The Relational Antecedents of Project-Entrepreneurship:

Network Centrality, Team Composition and Project Performance

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Abstract

The relational antecedents of project-based enterprises have not yet received systematic investigation. These ventures are typically created by individual freelancers who are usually embedded in networks of collaborative relationships that convey the information and resources required to carry out new projects. Using a relational perspective of entrepreneurial discovery and team composition, we analyze the performance determinants of project-entrepreneurs, namely the individuals who are responsible for launching and carrying out those projects. We argue that project entrepreneurs' performance is related to their degree of centrality within the social network, and their familiarity with the selected project-team as captured by the distribution of ties among team members. We test our hypotheses within the Hollywood Film Industry over the period 1992-2003. The findings point to the existence of diminishing returns to centrality and performance benefits from assembling teams that combine old-timers and newcomers. The theoretical contributions and implications of the study are discussed.

Key Words: Project-entrepreneur; Network centrality; Team composition; Commercial performance; Feature-film industry.

1. Introduction

Project-based organizing of company operations has become pervasive in today's economy. Research in this area has been primarily focused on projects as temporary organizational configurations for allocating personnel and resources within stable firms (Hobday, 2000; Davies and Brady, 2000; Prencipe and Tell, 2001). Yet, besides the use of projects as coordinating mechanisms within established companies, project-based organizations, whereby the company is little more than a set of contracts that ceases to exist once the project is completed, can be found across a wide range of industries. Alternatively referred to as single-project organizations (Baker and Faulkner, 1991), market organized projects (Lorenzen and Frederiksen, 2005) or project-based enterprises (DeFillippi and Arthur, 1998), these temporary ventures (henceforth project-based enterprises) are especially common in the context of market-based freelance contracting, where they are deliberately created for a limited time and purpose. In order to cope with highly dynamic environments wherein product demand shifts rapidly and unpredictably, project-based enterprises bring together specialists to work as a team and provide their expertise to a specific task, and neither party has any expectation of continued employment or cooperation after the successful completion of that goal (Bechky, 2006). Industries where project-based enterprises are widespread include: music (Peterson and Berger, 1971), movies (Baker and Faukner, 1991), software (Ibert, 2004), television (Windeler and Sydow, 2001), construction (Eccles, 1981), and new media (Grabher, 2002).

With their emphasis on unique outputs and stable work roles, these "highly singular" (Whitley, 2006) organizations have a few distinctive features. They have limited lives devoted to producing a singular objective or goal, they typically grow to their full-size almost immediately after founding and get disbanded very rapidly when the project ends, and their leaders are engaged in a serial fashion forming new projects as fast as existing ones finish. In contrast, more traditional firms have longer lives, typically evolve to full size over a long period of time and their leaders are generally able to focus on the current organizational challenges without the fear of being unemployed in the very near future. Because project-based enterprises leaders are engaged in launching and organizing projects in a serial manner, we label them *project-entrepreneurs*.

What makes project-entrepreneurs particularly intriguing from a theoretical standpoint is that they have to rewire these temporary ventures whenever new project opportunities emerge. As a result, they are exposed repeatedly to problems and tasks typical of the entrepreneurial process. Indeed, project-entrepreneurs face two critical challenges that invariably characterize the creation of a new venture: locating the right opportunity to launch the project venture and assembling the most appropriate team to exploit that opportunity effectively (Venkatraman, 1997; Shane and Venkatraman, 2000). Resolving the first challenge requires project-entrepreneurs to access an extensive range of information needed to seize new investment opportunities. Resolving the second challenge requires assembling a collaborative team that has to fit well with the particular challenges of the project and has to function almost immediately to reduce the risk that performance might be adversely affected (Whitley, 2006).

Finding lucrative opportunities and assembling effective teams are two crucial conditions that have to be met consistently in order for project-entrepreneurs to be successful in the long run. Because each output is unique, delivered in a context of flux in which "elements are combined, taken apart and recombined in a continuous process of organizational formation and dissolution" (Baker and Faulkner, 1991: 283), this task is far removed from the repeated problem-solving effort that characterizes stable organizations – which typically draw more heavily from well established routines to guide their search for solutions (Levitt and March, 1988). As Whitley pointed out (2006: 81): "The more singular are outputs, the more likely that organizations will have to deal with exceptions to their routines and adjust to variations in materials and the work environment."

Given the drives for uniqueness and innovation of each new project, choices among alternative lines of action involve a high degree of experimentation and "feel" (Faulkner and Anderson, 1987: 880).

Extant literature has not investigated the project-entrepreneurial challenge, either in the entrepreneurship or the project management literatures. The former has examined serial entrepreneurs (MacMillan, 1986), but not in "singular" project settings. The latter has been largely dedicated to the study of projects as intra-firm administrative configurations for coordinating and organizing standing personnel. As a result, we still know very little about the determinants of project-entrepreneurs' success (DeFillippi and Spring, 2004). Where do project-entrepreneurs tap the information required to locate attractive project-opportunities? How can they increase the likelihood of assembling successful project teams? What resource combinations ultimately drive the project-entrepreneur's success in the face of high uncertainty?

We address these questions by drawing from research on social networks and team-assembly mechanisms to develop and test a conceptual model predicting the performance of project-entrepreneurs. We start by observing that project-entrepreneurs are part of a vast network of collaborations originating from the ongoing process of creating and dissolving relationships that bring new project-opportunities to fruition. We suggest that this complex network, which is the result of past collaborations and the medium through which future collaborations develop, acts as a repository of information. Since the identification of valuable opportunities hinges on access to private information, social networks play a vital role in providing conduits through which this information flows (Granovetter, 1973; Coleman, 1988). Accordingly, we predict that project-entrepreneurs located at the centre of these collaboration networks are more likely to identify attractive project opportunities because they have a better sense of the options that are available within the field. However, we expect to observe diminishing returns to centrality as social ties take effort to form and the ability to manage multiple relationships faces cognitive limits (Hansen, Podolny and Pfeffer, 2001). By bringing together insights on team coordination (Edmondson, Bohmer and Pisano, 2001) and repeated social interaction (Jones, Hesterly and Borgatti, 1997), we also anticipate that project-entrepreneurs will be better off by assembling teams that combine past collaborators and newcomers. Teams with both common and diverse experiences will enjoy the benefits of shared understanding to effectively exchange knowledge and unique perspectives to support innovation. Accordingly, we predict that project-entrepreneurs' performance is a function of the project-entrepreneur's familiarity with the selected team members as captured by the distribution of ties between previous collaborators and newcomers.

