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How Does Team Diversity Evolve? Exploring Adaptation and Perpetuation Perspectives in Entrepreneurial Team Change

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Abstract
The influence of the evolution of team diversity on performance is a neglected yet important issue in entrepreneurial

ventures where team changes are extensive. In addressing this gap, we conceptualize how diversity influences team change and consequently impacts firm growth. Utilizing both individual and firm level data, we test our conceptual model on a novel sample of 137 team change events in 94 new-technology based firms using multi-level analysis. Results show that team variety does not directly influence change in team variety but that this relationship is significantly moderated by team separation and team disparity. Increase in team variety influences firm revenue growth. Managerial implications are discussed.

INTRODUCTION

Change impacts all aspects of organizational life, such as resource acquisitions, strategic decisions and, ultimately, firm performance (van de Ven & Poole, 1995). Spanning from the micro-individual level to the macro-field level, past scholars have focused on its antecedents (Dutton, Ashford, O'Neill, & Lawrence, 2001; Greve & Taylor, 2000), timing (Ancona & Chong, 1996) as well as impact (Arrow & McGrath, 1995). In all cases, scholars agree that understanding the nature of organizational change is crucial to explain the change-performance relationship.

Change in management and entrepreneurial teams is an important and frequent aspect of the change process (e.g., McGrath & Tschan, 2004). According to organizational theorists, team-changes result from two competing forces (Boone, Van Olffen, Van Witteloostuijn, and De Brabander, 2004). On one hand, team changes are part of an adaptation process. To be able to adapt their courses of action, teams often increase their within-team diversity, attracting and/or replacing existing members with different newcomers (Schneider, Smith, Taylor and Fleenor, 1998). On the other hand, a team may perpetuate the status quo by reproducing its characteristics. According to studies on homophily (McPherson, Smith-Lovin and Cook, 2001) and to Schneider's (1987) attraction-selection-attrition theory, similar individuals will be retained and attracted by the team, whereas more diverse ones will be excluded, resulting in a decrease of within-team diversity.

Despite their differences, both perspectives agree that: a) teams change as a result of a compelling need for (more or less) diversity and b) team change is fostered by either adaptive or perpetuating forces. It follows that, as a result of team change, within-team diversity evolves over time, fostering as well as inhibiting future team changes, and consequently influencing the qualitative nature of change.

The notion of diversity is therefore critical in predicting both future organizational conditions and performance. Indeed, there has been vast attention to the multidimensional nature of within-team diversity. Harrison & Klein (2007), in their theoretical paper, distinguish three types of within-team diversity, i.e., variety, separation and disparity; where variety refers to differences in functional background, separation to differences in values, and disparity to differences in status. Notwithstanding the fact that they all coexist within a team, they are different in

nature and, therefore, might function differently. However, extant research falls short in explaining how and to what extent team variety, separation and disparity predict change in within-team variety, and how such change ultimately impacts on organizational performance. This omission is especially important because the processes by which change occurs, whether by adaptation and/or perpetuation, may influence these outcomes. This approach is especially important in highlighting that team diversity is not simply related to functional variety but is a heterogeneous construct.

In an attempt to fill this void, we conceptualize how distinct types of within-team diversity influence the nature and timing of team change. On the one hand, adopting an adaptation perspective, we hypothesize a direct positive effect of team-variety on change in team-variety. On the other hand, according to the perpetuation approach, we postulate that separation and disparity will have a negative moderating effect on variety and change in team-variety relationship. Further, we attempt to reconnect team change dynamics to team effectiveness and performance. Our basic idea is that the source of change may have a different impact on how teams are able to cope with a variety of environmental demands, thus influencing firms' performance differently.

We test our conceptual model on a novel sample of new technology-based firms spun-off from academic institutions. We believe this is a sound empirical setting to test our hypotheses for different reasons. First, such a setting typically involves numerous instances of team member change (e.g., Chandler, 2005; Ucbasaran, et al., 2003; Beckman, 2008). Second, entrepreneurial team formation is driven both by cognitive assonance and by the need to fill gaps in functional roles, which is a major issue in academic spin-offs (Vanaelst, 2006; Clarysse, 2004). Third, targeting a specific class of new-technology-based firms (i.e., academic spin-offs) we are able to focus on an under-investigated source of within-team differences, this being the presence of multiple institutional logics (i.e., the science and the business logic) that affect simultaneously individual beliefs, values and cognition of team members (Kraatz & Block, 2008; Pache & Santos, 2010). Fourth, and more generally, as entrepreneurial teams affect firm performance directly (Kor, 2000), by providing access to an array of valuable financial, social, and human capital resource, this

context enable us to reconnect organizational-level measures of performance (e.g., sales growth or profitability) to team characteristics.

Results show that team separation and team disparity negatively moderate the relationship between team variety and change in team variety. Evidence also suggests that change events with higher impact on team variety benefit firms' revenue growth.

Our paper contributes to the literature in several ways. First, we synthesize the team change literature and diversity studies, shedding new light on how different types of diversity function according to adaptation and/or perpetuation perspectives and to what extent they impact changes in teams. We go beyond analysis of the importance of variety in functional background to highlight the heterogeneity of the team diversity construct by also incorporating the role of differences in values and status of team members. Second, we extend existing insights by conceptualizing and showing how diversity evolves over time and under what conditions it predicts superior organizational performances. Third, and more specifically, we extend the limited literature on the role of team evolution in meeting the growth challenges in the academic spin-off context.

This paper unfolds as follows. In the next paragraph, we review the conditions that lead to change in team variety. We then develop our hypotheses relating to our conceptual model (see Figure 1). We then describe our data and method, followed by the empirical analysis. Finally, we discuss our findings in the context of extending the existing literature.

--Insert Fig. 1 here—

THEORY AND HYPOTHESIS

Team Variety and Change in Team Variety: An Adaptation Perspective

The studies rooted in the Carnegie School (Simon, 1947; March and Simon, 1958) tradition point out that the variety of problems that an organization can face depends on the variety of cognitive resources to leverage. The construct of team variety—i.e., the composition of differences in kind, source or category of relevant knowledge or experience among unit members (Harrison and Kleine, 2007)—has often been used to capture the value of diversity of cognitive resources for decision quality and team performance (Bunderson & Sutcliffe, 2002).

