24.78	0.007
	DIVERSITY_AGE	0.14	0.22	-33.79	0.003
Teams with 2 or more INSIDER SRGs	n	27	21	28.69	
	SRGs	2.85	2.23	27.69	0.004
	DIVERSITY_ISCED	0.70	1.01	-30.27	0.044
	DIVERSITY_AGE	0.16	0.21	-25.37	0.154
Teams with 2 or more OUTSIDER SRGs	n	9	6	39.63	
	SRGs	2.67	2.13	25.23	0.037
	DIVERSITY_ISCED	0.82	0.98	-16.88	0.557
	DIVERSITY_AGE	0.14	0.23	-38.38	0.191
Teams with INSIDER & OUTSIDER SRGs	n	17	27	-37.13	
	SRGs	3.06	2.47	23.64	0.056
	DIVERSITY_ISCED	0.89	1.08	-17.31	0.102
	DIVERSITY_AGE	0.12	0.22	-43.57	0.011
All teams	**n**	**154**	**154**		

Notes: Values reported for the sub-groups of teams with 2 or more SRGs are, respectively: the average number of SRGs, the average value of the variable DIVERSITY_ISCED, and the average value of the variable DIVERSITY_ AGE.

Table 6: Projects included in interviews.

Project ID	Sector	NINI Year	Member ID	Birth	Educational field	Educational attainment	Member status	Local university	
A	Energy (High tech)	2017	1	1970	Natural sciences, ICTs, Engineering	PhD	Older graduate	Insider	Interviewed
			2	1985	Natural sciences, ICTs, Engineering	PhD	Student/recent graduate	Insider	
			3	1967	Natural sciences, ICTs, Engineering	PhD	Older graduate	Outsider	
			4	1991	Natural sciences, ICTs, Engineering	Master	Student/recent graduate	Insider	
			5	1988	Natural sciences, ICTs, Engineering	Master	Student/recent graduate	Insider	
B	Biomedical engineering (High tech)	2017	6	1987	Natural sciences, ICTs, Engineering	Master	Student/recent graduate	Insider	
			7	1987	Natural sciences, ICTs, Engineering	PhD	Student/recent graduate	Insider	Interviewed
			8	1987	Natural sciences, ICTs, Engineering	Master	Student/recent graduate	Insider	
			9	1987	Natural sciences, ICTs, Engineering	PhD	Student/recent graduate	Insider	
C	Mechanics (High tech)	2016	10	1968	Natural sciences, ICTs, Engineering	PhD	Older graduate	Outsider	
			11	1985	Natural sciences, ICTs, Engineering	PhD	Student/recent graduate	Insider	
			12	1970	Natural sciences, ICTs, Engineering	PhD	Older graduate	Outsider	
			13	1986	Natural sciences, ICTs, Engineering	PhD	Student/recent graduate	Insider	Interviewed
			14	1976	Natural sciences, ICTs, Engineering	Master	Older graduate	Outsider	
D	Professional services (Low-medium tech)	2017	15	1986	Medicine	Master	Older graduate	Insider	Interviewed
			16	1981	Medicine	Master	Student/recent graduate	Insider	
			17	1979	Medicine	Master	Older graduate	Outsider	
E	Professional services (Low-medium tech)	2017	18	1989	Business, Administration, Law	Master	Student/recent graduate	Insider	
			19	1990	Business, Administration, Law	Master	Student/recent graduate	Insider	Interviewed
			20	1991	Business, Administration, Law	Master	Student/recent graduate	Insider	Interviewed
			21	1992	-	High school	Non graduate	-	
			22	1993	Business, Administration, Law	Master	Student/recent graduate	Outsider	
F	Tourism (Low-medium tech)	2016	23	1990	Business, Administration, Law	BSc	Student/recent graduate	Insider	Interviewed
			24	1989	Natural sciences, ICTs, Engineering	Master	Student/recent graduate	Insider	
			25	1974	-	High school	Non graduate	-	
G	Tourism (Low-medium tech)	2011	26	1982	Business, Administration, Law	Master	Student/recent graduate	Insider	
			27	1982	Business, Administration, Law	Master	Student/recent graduate	Insider	Interviewed

			28	1983	Natural sciences, ICTs, Engineering	Master	Student/recent graduate	Outsider	
H	Fashion (Low-medium tech)	2012	29	1976	Natural sciences, ICTs, Engineering	Master	Older graduate	Insider	
			30	1980	Education, Arts & Humanities, Social sciences	Master	Student/recent graduate	Outsider	
			31	1976	Natural sciences, ICTs, Engineering	Master	Older graduate	Outsider	Interviewed
I	Fashion (Low-medium tech)	2010	32	1985	Education, Arts & Humanities, Social sciences	Master	Student/recent graduate	Insider	Interviewed
			33	1985	Education, Arts & Humanities, Social sciences	Master	Student/recent graduate	Insider	Interviewed
			34	1983	Education, Arts & Humanities, Social sciences	Master	Student/recent graduate	Insider	
			35	1983	Education, Arts & Humanities, Social sciences	Master	Student/recent graduate	Insider	
J	Agriculture (Low-medium tech)	2014	35	1988	Natural sciences, ICTs, Engineering	Bachelor	Student/recent graduate	Insider	Interviewed
			37	1987	Other	Bachelor	Student/recent graduate	Outsider	
			38	1987	-	High school	Non graduate	-	
			39	1988	-	High school	Non graduate	-	
K	Agriculture (Low-medium tech)	2013	40	1983	-	High school	Non graduate	-	
			41	1984	Natural sciences, ICTs, Engineering	Master	Student/recent graduate	Insider	
			42	1986	Education, Arts & Humanities, Social sciences	Master	Student/recent graduate	Outsider	Interviewed
			43	1983	-	High school	Non graduate	-	

Figure 1: Perceived value of university activities supporting entrepreneurship.