We test our hypotheses in the context of the US feature film industry over the period 1992-2003. The break-up of the Hollywood "Studio System" from the mid-1950s onwards is a prime example of a shift from hierarchical organization to project-based working (Storper, 1989). Though a few major corporations still control film distribution, Hollywood hosts one of the world's most entrepreneurially-oriented production networks. In this context, the project entrepreneur typically is an independent producer whose main task is to identify suitable project opportunities and pursue them by assembling teams of free agents best suited to those jobs (Jones and DeFillippi, 1996). Our paper focuses on how movie producers' structural position within the social network, as well as the composition of the team they assemble, affects their commercial performance as measured by movies' box office receipts.

2. Theory

2.1 Project-entrepreneurs and new project opportunities: The role of network centrality

When project-entrepreneurs decide to embark on a new venture they are faced with a typical entrepreneurial problem. They need to identify a project opportunity that embodies sufficient profit potential to more than compensate for the opportunity cost of forfeiting alternative investments, a liquidity premium for the time and capital to be invested, and a premium for risk bearing. They also must organize the resources needed to bring that opportunity to fruition (Shane and Venkatraman, 2000). How do project-entrepreneurs identify promising opportunities for their next project? Where do these opportunities come from? A vast tradition of entrepreneurial research grounded in the Austrian Economics School suggests that the answer to these questions rests with the distribution of information among individuals (Hayek, 1945). As they possess different information, individuals recognize opportunities that others cannot yet see. Indeed, social actors can be expected "[…] to differ considerably in the information they possess … Such differences in information … typically imply differences in positioning relative to new opportunities" (Denrell, Fang and Winter, 2003: 985). These informational idiosyncrasies create opportunities for the project entrepreneur (Kirzner, 1973, 1997).

Although information can obviously be tapped through a variety of non-social ways (e.g., changes in domain-focus, literature, and new education, etc.), several studies in economic sociology suggest that most of the exposure occurs through social networks. A large body of empirical evidence on diffusion and social influence attests to the importance of social networks as conduits for the transmission of private information (Coleman, Katz and Mendel, 1957; Granovetter, 1973; Coleman, 1988). As Gulati pointed out (1995: 623-624): "That social networks are conduits of valuable information has been observed in a variety of contexts, ranging from interpersonal ties… to interlocking directorates… The common theme throughout this body of research is that the social networks of ties in which actors are embedded shapes the flow of information between them…" Hence, to the extent that project-entrepreneurs occupy heterogeneous positions in networks as a result of their transition from project to project, their access to this information varies. And to the degree that better access to private information generates greater awareness of available opportunities differences in network position can partly explain inter-individual variance in the ability to locate lucrative opportunities (Stuart and Sorenson, 2004).

A well established approach to capturing such structural differences is to look at actors' social network centrality. Being central ensures that the project-entrepreneur is a passage point for the information that flows through the field, thereby improving his alertness towards extant opportunities and providing a richer pool of project alternatives to choose from. These observations suggest that project-entrepreneurs are more likely to see performance benefits when they occupy a central position within the social structure of the project-setting in which they operate. This should enhance the entrepreneur's ability to select better project-opportunities, resulting in higher likelihood of success.

Although we expect centrality to be positively correlated with project performance, we also note that as project-entrepreneurs increase their centrality, they may have to bear increasing costs which might lead to a non-monotonic relationship between centrality and performance. We pull together two theoretical mechanisms that might account for this pattern. First, an increase in centrality implies higher coordination costs because more time and energy must be devoted to monitoring and managing the relationships. Given the degree of uncertainty that usually surrounds any innovation process, it is plausible to assume that the costs incurred to negotiate and monitor an increasingly large number of relationships will in the end hamper their information benefits. The effort required to engage in new collaborations will inevitably divert attention and time away from activities critical for the success of the project, so jeopardizing the quality of the end result. For instance, recent evidence on scientific collaborations and research productivity suggests that the effort associated with establishing and maintaining relationships with too many scientists may result in diminishing returns because "relationships require time, energy, and attention to establish and maintain, and because these are limited" (McFadyen and Cannella, 2004: 737).

Second, as project-entrepreneurs become increasingly central within the network they have to bear higher cognitive pressures due to the complexity of processing larger inflows of information (Dodds, Watts and Sabel, 2003). Facing too many alternatives raises the opportunity cost of inspecting each of them, while also compounding the risk of making poor decisions (Schwartz, 2004). Cognitive research points to various disfunctionalities that may arise from overexposure to information or 'information overload' (Simon, 1971; for a comprehensive overview see also Sutcliffe and Weick, 2007). According to Schneider (1987), for instance, when economic actors (individuals or organizations) are overloaded, primary and secondary symptoms become manifested. Primary symptoms include a lack of perspective and an inability to select out irrelevant information, leading to cognitive strain that adversely affects the timeliness and quality of decisions (Eppler and Mengis, 2004). These symptoms prompt a variety of coping strategies that may produce a set of secondary symptoms such as reduced scanning, narrowed attention, and a desire for increased control. Secondary symptoms compound both the mental effort and the time required to make sense of the information, with the effect of exacerbating the problems actors are trying to solve (Sutcliffe and Weick, 2007). This speculation is consistent with theorizing by Perry-Smith and Shalley (2003) who suggest that the downside of a high degree of centrality in interpersonal networks is the accumulation of too much domain-relevant knowledge and experience. Hansen and colleagues (2001) also hint at this possibility when they note that large networks might prove counter-productive as they compound the problem of assimilating diverse suggestions, solutions and ideas. Taken together these arguments lead to the following hypothesis**:**

> *Hypothesis 1*: *The performance of project-entrepreneurs exhibits decreasing marginal returns to their centrality in the social network. The benefits of centrality initially increase, but the rate of increase diminishes at higher levels of project entrepreneurs' centrality.*

2.2 Project-entrepreneurs and team assembly: Combining old-timers and newcomers

The previous discussion has stressed how project-entrepreneur's network-centrality provides benefits in the form of access to a wider pool of project-opportunities, resulting in increased likelihood of selecting better projects. But access per se does not ensure the successful combination of the resources required to bring the opportunity to fruition, especially when project performance depends on the interaction and coordination among a team of people. Especially complex project tasks require careful coordination among multiple actors performing interconnected subtasks (Edmondson et al., 2001). The idea of "coordinated" interaction is central to received definitions of routines. Cohen and Bacdayan (1994: 555) defined routines as "patterned sequences of learned behavior involving multiple actors who are linked by relations of communication and/or authority." As such, routines are anchored in the context or social network of actors whose behavior they are meant to govern. The ability to coordinate complex interconnected subtasks therefore depends on preserving patterns of interaction among actors, particularly those who contributed to their creation.