Teams whose members draw from broader pools of information resources, e.g. their functional background, will likely make more effective decisions and obtain better performances than units exhibiting lower level of variety (Buyl et al., 2011). The ability of team members to interpret and adapt to increasing environmental and organizational complexity, is therefore dependent on the knowledge-base and cognitive characteristics of its members. Following this line of reasoning, teams with broader functional backgrounds are more aware of the functional needs that remain unfilled in the existing team configuration. These teams may seek fresh perspectives and new cognitive resources, and thus adapt their activities and reconfigure themselves.

Both entrepreneurial and top management team literature emphasize this view, arguing that teams intentionally change to address evolving streams of problems (Buyl et al., 2011; Shalley and Perry-Smith, 2008). For example, both Kamm and Nurick (1993) and Larson and Starr (1993) show that an entrepreneurial team seeks partners on the basis of its perceived needs. In an attempt to tap them, the team performs a systematic self-assessment of its resources and compares this against some ideal inventory of resources. In seeking to address the resultant gap, they replace some existing members with different newcomers (Boone et al., 2004)

Moreover, Chang, Bordia, and Duck (2003) show that the introduction of small changes to interrupt the team's current state of inertia and create an environment of instability may increase the team's propensity for larger changes in the future. Accordingly, the entrance of a new team member with non-overlapping knowledge might increase the probability of team change in the future. For example, entrepreneurial teams of young, technology-based firms are often made up of researchers with in-depth knowledge about the technical core of the business but who lack managerial skills (Colombo & Grilli, 2005). By providing new frames of reference, the entry of a new team member with general management competencies (i.e., an increase of team variety) might underscore the need for further specialist skills (e.g., intellectual property management or marketing). Since young organizations face severe resource constraints, the easiest way to acquire these skills is by attracting experts to join the entrepreneurial team (Clarysse & Moray, 2004; Vanaelst et al., 2006). Based on this reasoning, we propose the following:

Hypothesis 1: Team variety is positively correlated to change in team variety.

The Moderating Effect of Separation and Disparity: A Perpetuation Perspective

Studies on the dynamics of organizational demography have emphasized the tendency of small groups to reproduce their own demographic composition. Pfeffer (1997: 99), for instance, observed that "demography has a tendency to perpetuate itself—to use Kanter's (1977) apt phrase, to exhibit "homosocial reproduction". But why is it that we prefer to form groups with certain people? Research in the sociology of organizations has explained group formation drawing on the mechanism of homophily, according to which individuals tend to engage in relationships with others who possess similar characteristics. In principle, these characteristics may refer to social identities that are attached externally to individuals (e.g., ascribed characteristics such as gender, race, or age) or to internal states concerning values, beliefs, or norms (Lazarsfeld & Merton 1954). According to social identity theory, demographic attributes that are easily detected can indeed be socially meaningful (McGrath, Berdahl, & Arrow, 1995; O'Reilly, Williams, & Barsade, 1998). Traditionally, research has focused on surface-level differences (e.g., age, gender or ethnicity (Ruef et al., 2003), however, recent empirical studies have shown that homophily processes involve the area of occupations (McPherson, Smith-Lovin, & Cook, 2001; Burton & Beckman, 2007). Even psychological mechanisms have often been invoked to explain the general tendency toward homogenization. The basic proposition of these studies is that similarity on a salient dimension enhances interpersonal attraction: this is known as the similarity-attraction-attrition process (Schneider, Smith, Taylor, & Fleenor, 1998), according to which groups and organizations move toward and perpetuate member homogeneity because individuals are attracted to, selected by, and stay with organizations that suit their personality characteristics (Schaubroeck, Ganster, & Jones, 1998).

On top of team variety, the literature has identified two other facets characterizing the concept of team-diversity, namely separation and disparity (Harrison and Klein, 2007). As to the former, research refers to the differences in opinion among unit members, as for values, beliefs and attitudes. More specifically, separation is minimum when all members are psychologically or attitudinally similar in opinion; whereas separation is maximum when the unit is comprised of two extreme and opposing cliques. Reduced separation fosters a higher level of

cooperation and trust; on the contrary, a team low in separation will experience higher conflicts and low level of cohesion.

If team members are sharply separated, they might be motivated to seeking out (external others) with a similar socially-derived identity. Therefore, each subunit might prefer to add individuals sharing one subunit's values and beliefs, but not the other. Research shows that individuals that are psychologically similar most likely have been involved in a similar set of activities (e.g., exposed to the same set of logics, experienced similar career-paths) thus developing idiosyncratic cognitive schemes (Fitske, 1981). In such a scenario, maximum separation can foster team members to select the new entrants from two marketed different factions, engendering the variety of functional experiences, (Harrison & Klein, 2007). Under sharp separation individuals might be motivated to get new information to support their position, including seeking out (external) others who support their own perspective. In this way the members of a subunit may develop knowledge base not shared by the members of the opposing subunit (Peterson & Thompson, 1997). However, the knowledge and argument base associated with each of the factions is likely to increase and to be brought forward to the rest of the unit.

In contrast, if separation is minimal, team members may want to perpetuate the type of business or atmosphere, which already exists (Sapienza, Herron, and Menendez, 1991, p. 265), inviting or attracting people with a like-minded approach (Clarysse & Moray, 2004). Accordingly to perpetuation perspectives, most likely, the functional experiences and knowledge of entrants will duplicate incumbent's ones.

Drawing of this reasoning, we offer the following hypothesis directly linking team separation to team variety:

> *Hypothesis 2: Team separation will moderate the relationship between team variety and change in team variety, such that the relationship will be weaker when separation is low.*

Disparity reflects differences in concentration of valued social assets or resources, such as status, among unit members. When disparity in a group is at maximum, one member of the unit outranks all the others (Harrison and Kline, 2007). A high level of disparity might also foster silence, suppression of creativity and withdrawal (Pfeffer & Davis-Blake, 1992).