When assembling a team, the project-entrepreneur typically has the option of resorting to prior collaborators (or old-timers) versus hiring new ones (or newcomers). A history of shared work experience provides project-participants with coordination advantages. Project members with a history of prior interactions typically share the same language and similar perspectives that help them achieve agreement on appropriate actions more quickly and carry them out more efficiently (Jones et al., 1997). In addition, the trust arising from prior relationships facilitates the exchange of tacit knowledge and the execution and implementation of ideas. For example, in his study on product development teams in a high-tech company, Hansen (1999) found that frequent interaction proved especially valuable in transferring the highly tacit knowledge relevant for these projects. Likewise Reagans, Zuckerman and McEvily (2004) found that shared work experience and trust resulted in shorter project duration.

But trust can also make you blind because it can make it harder to see opportunities that are available outside established relationships among old-timers. As Powell and Smith-Doerr (1994: 392) put it: "[...] ties that bind may also turn into ties that blind." This effect has been documented extensively in distributive cognition research which shows how individuals that are part of cohesive groups tend to develop homogeneous perspectives and disregard ideas discrepant with their dominant approach to problems (Dunbar, 1993). They become less receptive towards original information and unable to see the value of ideas and people that reside outside their traditional boundaries (Chatman, 1991). In this respect, newcomers are critical because "[…] the elements of ingenuity and improvisation they can bring can yield fresh perspectives for a team… thus generating creative solutions" (Perretti and Negro, 2006: 761). This idea is consistent with Uzzi and Spiro's (2005: 464) finding in the Broadway industry that high levels of social cohesion among industry participants "can potentially undermine a productive distribution of the kinds of conventions and extensions that are critical for creativity in an art world." The addition of new members to an existing network of collaborators also enhances the ability of the team to tap multiple pockets of information and knowledge (Morrison, 2002).

The previous discussion suggests that while newcomers can bring in fresh new ideas and perspectives, old-timers provide the stability needed to work smoothly and get things done. If in fact old-timers facilitate efficient coordination and smooth functioning of existing routines while newcomers foster new ideas and creative solutions, then the performance benefits accruing to project entrepreneurs should be higher when they assemble project-teams that combine old-timers and newcomers. Old-timers are likely to enhance team efficiency but may display limited ability to innovate. Newcomers will generate more variance but may find it more difficult to coordinate their efforts due to lack of shared experience. The ideas gathered through external bridging ties will have difficulty being shared within the group and being translated into group decisions (i.e., process loss).

We thus contend that project-teams consisting of both old-timers and newcomers will have the common ground to interact effectively and the original perspectives to promote innovation. Accordingly, we hypothesize:

Hypothesis 2: *Project entrepreneurs who assemble teams that combine old-timers and newcomers are likely to attain higher performance.*

3. Research setting

We explore our ideas within the context of the Hollywood Film Industry. Hollywood is the setting of one of the world's most entrepreneurially-oriented production networks. Under what is variously known as the "package-unit" or "short-term project" (Faulkner and Anderson, 1987) system, a set of independent contractors coalesce for a relatively short period of time around one-off projects to contribute the organizational, creative, and technical talents that go into the production of a film. The inherent transience of this production system results in a high rate of tie formation and dissolution, and a continuous rewiring of the network: "[…] firms and subcontractors combine for a specific project, disband when the project is finished, and then combine for new projects" (Jones, 1996: 58). Bringing new projects into this system is the business of independent producers, i.e., project-entrepreneurs. Producers first identify and secure the rights for a story (script) with some potential and then hire the creative team (director, cinematographer, etc.) whose task is to bring the story to the screen. Filming begins once these individuals have signed onto the project and the team has secured the required financing. The process is summarized by producer Marty Bregman: "I either buy a book, or have an idea, or acquire a magazine piece which I believe will ultimately make a good film. After I acquire the rights, I 'cast' a writer who has the right sensibility for this specific material… After I have a screenplay, I bring on a director" (quoted in Bales, 1987: 50).

Various aspects make this industry an intriguing setting for analyzing the theoretical mechanisms described previously. First, it is an industry that allows one to study simultaneously the controllers who hire (the project-entrepreneurs), the personnel being hired, and the commercial returns of the projects as a tangible outcome of the entrepreneurial effort. The process "is a dual matching of projects, economic returns to projects and their participants, and subsequent rehiring and renewal of ties on new project organizations" (Faulkner and Anderson, 1987: 881). Second, producers need to rely extensively on their social networks to navigate the production sequence at least for two kinds of crucial information. On the one hand, they must search for project-opportunities or storylines that they will pursue.[1] Good storylines are the foundation of a successful movie production (Eliashberg, Hui and Zhang, 2006), yet they are very hard to locate, a point compellingly made by producer Kathleen Kennedy (president of Steven Spielberg's Amblin Entertainment): "[…] we always look for a good story. That sounds very simplistic…but you'd be surprised – it is the most difficult thing to find" (Brouwer and Wright, 1991: 17). Producers' networks may help them identify alternatives and remain updated about emerging opportunities. As producer Michael Medavoy noted: "[…] relationships with many of the creative people in the business [help] selecting which movies we choose to make, figuring out what hasn't been done, making original choices" (Brouwer and Wright, 1991: 17). On the other hand, once a promising story has been found, producers have to match up the right talent with the project. Information about prospective project-participants' ability to work competently and cooperatively is conveyed through their track record, word-of-mouth, and the producer's history of prior interactions.

Third, this is an industry where assembling the right team is critical for capturing the value of the project. Completing a film on time and achieving artistic goals requires at the same time a high degree of experimentation, and the complex task of combining professionals and coordinating their

[1] At the development stage of the project an established producer typically scans a variety of alternatives in the form of original screenplays, books for adaptation, film treatment outlines, script ideas, etc. (Finney, 2008).

efforts. As Baker and Faulkner (1991: 287) pointed out: "[…] there must be a great deal of mutual coordination between those who supervise the transformation of 'raw materials' and those who provide the expertise and talent for this process. Thus coordination of role players is a pressing problem." Some empirical evidence suggests that film-professionals may respond to these coordination problems by establishing enduring collaborations with trusted partners (Zuckerman, 2005; Ferriani et al., 2005). However, it is unclear the extent to which this relational strategy is truly beneficial to the performance of the project. This is reflected in acclaimed producer/director Peter Weir's observation[2] that "when you stick to the same collaborators for too long you may run out of creative frictions."

4. Methods and measures

4.1 Data

We collected data on all the 2,146 feature length movies produced by 2,156 producers and distributed in the United States by the 8 Majors – i.e., the seven historical majors (Universal, Paramount, Warner Bros, Columbia-Tristar, Disney, 20th Century Fox and Metro-Goldwyn-Mayer) and Dreamworks – and the two largest independent distributors (Miramax and New Line) over the period 1992-2003. This time period was one of relative technological and market stability, for which comprehensive data are available. From the movies released in the US over the study period, we excluded documentaries, foreign-made films, short films, and compilation screen classics in order to render films more comparable (for a similar approach see Cattani and Ferriani, 2008). For each movie we then identified the corresponding producer(s), and all the members of the core team, i.e., the director, the writer, the cinematographer, the editor, the production designer, the cinematographer, and the composer. Following the lead of previous studies (Zuckerman and Kim,

[2] First author's personal interview with Peter Weir.

2003; Ferriani, Corrado and Boschetti, 2005; Hsu, 2006), we collected these data using the Internet Movie Database (IMDB); we also integrated these data with data from the O' Neil (2003) and the Alan Goble Film Index (Goble, 2005) whenever necessary.

It is worth noting that while some producers were active in the industry before the beginning of the observation period, others started operating during the study period. Producers differ with respect to their histories and past experiences. In the analysis we accounted for differences in initial conditions by adopting a window of three years and running the analysis for the period 1995-2003, resulting in 1964 useful observations for the statistical analysis. A distinctive feature of the industry is that the distribution of movies among producers is highly skewed, with a few producers producing most of the movies. Furthermore, over the study period several producers made only one movie. Although we used their information to create our variables of theoretical interest so as to have a more precise characterization of the social field, we report the results with and without those cases (see below).

4.2 Dependent variable

We measured project performance in terms of commercial performance – i.e., box office receipts – following the lead of many other studies that have investigated issues of performance in the film industry (Faulkner and Anderson, 1987; Sorenson and Waguespack, 2006). While the advent of new technologies – television, VCR, cable and DVD – has expanded the number of viable revenue sources, box office returns remain "the most important benchmark when considering a film, as these ancillary revenues tend to correlate highly to the movie's performance during its theatrical exhibition period" (Sorenson and Waguespack, 2006: 14). We used revenues instead of profits as our dependent variable because only a limited portion of the movies in the sample reported budget data.

In line with others, we evaluated commercial performance based on the "annual slate of productions rather than on the performance of individual films" (Miller and Shamsie, 2001: 731) – i.e., summing up the box office receipts of all movies each producer produced in a given year. Box office receipts were adjusted by a price deflator based on the consumer price index (CPI) per year, with 2003 as the base year. Movie box office distribution is highly skewed: given the uncertainty of the industry, only a few movies fare well when they are distributed. In the analysis we thus expressed the dependent variable as the log of the total box office receipts grossed by the movies a producer produced in a given year. Moreover, as yearly box office increases with the number of movies, we expressed all controls at the movie level as ratios with respect to the total number of movies a producer made during the focal year.

4.3 Independent variables

We computed the network measures by creating a social network topology of the industry using an analysis of "actor-by-actor" networks derived from two-mode affiliation data in which the professionals are the actors and each film project is the event. Examples of affiliation networks that have been studied in the past include networks of individuals joined together by common participation in social events (Davis, Gardner and Gardner, 1941), CEOs of companies joined by common membership of social clubs (Galaskiewicz and Marsden, 1978), collaborations among Broadway artists (Uzzi and Spiro, 2005) and co-authorships (Newman, 2001), in which the groups to which actors belong are respectively the groups of actors appearing in a single show or the groups of authors of a scientific article. Following the same approach, for each year we created an adjacency matrix by assigning a tie between any two professionals who worked on a project together. We accounted for the duration of ties by using a three-year moving window, making the adjacency matrixes time-varying. If professionals did not work on a project for three years, we removed them and their ties from the network in the fourth year. If they re-entered the following year, we included them and their collaborative links back into the network (for a similar approach see McFadyen and Cannella, 2004; Uzzi and Spiro, 2005).

The adjacency matrix for a given year therefore records collaborations formed in that year and in any of the previous three years. We started with the professionals that worked in 1995 and used the data from the prior three years to construct the accumulative relational profiles. That is, the period 1992-1995 can be viewed as the time required for establishing the network structure that professionals bring to the period 1995-onwards. Starting from 1995, we then added new professionals each year in accordance with the distribution of new movies. We used the resulting 9 time-varying matrices to calculate all individual level network measures. We tested our hypotheses by employing two measures that capture producers' access – as indicated by their structural position within the social network – and coordination efforts – as indicated by the composition of the team they assembled.

Producer Centrality. To test Hypothesis 1, we computed a measure of how well-connected, or active, the project-entrepreneur is in the overall network. There are several approaches to scrutinizing the centrality of actors in networks that examine the information scope available to them. Different approaches, however, make different assumptions about how "traffic" flows through the network, which means that different measures are more or less appropriate depending on how closely the flow of interest matches those assumptions (Borgatti, 2005). Since we were interested in the movement of information across the network and the risk of exposure of each node (producer) to such flows, we opted for the eigenvector centrality measure (Bonacich, 1972). According to the eigenvector approach, central nodes are those connected to other nodes that are themselves well-connected. This measure is well suited to our purposes because it does not rest on as stringent assumptions as other equally popular measures do. In particular, unlike centrality measures that account only for geodesic paths like closeness and betweenness, the eigenvector measure does not imply that the traffic will only follow the shortest network path, which is usually not the case with information (individuals in fact may share information along multiple paths, and not just the shortest path); nor does it assume that the traffic flows from node to node (as it is, for instance, implied by betweenness centrality) – a key distinction because the spread of information may be broadcast from a node. Instead, the eigenvector measure assumes that "traffic is able to move via unrestricted walks rather than being constrained by trails, paths or geodesics. In addition, the measure […] is consistent with a mechanism in which each node affects all of its neighbors simultaneously" (Borgatti, 2005: 62). These properties make this measure well suited to the type of connectionist argument advanced in this study.