In the entrepreneurship domain, founders' industry experience is central for the growth of start-ups (e.g., Siegel, Siegel, & MacMillan, 1993). Experienced team members are familiar with customers, suppliers, and competitors and are therefore better able to evaluate and tackle strategic issues (Cooper, Gimeno-Gascon, & Woo, 1994); they have better developed networks within the industry that they can use as a resource in the venture. Moreover, experience has been shown to be a critical factor in studies of the effects of leaders and their organizations. Roberts and Berry (1985, p. 323), for example, find that "familiarity with the technology and market being addressed is the critical variable that explains much of the success or failure in new business development." Conversely, founders with less experience in the industry may not have the same capabilities and knowledge to draw on as the firm evolves (Eisenhardt and Schoonhoven 1996).

Therefore, industry experience is a "valuable" asset for the entrepreneurial venture. However, when this resource is distributed heterogeneously, status differences emerge creating the premise to exercise power within the team. In their study on top management teams, Eisenhardt and Schoonhoven (1990) point out that managers with a great deal of industry experience likely exert a great deal of influence on less experienced team members. Further, the asymmetric distribution of a valuable resource can lead to dysfunctional team change decisions. According to Harrison and Klein (2007) higher levels of disparity would tend to diminish or even neutralize the benefits expected from the presence of differing sources of task-relevant knowledge within the team. Members holding the highest concentration of the team's valued resources and with the highest status likely dictate the team's practices and performance. In contrast, team members with less power or status are likely to remain silent, deferring to the top members' wishes and failing to share critical information. Pitcher and Smith also suggest that a significant power shift renders the heterogeneity and the diverse cognitive perspectives that it represents less and less influential in the strategic decision-making process (2001).

Hence, higher status individuals, in order to maintain their predominant role will aim for team stability, rather than team change. Indeed, they will perpetuate the stability of the social system. Where they do attract newcomers, this will likely be relatively identical so as not to change the qualitative nature of the team. Accordingly, we hypothesize:

Hypothesis 3: Team disparity will moderate the relationship between team variety and change in team variety, such that the relationship will be weaker when disparity is high.

Change in Team Variety and Firm Performance

The idea that demographic diversity improves team performance is based on the informational diversity-cognitive resource perspective (Williams & O'Reilly, 1998), which suggests that distributional differences can serve as indicators of available knowledge and differing perspectives. A team that is more diverse in terms of demographic variables related to the task may be more successful than a homogeneous team because the former team can draw on a greater pool of knowledge and different perspectives (Chattopardy, Glick, Miller & Huber, 1999; Hambrick & Mason, 1984). A recent meta-analysis by Bell and colleagues (2011), based on 31 studies, indicates that team variety of functional background is positively and statistically significantly related to performance, especially when innovative outcomes are considered.

At the firm level, heterogeneity in team members' functional backgrounds likely has a positive impact on new venture performance as it provides a diverse stock of knowledge, capabilities, and expertise upon which the team can draw when pursuing entrepreneurial activities (Milliken & Martins, 1996; Randel & Jaussi, 2003). Ensley and Hmieleski (2005) find a positive relationship between an entrepreneurial team's functional heterogeneity and net cash flow and sales growth of the new venture. Furthermore, there is some evidence that start-up teams' functional experience shapes the competitive strategies, and ultimately performance, of new ventures (Shane & Stuart, 2002; Shrader & Siegel, 2007). For example, a broad scope of functional experiences improves organizational responsiveness to competitors' actions (Hambrick et al., 1996) and to environmental shifts, caused, for example, by technological discontinuities (Keck & Tushman, 1993). In sum, the wider breadth of cognitive perspectives and abilities is assumed to enhance information processing and encourage teams to be more effective solving complex, non-routine problems (DeDreu & West, 2001). It follows that increases in this variety likely enhance this ability. Thus:

Hypothesis 4: Increase in team variety is positively correlated to firm's growth.

Extending this line of reasoning, we maintain that a key mechanism through which team variety influences team performance is the organizational ability to re-design the team, by including novel frames of references, knowledge base and experiences. According to Hambrick et al. (2007), the heterogeneous team has a broader potential behavioral repertoire and is able to "conceive and launch actions on many fronts." Team (re)design is a mediating process relating cognitive resources to team effectiveness (LePine, Piccolo, Jackson, Mathieu, & Saul, 2008). As a team's reconfiguration process becomes more disrupted through low levels of team variety, the more difficult it becomes to effectively carry out its tasks. Thus, we expect change in team variety to mediate these relationships. Specifically, team variety should lead to higher levels of change in team variety, which should, in turn, lead to higher task performance. Conversely, teams with low levels of team variety should experience lower levels of team adjustment (i-e-, team redesign), which should then lead to lower levels of task performance. Thus:

Hypothesis 5: Change in team variety will mediate the relationship between team variety and firm's growth.

Recently there has been increased attention to contextual conditions that unlock the potential of variety of knowledge at the team level (for a review, see Joshi and Roh, [2009]). Joshi and Roh (2009) emphasize variety in terms of diversity in industry experience, functional background, and non-redundant network ties. Van Der Vegt and Bunderson (2005) find that diversity of knowledge and expertise benefited team performance only when team members had a shared identification with the group. This shared identification gave the team the motivation to persist and overcome the challenges associated with stereotyping members with different types of expertise. Extending this line of reasoning, we propose that the effect of team variety will be weaker under conditions of lower team separation on firm growth as mediated by change in team variety. Given the relative importance of team variety to team outcomes (Bell et al, 2011) and team separation to team functioning (Kane, Argote and Levine, 2005), when team separation is low, the influence of member change on change in team variety is lower, which will not impact task performance as much. Conversely, when team separation is high and team variety is high, this interaction on

task performance as mediated by change in team variety will be stronger. Thus, if change in team variety occurs when team separation is low, the total effect on firm growth will be less pronounced.

Hypothesis 6: Change in team variety will mediate the effect of the interaction between team variety and team separation on firm's growth.

We also propose that the effect of team variety will be weaker under conditions of higher team disparity on firm growth, as mediated by change in team variety. Higher levels of disparity would tend to diminish or even neutralize the benefits expected from the presence of differing sources of task-relevant knowledge within the team. Conversely, when team disparity is low and team variety is high, this interaction on task performance as mediated by change in team variety will be stronger. Thus, if change in team variety occurs under conditions of high-disparity, the total effect on firm's performance will be less pronounced.