We therefore calculated the variable producer centrality by applying the eigenvector procedure to each of the nine adjacency matrices. Given the adjacency matrices A, the eigencentrality of vertex i (denoted ci), is given by $c_i = \alpha \sum A_{ij} c_j$ – where α is a parameter. The centrality of each vertex is determined by the centrality of the vertices to which it is connected.[3] We squared the variable to test the argument that the effect of centrality on dependent variable exhibits diminishing marginal returns. We computed all measures using UCINET VI.

Percentage of Old Ties. To test Hypothesis 2 we measured the shared experience of the team members with the variable *Percentage of Old Ties*. The variable captures the extent to which producers produced movies in which the professionals involved worked together in previous movies using a 3-year window. Since the same producers might realize two or more movies in a given year, we created the variable by first computing the ratio of the team members who worked together at least once in the past 3 years to the total number of team members working on the same project

[3] The parameter α is required in order to give the equations a non-trivial solution and is therefore the reciprocal of an eigenvalue. It follows that the centralities will be the elements of the corresponding eigenvector. The normalized eigenvector centrality is the scaled eigenvector centrality divided by the maximum difference possible expressed as a percentage (Bonacich, 1972).

(movie) and then calculating the average between these ratios – i.e., summing the single ratios and dividing this sum by the number of movies that producer *i* produced in year *t*. The variable thus varies from 0 (a producer made movies in which all team members never worked together before) to 1 (a producer made movies in which all team members worked together before).

4.4 Controls

We included several control variables – at the producer and the movie level – to rule out alternative explanations for our results.

Sequel. Although sequels tend to be more expensive and sometimes generate lower revenues than original films, they may still outperform the average film if they can capitalize on a successful formula. Following other studies (e.g., Ravid, 1999), we created a variable *Sequel,* defined as the ratio of movies that are sequels to the total number of movies each producer produced in a given year.

Adapted Script. Movies that are adaptations of, or are based on, a previous story (e.g., books, novels, comic strips, or TV shows) are more likely to appeal to the audience than movies that rely on an entirely new script because the public is already familiar with the story (Litman and Kohl, 1989). We thus created the variable *Adapted Script* to account for the percentage of all movies a producer produced in a given year based on prior material.

Rating. Another important factor on the creative side is the rating assigned by the Motion Picture Association of America (MPAA). Ratings signal the degree of graphic sequences, violence, and harsh language in a movie. Prior research suggests that features produced for mature audiences (R and NC-17) perform worse at the box office (Ravid, 1999). Moreover, since movies rated G, PG, and PG-13 have greater audience potential, and mall owners sometimes contractually prohibit theaters from showing NC-17 films, studios often exert pressure on producers and directors to ensure their films will receive a rating aligned with their market aspirations. We accounted for this possible source of interference by creating the variable *Family Rating* to represent the percentage of all movies a producer produced in a given year that fall in the *P, G,* or *PG-13* category.

Co-producers. In the movie industry, a co-production alliance is formed when one producer collaborates with another to develop and finance a movie jointly (Palia, Ravid and Reisel, 2008). Movie alliances are formed through temporary contracts, often termed co-financing agreements, without establishing a new entity. The alliance partners share production and distribution costs, and agree to split future revenues. Film industry insiders often cite resource pooling as a motive for alliance formation (Chetwynd, 1999). Producers may agree to combine resources because a single producer cannot undertake large-scale investment projects on its own. To account for co-production effects we created the variable *Co-producers* as the ratio of movies co-produced by two or more producers to the total number of movies produced in a given year by the focal producer.

Major. It is quite common for a major distributor to be a financer of the movies that it releases (Litman and Kohl, 1989). Besides financial resources, a producer's involvement with a major facilitates access to other resources such as human capital (e.g., movie professionals' skills and talents) and studio facilities. The presence of a major is also likely to place additional emphasis on short-term commercial performance. For each producer, we thus created the variable *Major*, i.e., the ratio of movies co-produced by a major to the total number of movies a producer produced in a given year.

Release Date. The release date of a motion picture also provides some indication of its box-office potential. Since moviegoers tend to crowd during certain periods (e.g., Christmas and the summer), high caliber movies are released only on those dates. We thus created a variable – *Release*

Date – measuring the ratio of movies shown during these two peak periods to the total number of movies produced in a given year by the focal producer.

Number of Stars. The likelihood that a movie might fare well at the box office could also be a function of having *stars* among the crewmembers. Actors such as Brad Pitt or Tom Cruise have appeared repeatedly in highly successful movies as their presence is capable of attracting a much broader audience compared to other fellow actors with equal or even superior artistic talent. To estimate the performance implications of having one or more *stars* we first had to establish which team members could be classified as stars. Following previous research (e.g., Elberse, 2007), we looked at each individual professional's commercial reputation as defined by his/her involvement in at least one movie included in the "All-time USA Box Office" list over the three years prior to the focal one. We then measured the average number of stars who worked on the movies a producer made in a given year. We collected information on the movies included in the all-time USA box office list from IMDB.

Critical Reception. We also considered whether producers' yearly box office returns might be affected by critics' reviews: movie-goers might be more inclined to watch movies based on the critical acclaim they receive. Accordingly, we estimated the final model after we entered a measure of critical reception. We created the variable by using data from a well known online public source (humorously called) www.rottentomatoes.com, which rates all movies distributed in the U.S. The meta-score is a weighted average of up to 30 reviews from national critics and publications for a given movie. For each review, the critic's score is converted to a 0-10 point scale. In those cases when a critic does not provide a numeric score, the internal staff converts the reviewer's general impression into a score based on that critic's word choice, tone, and authoritativeness. The individual scores then are averaged to produce an overall rating of critical acceptance. Because the same list of critics is used to evaluate each movie, the scores are consistent and the risk of bias mitigated. We thus created the variable *Movie Critical Reception* by computing the average of the meta-score values of all movies in which each professional was involved in a given year.

Producer Structural Holes. Structural holes may influence producers' likelihood of identifying valuable opportunities by providing access to more diverse and less redundant information. Research by Burt (2004) on the networks around managers in a large American electronics company suggests that good ideas originate disproportionately from individuals who span structural holes. To account for this effect, for each producer in the network we estimated the variable structural holes using Burt's (1992) classic network constraint index, which we computed in UCINET VI. To avoid simultaneity with the dependent variable we entered the *Producer Structural Holes* variable with a 1-year lag into the final model.

Producer Industry Tenure. Previous accounts of the film industry suggest that faced with high levels of market uncertainty movie producers often make key decisions based on their instinct and experience (Shamsie, 2005). Experienced producers have a deeper knowledge of the environment and are more integrated into existing networks of stakeholders. Both conditions enhance their ability to create coalitions and orchestrate resources to support their initiatives. Industry experience also improves individuals' ability to execute new projects, assess more comprehensively and justify projects that would otherwise seem too risky in the absence of that experience (Simsek, 2007). We accounted for producers' heterogeneity in their experience levels by creating the variable *Producer Industry Tenure* as the number of years the focal producer has spent in the industry.

Team Quality. The extent to which a movie fares well at the box office is likely to depend on the quality of the human capital a producer employs. We measured the quality of human capital – *Team Quality* – by calculating the cumulative number of awards won and the nominations received up to time $t - 1$ by the key professionals (i.e., producer, writer, director, leading and supporting actors, editor, and cinematographer) involved in each movie a producer realized in a given year. A high number of awards in an individual's career may indicate an exceptional talent and thus the ability to deliver outstanding performances.

Our human capital measure does not focus exclusively on Academy Awards but we collected data on awards and nominations from each one of the following 10 professional societies (O'Neil, 2003): 1) Academy of Motion Picture Arts and Sciences; 2) Directors Guild of America; 3) Writers Guild of America; 4) American Society of Cinematographers; 5) American Cinema Editors; 6) Producers Guild of America; 7) Hollywood Foreign Press Association; 8) National Board of Review Awards; 9) New York Film Critics Circle; 10) the Los Angeles Film Critics Association. The primary sources for these data were the official websites of the bestowing organizations (for a similar approach see Ferriani, Cattani and Baden-Fuller, 2007).

Movie Genre. The likelihood of producing movie that fare well at the box office might also depend on movie genre. Family or action movies for example are more likely to appeal to a broader audience and thereby generate more box office than horror or war movies. We thus computed the variable *Movie Genre* as the ratio of movies that belong to a given genre to the total number of movies in which each professional was involved in a given year. We collected genre information from IMDB (e.g., Hsu, 2006).

Resource Availability. The amount of financial resources available to produce movies in a given year is likely to affect producers' commercial performance. Accordingly, we controlled for the producer's box-office in the previous year (*Previous Year Movie Box Office*). This is tantamount to entering the dependent variable with 1-year lag into the model. Alternatively, we could have used data on movie budget, namely the amount of resources invested in the making of the movies during the focal year. However, because data on budget are available only for approximately half of the sample movies, we preferred to use movie box office alone.

Year. Since we had no a priori expectations about the existence of a time trend over the study period (e.g., macro-economic trends, changes in taste or fashion, and other factors that might affect the movie industry), we ran the analysis by using year dummies. We also entered the variable year into the model as a continuous variable, but found the results to be qualitatively similar to those reported here.

4.5 Model

To test the previous hypotheses, we estimated a random intercept effects model. The model has the following basic form

$$y_{it} = \mu_t + \beta x_{it} + \gamma z_i + a_i + \varepsilon_{it}$$

Instead of assuming that a_i represents a set of fixed parameters as in the fixed-effects model, in the random-effects model each a_i is a random variable with a specified probability distribution. Typically, it is assumed that a_i has a normal distribution with a mean of 0 and constant variance, and that it is independent of x_{it}, z_i and ε_{it} (Allison, 2005). Unlike conventional OLS, in the random-effects model standard error estimates adjust for the "within-subject" (i.e., producers) correlation in the repeated measurements of each variable. After taking the log of the dependent measure, the final model is

$$\begin{aligned}\text{Log}\ (\textit{Movie Box Office}_{it}) &= \alpha_i + \beta_1 (\textit{Movie Genre}_{it}) + \beta_2 (\textit{Family Rating}_{it}) + \beta_3 (\textit{Sequel}_{it}) + \beta_4 (\textit{Adapted Script}_{it}) + \beta_5 (\textit{Release Date}_{it}) \\ &+ \beta_6 (\textit{Number of Stars}_{it}) + \beta_7 (\textit{Co-producers}_{it}) + \beta_8 (\textit{Major}_{it}) + \beta_9 (\textit{Team Quality}_{it}) + \beta_{10} (\textit{Movie Critical Reception}_{it}) \\ &+ \beta_{11} (\textit{Previous Year Movie Box Office}_{it-1}) + \beta_{12} (\textit{Producer Structural Holes}_{it-1}) + \beta_{13} (\textit{Producer Industry Tenure}_{it}) \\ &+ \beta_{14} (\textit{Producer Centrality}_{it-1}) + \beta_{15} (\textit{Producer Centrality2}_{it-1}) + \beta_{16} (\textit{Percentage Old Ties}_{it}) \\ &+ \beta_{17} (\textit{Percentage Old Ties2}_{it}) + \textit{Year Dummies} + \varepsilon_{it}\end{aligned}$$

where the subscript *i* refers to the producer who made one or more movies in year *t*. We report significance levels based on Huber–White robust standard errors to control for any residual heteroscedasticity across panels. We obtained our estimates using PROC MIXED in SAS (version 9.1).

4.6 Results

Tables 1 and 2 present the descriptive statistics and the correlation values for all variables, respectively. We assessed multicollinearity by calculating a tolerance factor (and the corresponding Variance Inflation value). While there is no formal cut-off point for determining the presence of multicollinearity, statisticians usually suggest 0.4 as a threshold below which multicollinearity might become an issue (Allison, 1999). We found no variable to violate such level.

Random intercept estimates are reported in Table 3. Although the coefficients are not displayed, all models include year dummies and movie genre controls. In addition to likelihood ratio tests used to compare nested models, we utilized information measures to compare competing models, including non-nested models. In particular, the tables report Akaike's information criterion (AIC) and Schwarz BIC, which estimate the loss of precision resulting when the MLE replaces the true parametric value in the likelihood function. Smaller values of AIC indicate better fitting models. For instance, AIC can be interpreted as an estimate of the loss of precision (increase in information) that results when θ_x, the maximum likelihood estimate, is substituted for the true parametric value, θ_t, in the likelihood function. Thus, by selecting the model with minimum AIC, the estimated loss of precision is minimized.