Hypothesis 7: Change in team variety will mediate the effect of the interaction between team variety and team disparity on firm's growth.

DATA AND METHODS

Research Setting

We tested our hypotheses on the population of 473 Italian academic spin-offs from the 64 Italian Science, Technology Engineering Mathematics (STEM) universities and the 4 Italian Public Research Centers, since 1995. Our definition of academic spin-offs includes all start-ups based on a public university/research-centre developed technology, which have at least an academic or the public institution among the founders (Fini, Grimaldi, and Sobrero, 2009; Vohora, Wright and Lockett, 2004). The list of firms was created in 2006 by contacting each public institution Technology Transfer Office (where available) as well as the Network for the Valorization of University Research (NETVAL, www.netval.it) and was subsequently updated on a yearly basis. Each company was identified on the Italian Company House database (https://telemaco.infocamere.it/) to obtain financial and other background information. Information was crosschecked using the AIDA database

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(h. In 2011, we downloaded annual panel data for each year since incorporation.

The key variables for this study are constructed from entrepreneurs' career histories. Given our focus on young technology firms, we assume that all individuals who own some equity in the companies are also actively participating in their operations (Ucbasaran, Lockett, Wright and Westhead, 2003; Fini, Grimaldi, Marzocchi, and Sobrero, 2012). Therefore, we define an entrepreneur as an individual who owns, or has owned, some company shares at any given time. For each of the entrepreneurs, we constructed a monthly database of their career history until 2011 from a novel set of archival sources, including: social networks (e.g., Linkedin, Xing, Vidaeo, Academia.edu and Facebook), firms' websites, personal homepages, as well as extensive Web searches. This was a highly intensive process. Over a two-year period (2010-2011), we completed two complete searches for each person, spending about 2,000 person-hours. For a sub-sample of 132 entrepreneurs, we crossed checked the secondary data with primary data gathered during face-to-face interviews. No differences emerged in the assessed career paths. We also checked for survivorship bias, searching both the Italian Companies House database and AIDA database for companies owned by either public research institutions or public research institutions foundations that went out of business between 1995 and 2011. We were unable to identify any further companies beyond those already included in the dataset.

As a result of our effort, we were able to retrieve at least one element of career history information for 2299 entrepreneurs out of 2376. However, due to the longitudinal nature of our study, we had to characterized within-team diversity before and after any given change event. This resulted in a significant decrease of our sample size.

Recent simulation studies indicate that team measures based on incomplete information tend to produce downward biased correlations (random missing data on 20% of team members causes a 10% reduction in expected correlations) and higher standard errors (Allen, Stanley, Williams and Ross, 2007; Nesterkin and Ganster, 2012). Unfortunately, these studies do not suggest a critical threshold to maximize trade-off between statistical power and measurement bias. Following Ancona and Caldwell's (1992) study on new product development teams, we retained teams

satisfying all the following conditions: (i) missing data not exceeding 25% of team members; (ii) available information on three team members or more; (iii) available information on members departing and joining the team. Our final sample includes information on 137 team-change events nested in 94 firms. Complete data were available for 113 team-change events out of 137; 11 cases involved missing data ranging from 1% and 9%, whereas in 13 cases from 10 to 25%.

Measurement

Team variety. This is measured as differences in team members' functional background. We coded all functional categories in which each entrepreneur has been involved over his/her career-paths. Accordingly, we identified 12 categories, namely: Administration/HR, Business Development/Strategic Planning, Customer Service, Engineering/IT, Finance/Accounting, General, Marketing, Operations, R&D, Sales, Science, Social Science/Law. As suggested by Buyl et al. (2011), we used the Attneave's (1959), entropy-based, transmission measure T_{xy}, accounting for both the expertise-overlap between team members as well as the number of functions undertaken by them (Bunderson and Sutcliffe, 2002). This indicator is derived from a two-dimensional frequency matrix, having on the X axes the functional categories ($1 < i < n$) and on the Y axes the list of team member ($1 < j < m$). T_{xy} equals $H_x + H_y - H_{xy}$, where H_x represents the distribution of the team members over the functional categories; H_y refers to the distribution of the number of functional categories over the team members; whereas H_{xy} represents the entropy of the frequency matrix. A high value of T_{xy} entails high functional background diversity (see table 1 for more information). For any given "change-event", occurring at time t, we assessed team variety before, at t-1, and after, at t+1.

Team separation. To operationalize team separation, we considered each entrepreneur's academic affiliation. The rationale is that individuals, as a result of their exposure to the academic environment, develop values, beliefs and attitudes that are coherent with the institutional logic of public research (Merton, 1968; Fini and Lacetera, 2010). Accordingly, we hold that minimum separation occurs when all team members either shared an academic affiliation or had no exposure to academia at all. On the contrary, maximum separation occurs where only half of the team has an

academic affiliation. As a result of its symmetric nature, as suggested by Harrison and Klein (2007), the separation index is calculated as the standard deviation of the academic affiliation of each team member. For any given "change-event" occurring in year t, this index is calculated at t-1.

Team disparity. The index of team disparity is based on team members' industry experience. Following the stream of research that sees prior experience in a given industry as a valuable asset for entrepreneurs operating in that specific industry (Baum, Locke and Smith, 2001), we argue that team members that have already worked in the same industry of their newly-established venture, are more knowledgeable and gain more credibility and status in the team, compared to those without such experience. We operationalize team disparity using the coefficient of variation (Allison, 1978, Sorenson, 2001, Harrison and Klein, 2007). In particular, we calculated the number of days (d) each entrepreneur has previously worked in the same industry of their newly-established venture (as specified by the ATECO code[4]). We then divided the standard deviation of (d) by its mean ($SD(d)/d_{mean}$). Disparity describes both the distance between team members and the concentration of attribute d among them. It then follows that maximum disparity occurs when all but one team member have the lowest possible value of d (i.e., no same-industry experience at all). For any given "change event" occurring in year t, this index is calculated at t-1.

--Insert "Table 1" here--

Dependent variables. For the first stage dependent variable, we employ change in team variety. As a result of any given change in the entrepreneurial team at time t (i.e., an entry or an exit of a shareholder), we model the difference in the team members' functional background comparing team variety at t+1 with that at t-1. For the second stage dependent variable, we refer to turnover growth. In particular we model growth in sales over at least a 4 year time-span after the change at time t. For example, if the change event occurs in 2003, we consider, for that specific event, the growth in turnover between 2003 (t) and 2007 (t+4).

Control variables. Team change may reflect varying contextual conditions. We attempt to rule out alternative explanations for change of team variety by including several control variables: team stability (measured as the number of years since the last team change event occurred); the degree to which firms and other

institutions influence policy decisions (as captured by the amount of equity hold by firms, universities and other public research organizations); firm age; firm revenue at team change event time; revenues growth in the two years preceding team change event; industrial affiliation (1 = biotech firm; 0 = all other sectors); and task environment (1 = manufacturing start-up ; 0 = non-manufacturing start-up). Even for the model predicting revenue growth on change in team variety we include control variables to partial out the influence on firm resources such as the team functional scope (measured as the count of different functional experience represented within the team) and cumulated industry experience of team members.

Statistical Modeling

As our conceptual model involves a mix of direct relationships and indirect relationships with both mediating variables, we employ several statistical techniques. In particular, for Hypotheses 1-3, following the suggestion by Cohen and Cohen (1983), we utilize hierarchical and moderated hierarchical regressions. For Hypotheses 4 and 5, we test mediation effects as proposed by Preacher and Hayes (2004) and Edwards and Lambert (2007). Finally, in hypotheses 6 and 7, we employ moderated mediation analysis (Preacher, Rucker, & Hayes, 2007).

While mediation and moderation models are extensively used in the social sciences, moderated mediation is relatively new (for an extensive review of the topic see Preacher et al., 2007). Moderated mediation occurs when mediation relations are contingent on the level of a moderator. Specifically, hypotheses 6 and 7 stated that the magnitude of the indirect effect linking team variety to revenues growth is contingent, respectively, upon the level of team separation and the level of team disparity.

RESULTS

Table 1 reports descriptive statistics and full inter-correlations of variables included in the study. On average, a team change event occurs five years after start-up. Some 33% of firms are in the biotech industry and 43% are manufacturing firms.

Focusing on substantive variables, the variable means and standard deviations indicated good dispersion. However, the distribution of team disparity had a slight floor effect (skewness = 1.47), whereas the distribution of team separation had a

slight ceiling effect (skewness = −1.07). In both cases, we dealt with the problem caused by non-normal distribution by piggybacking on Box-Cox transformations of original variables. Statistical tests conducted on the transformed variables revealed that normality assumptions were met. The correlations among the different types of within-team diversity were low to moderate.

--Insert "Table 2" here--

Test of Hypotheses

Hypotheses 1- 3. Table 2 shows the results of the hierarchical moderated regression analyses used to examine Hypotheses 1 - 3, which test the main effects of team variety on the change of team variety, as well as the moderated effect of team separation and team disparity on change of team variety. This regression was based upon a sample of 137 team-change events nested in 94 firms. As indicated in Table 3, six models are reported. In the first model (Model A), the control variables (i.e., team stability, prior team change events, external control, firm age, firm revenues at team change, and industry dummies) were entered. These controls accounted for approximately 4% of the total variance, with none of the variables being statistically significant.

Hypothesis 1 stated that team variety (i.e., the diversity of functional experience in the team) lead to team change events with higher impact on team variety. The results, shown in Model B, indicate that team variety does not have a direct influence (b = .07, p = .411) on change of team variety. Team separation and team variety enter as main effects in Model C; even controlling for other team properties, team variety does not exert a significant influence on change of team variation.

Hypothesis 2 tested the moderating effect of team separation on the relationship between team variety and change of team variety. The regression results presented in Model D indicate that the team variety and team separation interaction (b = .17, p = .032 is significant, supporting Hypothesis 2. A simple slope analysis was conducted at one standard deviation above and below the mean (Preacher, Curran, & Bauer, 2006). Figure 2 graphically depicts this moderating effect. As team separation varies from low to high levels, the sign of the team variety-change of team variety overturns (from negative to positive) and the magnitude grows considerably (the size

of the slope for high team separation is approximately three times than for low team separation).

Hypothesis 3 predicted that the relationship between team variety and change of team variety would be stronger for low levels of team disparity. The regression results presented in Model E indicate that the team variety and team disparity interaction (b = -.16, p = .049) is significant, providing support for Hypothesis 3. Figure 3 graphically depicts the results of the slope analysis for this moderating effect. As team disparity passes from low to high levels, the sign of the sign of the team variety-change of team variety overturns (from positive to positive) and the magnitude grows considerably (the size of the slope for low team disparity is approximately three times than for high team disparity).

--Insert "Table 3" here--

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Hypothesis 4. Hypothesis 4 predicted that change of team variety would affect team task performance as captured by firm revenue growth. Once again, hierarchical regression was employed to test this. Table 4 shows the results of the hierarchical regression analysis. In the first step (Model a), the control variables were entered, including team functional scope, cumulated industry experience, external control, firm age, firm revenues, and context dummies. All covariates but manufacturing start-up are statistically significant, with step 1 accounting for 20% of the variance. In step 2 (Model b), change of team variety was entered, (b = .19, p = .020), accounting for an additional 6% of variance, supporting Hypothesis 4.

--Insert "Table 4" here--

Hypothesis 5. Hypotheses 5 used mediation analyses to test whether or not change of team variety mediated the relationship between team-variety and task performance. Table 5 presents the direct, indirect, and total effects for the mediation decomposition as recommended by Preacher and Hayes (2004), controlling for team functional scope after team change, cumulated industry experience, firm age, firm revenues, and context dummies. The indirect effect (b = 1.40, p = .844) was not significant. The far right columns of Table 5 provides 95% bootstrap confidence intervals for this indirect

effect; because intervals include zero, the direct effect is not significantly different from zero at alpha = .05. Thus, Hypothesis 5 was not supported. On the contrary, the direct effect linking team variety to revenues growth was negative and statistically significant.