The baseline model (Model 1) presents the results for the model with the controls only. Producers who produce movies that address a broader audience (*Family Rating*) and are sequels (*Sequel*) are more likely to fare well at the box office. Similarly, producers' likelihood of commercial success is enhanced when the movie release dates coincide with Christmas and/or the summer (*Release Date*), stars work on a movie (*Number of stars*), a Major is present in the production team

(*Major*), critics' reviews (*Critical Reception*) are favorable, the average quality of the human capital (*Team Quality*) employed is higher, and the producer has longer industry experience (*Producer Industry Tenure*). By contrast, projects that are co-productions (*Co-producers*) and rely on adaptations of existing material (*Adapted Script*) do not have an impact on producers' yearly box office. The variable capturing the amount of resources available (*Previous Year Movie Box Office*) is non-significant. One possible interpretation for this result is that given the highly uncertain nature of the industry, past performance (and thereby the resources that are so available) is a poor predictor of current performance. The control for structural holes is significant but in a direction that is contrary to the brokerage logic. A positive coefficient in fact indicates the existence of increasing returns to closure (i.e., absence of structural holes). This result suggests that the brokerage logic underlying structural holes could be at odds with the inherently collaborative nature of filmmaking and the high degree of reciprocity that characterizes this setting (Jones, 1996; Bechky, 2006). In such a context a *tertius iungens* orientation (Obstfeld, 2005), i.e., a behavioral inclination to create or facilitate ties among people in one's social network instead of keeping them far apart (as the *tertius gaudens* approach would suggest), seems to capture the true nature of the industry more accurately.[4]

Model 2 tests the marginally decreasing effect of network centrality (*Producer Centrality* and *Producer Centrality Squared*) on the commercial (box office) performance of the movies a producer realized in a given year (Hypothesis 1). The coefficient estimates are significant and in the postulated direction. In line with our theory, producers who become more central in the social network are more likely to increase their box-office revenues, but the rate at which yearly box office increases declines as producers become more central. We compared the relative magnitude of the two terms using the CONTRAST statement in SAS and found the linear terms to be much stronger than the

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[4] This result is consistent with previous research. In a study on interfim alliances and patenting output in the chemical industry, for example, Ahuja (2000) found evidence against structural holes, suggesting that the collaborative forms of innovations he studied benefited more from cohesion and density-driven trust than from sparse network structures. Similarly, Walker, Kogut and Shan (1997) found evidence in favor of cohesion for innovation in biotechnology.

quadratic term (p-value < 0.001) so confirming that the relationship with the dependent variable is marginally decreasing. The results support the hypothesis.[5] The overall fit of the model improves substantially, as indicated by the LR test ($\chi 2[L2\text{-}L1$ = 30.6 with p-value < 0.001 for 2 d.f.) and the AIC test (12687 vs. 12671.7).

Model 3 presents the results after the inclusion of the second variable of theoretical interest (*Percentage Old Ties*), which gauges the extent to which producers make movies with old collaborators or new professionals. Both the linear and the quadratic terms are statistically significant and in the expected direction. The results thus indicate the existence of an inverted U-shaped relation between the variable measuring the percentage of old ties and the dependent variable, so supporting Hypothesis 2. The overall fit of the model improves substantially, as indicated by the LR test ($\chi 2[L3\text{-}L1$ = 54.8 with p-value < 0.001 for 2 d.f.) and the AIC test (12687 vs. 12659.6). Again, we compared the relative magnitude of the two terms using the CONTRAST statement in SAS and, as hypothesized, we did not find a statistically significant difference between the linear and the quadratic terms.

Model 4 presents the results for the full model when all variables are included. The linear and the quadratic terms of the variables of theoretical interest are statistically significant and in the expected direction for both variables of theoretical interest. The overall fit of the model improves substantially as compared to the baseline but also with respect to Model 2 and Model 3, as indicated by the change in the value of the -2 Log Likelihood and the other statistics. With respect to the

[5] The significant negative coefficient of the squared term might suggest that centrality exhibits not only marginally decreasing but ultimately negative returns to performance. To probe into the nature of this relationship we estimated a spline function and checked the statistical significance of both the left slope and right slope of the curve (Aiken and West, 1991). Results from this analysis indicate that the right slope of the inverted U is not significant. We also checked the fit of the curvilinear model against a model in which we entered only the linear term of the variable. As indicated by LR tests ($\chi 2$ = 20.2 with p-value < 0.001 for 1 d.f.) and the AIC (12681.8 vs. 12671.7), the specification that includes the quadratic term fits the data better. We take these findings as evidence that there are diminishing (but positive) returns to centrality, as predicted by our theory.

baseline model, for example, the LR test ($\chi 2[L4\text{-}L1 = 83.4$ with p-value < 0.001 for 4 d.f.) and the AIC test (12687 vs. 12645.3) show a significant improvement.

4.7 Robustness Tests

We checked the robustness of the results to alternative model specifications. In particular, we tested the previous hypotheses by using the Generalized Estimating Equations (GEE) method to further control for producer heterogeneity and the existence of any systematic difference across producers due to unobserved effects by using PROC GENMOD in SAS. This method allows for correlation in the dependent variable across observations over time – due to repeated yearly measurements – by estimating the correlation structure of the error terms. By adopting an autoregressive structure, we assumed the correlations between repeated measurements of the dependent variable to decline from period to period (Allison, 2005). We also ran the model by imposing an exchangeable correlation structure, which assumes the correlations between repeated measurements of the dependent variable to be equal across time, but found the results to be qualitatively similar to those reported here. Additionally, we tried a less restrictive specification in which the correlation matrix for values of the dependent variable across the observation years has a "banded" structure. There is, in other words, one correlation for values that are one year apart, another correlation for values that are two years apart, and so on. All specifications yielded similar results.[6]

In order to more accurately appreciate the effect of not having a Major in the production team, we also estimated the previous models for a sub-sample that excluded producers who produced at least one movie that was co-produced by a Major in a given year. Again, we found no