--Insert "Table 5" here--

Hypothesis 6. Hypothesis 6 focused on the mediation of change of team variety on the team variety-firm's growth relationship under varying conditions of team separation. Bias corrected confidence intervals (see Table 6) indicated that the conditional indirect effect was statistically significant for low levels of team separation (b = -15.11; CI = -43.97; -1.97) and high level as well (b = 14.43; CI = 1.67; 36.63). Team variety has a positive indirect effect on revenues growth. Thus, hypothesis 6 receives support.

--Insert "Table 6" here--

Hypothesis 7. Hypothesis 7 focused on the mediation of change of team variety on the team variety-firm's growth relationship under varying conditions of team disparity. The conditional indirect effect was not statistically significant in that bias corrected confidence intervals contain the zero. Thus, hypothesis 7 was not supported.

--Insert "Table 7" here--

DISCUSSION

In this paper, we have examined the neglected but important topic of the influence of the evolution of within-team diversity on performance. Specifically, we focus on how diversity influences team change and consequently impacts firm growth. Utilizing a unique hand collected dataset that includes both individual and firm level data covering the population of academic spin-offs in Italy, we found support for four of our seven hypotheses.

Our findings add to extant research by highlighting that team diversity is not simply related to functional variety but is a heterogeneous construct. Our conceptual development, based on the theoretical co-existence of adaptation and perpetuation perspectives, considered how team variety, separation and disparity predict change in within-team variety, and how such change ultimately impacts on organizational performance. Our results extend previous literature by showing that while team

variety (ie. functional difference) does not directly influence change in team variety, this relationship is significantly moderated by team separation and team disparity. Moreover, increase in team variety influences firm revenue growth. Change in team variety does not significantly mediate the relationship between team variety and firm growth. Although change in team variety significantly mediates the effect of the interaction between team variety and team separation on firm's growth, the interaction between team variety and team disparity on firm growth is not significant.

As all studies, ours has a number of limitations that provide opportunities for further research. It is becoming increasingly recognized that the contexts in which entrepreneurship occurs are heterogeneous (Zahra and Wright, 2011), which would seem to suggest that further studies would be helpful to establish boundary conditions on our findings. First, although we suggest that the context of academic spin-offs is an appropriate one to examine the evolution of team changes, further research is needed to examine the impact of variety, separation and disparity using other samples of evolving firms such as corporate spin-offs or more traditional start-ups. Second, our sample is drawn from Italy yet differences between this Latinic institutional context and Anglo-American or emerging market contexts may influence team evolution that warrants further attention.

Notwithstanding the aforementioned limitations, we believe that our analysis has managerial and policy implications. While there has been considerable growth in the numbers of academic spin-offs, the challenges of growing these firms has been subject to considerable debate (Grimaldi, et al., 2011). Developing the appropriate mix expertise in entrepreneurial teams in these ventures has been highlighted as an important factor in moving beyond the start-up phase (Vohora et al., 2004; Vanaelst et al., 2006; Wennberg, et al., 2011). Our findings provide insights into the directions that entrepreneurs and technology transfer offices (TTOs) in universities may take in order to evolve effective teams. Not only do entrepreneurs and TTOs in spin-offs have to manage team evolution carefully and proactively, they have to pay attention to particular aspects. The importance of separation in terms of team values, rather than team disparity which relates to industry experience, in influencing team performance seems especially to be a useful insight in building entrepreneurial teams. This suggests that there TTO personnel can have a proactive role in 'scanning' team members and identifying best configuration of team composition, while assessing new entrepreneurial ventures' proposals. The focus on separation and hence on the

heterogeneity of values and beliefs is particularly relevant for academic spin-offs, where two very different institutional logics (market and research) often coexist. Nevertheless, it is fair to admit that it is not easy to identify psychological identical or different individuals. Differences or similarities are more likely to emerge during day-by-day interaction.

Our results are useful for aspiring entrepreneurs as well. For most of them team composition is a delicate issue. Family and friends are often involved as far as they provide emotional support or, more important, financial support. Team diversity aspects are often neglected. Entrepreneurs might have the time and willingness to think about other 'soft' aspects in choosing their team members, including the social identity of individuals that they bring in.

Last but not least venture capitalists (VCs) and institutional funders are always concerned about the characteristics of the founding team. Most of the literature highlights the attention paid by VCs to personality traits and to individual level characteristics (including passion for business, experience, functional background, etc.). Our results would invite VCs to investigate team diversity issues as well, and to think about team evolution over time based on the initial endowment of funders. Moreover, policy makers are ultimately concerned with the performance of newly established companies. In their support and funding scheme much attention should be paid to diverse facets of team diversity. Institutional actors might have an informative role, in trying to raise awareness on these aspects, through the organization of specific informative events, workshops, addressing entrepreneurs and their relevant stakeholders (VCs, TTO personnel, banks, incubators, etc.).

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Table 1
Operationalization of within-team diversity

Diversity type	Index	Source	Formula
Team Variety	Attneave's Transmission Index	Attneave's 1959	$H_x = \sum_{i=1}^{n} p_i * log \frac{1}{p_i}$ $H_y = \sum_{j=1}^{m} p_j * log \frac{1}{p_j}$ $H_{xy} = \sum_{i=1j=1}^{nm} p_{ij} * log \frac{1}{p_{ij}}$ $Txy = Hx + Hy - Hxy$
Team Separation	Standard Deviation	Harrison and Klein, 2007	$\sqrt[2]{(s_i - s_{mean})^2 / n}$
Team Disparity	Coefficient of variation	Harrison and Klein, 2007	$\left(\sqrt[2]{(d_i - d_{mean})^2 / n} \right) / d_{mean}$

Notes. p = proportional distribution of team member (1<i<n), or functional categories (1<j<m) or frequency matrix ('1,1'<'i,j'<'n,m'); s = separation attribute (i.e., whether or not an entrepreneur is affiliated to academia); d = disparity attribute (i.e., number of days each entrepreneur has previously worked in the same industry of their newly-established venture (1<i,..,j<n)

Table 2

Means, Standard Deviation, and Full Correlations among Study Variables—Hypotheses 1, 2 and 3

	Mean	St. Dev.	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
[1] Change of Team Variety[a]	-0.15	0.64											
[2] Team Variety[b]	1.24	1.17	0.04										
[3] Team Separation[b]	0.56	0.26	-0.03	-0.15									
[4] Team Disparity[b]	0.28	0.39	0.05	0.31	-0.24								
[5] Team Stability[b]	2.64	2.12	-0.05	-0.04	0.10	-0.24							
[6] Prior Team Change Events[a]	1.050	1.990	-0.07	0.27	-0.27	0.14	-0.29						
[7] External Control[b]	13.77	14.63	-0.10	-0.08	0.01	-0.15	-0.01	0.04					
[8] Firm Age[b]	4.68	3.19	-0.08	0.10	-0.31	-0.07	0.28	0.55	0.02				
[9] Firm Revenues[a]	427.09	999.78	0.01	0.21	-0.34	0.25	-0.13	0.39	-0.06	0.22			
[10] Past Revenues Growth	54.17	451.34	0.07	-0.04	-0.14	0.07	0.03	-0.31	-0.03	-0.16	0.35		
[11] Biotech Start-Up	0.32	0.47	-0.13	0.01	0.17	-0.05	0.17	-0.17	0.08	-0.13	-0.17	-0.01	
[12] Manufacturing Start-Up	0.44	0.50	0.08	-0.15	-0.19	0.00	0.03	-0.10	-0.05	0.07	-0.01	0.09	-0.17

Notes. Correlations greater than .20 are significant at $p < .05$; a. Absolute variation of Team Variety after team change events; b. Measured before t change event; Number of firms is 94; Full correlations are corrected for non independence of observations.

Means, Standard Deviation, and Full Correlations among Study Variables—Hypotheses 4, 5, 6 and 7

	Mean	St. Dev.	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
[1] Revenues Growth[c]	119.97	255.06								
[2] Change of Team Variety[d]	-0.15	0.64	0.29							
[3] Team Functional Scope[d]	3.06	1.57	0.13	0.17						
[4] Cumulated Industry Experience[d]	32.04	37.40	-0.17	-0.03	0.54					
[5] External Control[d]	13.86	16.48	-0.20	-0.14	0.02	0.05				
[6] Firm Age[d]	4.59	2.95	-0.31	-0.06	0.17	0.56	0.08			
[7] Firm Revenues[d]	430.34	893.69	-0.15	-0.03	0.29	0.53	-0.02	0.20		
[8] Biotech Start-Up	0.33	0.47	-0.15	-0.20	-0.17	-0.16	0.11	-0.15	-0.18	
[9] Manufacturing Start-Up	0.43	0.50	0.15	0.12	-0.10	-0.22	-0.00	-0.03	-0.12	-0.17

Notes. Correlations greater than .23 are significant at $p < .05$; c. Relative growth of time two revenues against time zero revenues; d. Measured after team change event; Number of firms is 73; Full correlations are corrected for non independence of observations.

Table 3

Model Comparison Results of Hierarchical Moderated Regression Analysis

Dependent Variable is Change of Team Variety

	Controls		Main Effects				Moderating Effects					
	Model A		Model B		Model C		Model D		Model E		Model F	
	b	s.e.	b	s.e.	b	s.e.	b	s.e.	b	s.e.	b	s.e.
Team Variety			0.07	0.09	0.07	0.09	0.06	0.09	0.09	0.09	0.08	0.09
Team Separation					0.02	0.10	0.07	0.09	0.03	0.09	0.08	0.08
Team Disparity					-0.00	0.09	-0.02	0.09	0.03	0.10	0.01	0.10
Team Var. X Team Sep,							0.17 ••	0.08			0.20 •••	0.07
Team Var. X Team Disp,									-0.16 ••	0.09	-0.19 ••	0.09
Team Stability	-0.03	0.09	-0.04	0.09	-0.03	0.10	-0.06	0.10	-0.03	0.09	-0.06	0.10
Prior Team Change Events	-0.04	0.09	-0.07	0.10	-0.07	0.10	-0.11	0.12	-0.07	0.09	-0.12	0.11
External Control	-0.09	0.08	-0.08	0.08	-0.08	0.09	-0.09	0.09	-0.07	0.09	-0.07	0.09
Firm Revenues at Team Change	-0.01	0.08	-0.02	0.08	-0.02	0.08	-0.04	0.09	0.02	0.07	0.01	0.08
Past Growth Rate	0.05	0.07	0.05	0.07	0.05	0.07	0.04	0.07	0.02	0.07	0.01	0.06
Firm Age	-0.05	0.08	-0.05	0.08	-0.05	0.08	-0.03	0.08	-0.08	0.08	-0.06	0.08
Biotech Start-Up	-0.13	0.08	-0.13	0.08	-0.13	0.09	-0.12	0.09	-0.12	0.08	-0.10	0.08
Manufacturing Start-Up	0.05	0.09	0.06	0.09	0.06	0.09	0.08	0.09	0.05	0.08	0.07	0.09
Change of Team Variety Intercept	0.12	0.12	0.11	0.12	0.11	0.12	0.06	0.11	0.16	0.11	0.11	0.11
Model Fit												
R-sq	0.04		0.04		0.05		0.09•		0.07•		0.11•••	

Notes.   Number of team change events is 137; Number of firms is 94; Method of estimation is maximum likelihood; Standard errors are clustered around firm; Standard regression slopes are reported; Statistical significance: •p<.10; ••p<.05; •••p<.01

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Table 4

Model Comparison Results of Hierarchical Regression Analysis

Dependent Variable is Revenues Growth

| | Controls | | Δ Team Variety | |
| | Model a | | Model b | |
	b	s.e.	b	s.e.
Change of Team Variety			0.19 ··	0.08
Team Functional Scope	0.22 ·	0.13	0.18	0.13
Cumulated industry experience	-0.02	0.15	0.00	0.13
External Control	-0.17 ·	0.09	-0.15 ·	0.08
FirmAge	-0.31 ··	0.13	-0.30 ··	0.12
Firm Revenues	-0.15 ··	0.08	-0.14 ··	0.07
Biotech Start-Up	-0.15 ··	0.08	-0.12 ··	0.08
Manufacturing Start-Up	0.12	0.08	0.10	0.08
Revenues Growth Intercept	0.75 ···	0.28	0.82 ···	0.28
Model Fit				
R-sq	.20···		.26····	

Notes.   Number of team change events is 98; Number of firms is 73; Method of estimation is maximum likelihood; Standard errors are clustered around firm; Relat growth of time two revenues against time zero revenues; Standardized regression slopes are reported; Statistical significance: •p<.10; ••p<.05; •••p<.01; ••••p<.001

Table 5

Effects Decomposition for Mediation

Path linking Team Variety to Change of Team Variety and Change of Team Variety to Revenues Growth

	Point Estimate	Bias Corrected Confidence Interval	
		Lower Bound	Upper Bound
Indirect Effect	1.40	-6.35	15.75
Direct Effect	-60.83	-151.50	20.43
Total Effect	-59.43	-147.27	20.22

Notes. Number of team change events is 98; Number of firms is 73; Method of estimation is maximum likelihood; Standard errors are clustered around firm; Relative growth of time two revenues against time zero revenues; Bias corrected confidence intervals achieved via bootstrap (5000 repetitions); Standardized regression slopes are reported; Statistical significance: •p<.10; ••p<.05; •••p<.01; ••••p<.001

Table 6

Moderated Mediation Results

Moderated Mediation Results of Team Separation Impact on Variety-Change of Variety-Growth Performance Relationship

	Point Estimate	Bias Corrected Confidence Interval	
		Lower Bound	Upper Bound
Condition Indirect Effects			
Low Team Separation	-15.11	-43.64	-1.97
High Team Separation	14.43	1.67	36.63

Notes.   Number of team change events is 97; Number of firms is 73; Method of estimation is maximum likelihood; Standard errors are clustered around firm; Relative growth of time two revenues against time zero revenues; Bias corrected confidence intervals achieved via bootstrap (5000 repetitions); Standardized regression slopes are reported; Statistical significance: •p<.10; ••p<.05; •••p<.01; ••••p<.001

Table 7

Moderated Mediation Results

Moderated Mediation Results of Team Disparity Impact on Variety-Change of Variety-Growth Performance Relationship

	Point Estimate	Bias Corrected Confidence Interval	
		Lower Bound	Upper Bound
Condition Indirect Effects			
Low Team Disparity	6.23	-7.47	33.578
High Team Disparity	-2.06	-22.61	11.464

Notes.   Number of team change events is 97; Number of firms is 73; Method of estimation is maximum likelihood; Standard errors are clustered around firm; Relative growth of time two revenues against time zero revenues; Bias corrected confidence intervals achieved via bootstrap (5000 repetitions); Standardized regression slopes are reported; Statistical significance: •p<.10; ••p<.05; •••p<.01; ••••p<.001
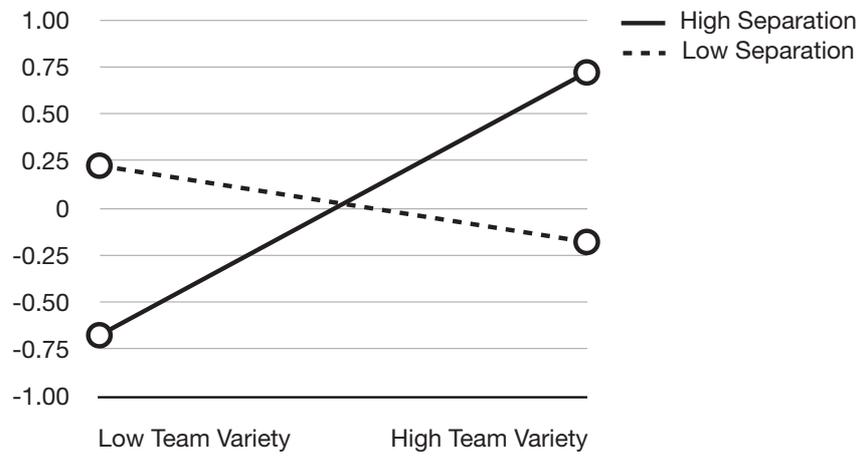
Figure 1

Within-Team Diversity and Change of Team Variety and Performance Relationship

Notes: the dashed lines represent mediation paths
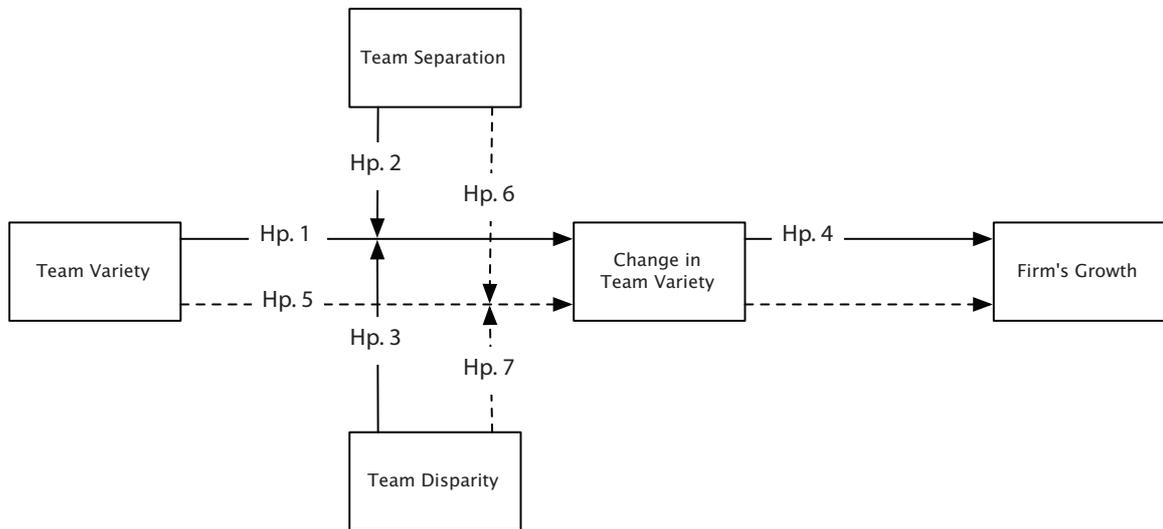
Figure 2

Interaction of Team Variety and Team Separation on Change of Team Variety

Figure 3

Interaction of Team Variety and Team Disparity on Change of Team Variety