[6] Given the nature of the data, with only 714 out of 1964 (i.e., 36% of the total) producers who are observed in our sample for more than one year, we preferred not to estimate the model using a fixed-effect specification. Under such circumstances a fixed-effects specification would cause a significant loss of information with the effect of increasing sampling variability because only within-subject variation would be accounted for. We also believe that the controls used in the analysis, including the lagged dependent variable, help temper the unobserved heterogeneity problem.

difference with the coefficient estimates reported in the paper. In line with Sorensen and Waguespack (2006) we also looked at crewmembers' number of movies as an alternative measure of human capital. More precisely, we checked the robustness of our results by estimating the model after substituting the number of movies each professional worked on for the number of awards/nominations received in the previous two years to re-create the variable team quality – which then captures the average team experience in making movies. Since the variable is highly skewed (with a few teams including professionals making several movies per year) we entered the variable into the model after taking the logarithm. Again, the results did not change appreciably. It is worth noting that creating the variable *Team Quality* using number of movies rather than awards/nominations produces similar results because the likelihood of receiving an award or a nomination is strongly positively correlated to the number of movies in which professionals work. Finally, we ran the analysis for the sub-sample consisting of producers who made at least two movies over the study period. In other words, we excluded those producers that produced only one movie. Although the sample size dropped from 1964 to 1330 producers, the results are qualitatively similar to those of the other models, so further supporting the previous findings. The results for all these additional analyses are available from the authors upon request.

5. Discussion and Conclusions

We started by noting that project-entrepreneurs, due to the transient nature of their ventures, must engage repeatedly in a search for lucrative project opportunities and assemble the most suitable team to bring that opportunity to fruition. We reasoned that the social fabric resulting from the ongoing rewiring of the project-network acts as a storehouse for the pool of knowledge created within the field. Thus, the way project-entrepreneurs are embedded in the larger network affects their ability to draw from the reservoir of knowledge in the field and to successfully navigate the systematic challenges they are exposed to.

The context for our study was the network of project participants who create Hollywood feature films. In film-making the project-entrepreneur is the producer, namely the individual who is charged with the responsibility of launching the venture, staffing the project team and bearing the venture's financial risks. We therefore reconstructed the entire Hollywood producers' collaboration network. We found that project-entrepreneurs' network centrality has a positive impact on their performance, but the rate of increase is marginally decreasing for higher levels of centrality. We also reasoned that when executing their projects, the relational antecedents of the team would have an impact. We found that best performing project-teams entail a mix of old-timers and newcomers. These effects hold independent of several model specification tests.

While project-based enterprises have special features in comparison to other entrepreneurial situations, the realization of new projects follows a standard process of opportunity identification and team assembly that is typical of any entrepreneurial effort. Our findings suggest that network-based arguments have a great potential to illuminate these two crucial entrepreneurial dimensions. In this regard, we believe that our study offers an original contribution to the field of entrepreneurship and social networks by having important implications for both theory and practice.

5.1 Implications for theory

The study contributes to the theory on social networks and entrepreneurial performance (Sorenson and Stuart, 2004; Stam and Elfring, 2008) by introducing a logic of causal influence that combines the informational benefits of social networks with the downsides arising from overly central positions. The finding that project-entrepreneurs who are more centrally located in the project network are more likely to increase their commercial performance indicates that their connections are an expression of how social capital gives access to project-opportunities. In our setting this translates into producers having privileged access to industry-specific knowledge, promising scripts, new technologies, or even contacts with professionals whose true talent the market has not yet come to fully appreciate and value (e.g., the undiscovered talent or the rising star). The additional finding of diminishing returns to centrality further implies that the there are limits to producers' capacity to take full advantage of such information, due to the complexity of managing and monitoring an increasingly large network. In sum, our findings seem to suggest that extensive social networks lead to a broader spectrum of opportunities but at the same time point to the potential downside of overexposure. Even though the previous literature has mainly focused on the benefits of occupying central network positions, centrality is no panacea.

This is an important finding for a number of reasons. First, it contributes to the nascent stream of work in social network literature highlighting the performance implications of being 'too central,' whether at the organizational or individual level. For instance, in a study on the relationship between alliance experience and firm benefits from R&D collaborations in the telecommunication industry, Sampson (2005) demonstrated the existence of diminishing marginal returns to alliance experience, measured as the degree centrality (alliance count) of the focal firm over a given time period. Owen-Smith and Powell (2003) similarly showed the existence of an inverted U-shaped relationship between the centrality of US Universities in the biotechnology industry network and their patenting output, thus implying "the possibility that university patenting efforts may be harmed by a very high volume of firm connections" (p. 1707). Moreover, this pattern of diminishing returns to connectivity is shown to be robust across multiple citation measures of patent quality. An analogous pattern was found by McFadyen and Cannella (2004) in their individual-level study on the effect of scientists' co-authorship networks on scientific productivity. By expanding their network of co-authors scientists have the opportunity to add new information and know-how to their knowledge stocks. Yet, as further relationships are added, the cost of developing the relationships eventually begins to outweigh the benefits. Interestingly enough, while these studies focus on different levels of analysis and use different performance measures, they also reach remarkably similar conclusions suggesting that the most productive networks share certain structural properties whose influence on performance remains relatively indifferent across levels of analysis. Second, and more generally, we observe that while in the network literature there is now ample discussion of the liabilities of being too embedded in social relations and thus overly constrained in terms of choices (Uzzi, 1997), there is only scant research that points to the risk of 'overconnectedness' – i.e., whether there are limits to the number of connections that are viable or necessary to sustain economic performance. These are two distinct concepts that are premised on different arguments. Overembeddedness results from actors' increasing resistance to embracing exchanges with strangers (whose propensity to cooperate is uncertain), whereas over-connectedness stems from the constraints faced by actors (individuals or organizations) on the amount of relationships (and by implication information) they can sustain. In this respect, the evidence of diminishing returns to overly connected producers is especially important because it attests to the fruitfulness of informing social network research with cognitive considerations (De Carolis and Saparito, 2006) and points to the previously disregarded role of social networks as possible sources of 'information overload' (Sutcliffe and Weick, 2007).

The study also adds to the literature on entrepreneurial team composition and performance (Ensley and Hmieleski, 2005; Forbes et al., 2006) by focusing on the importance of relational antecedents in new firms. The results indicate that the benefits to a new project-based enterprise of recruiting trusted alters must be balanced against the potential loss in new ideas and original solutions that newcomers are likely to contribute. This is an important finding that cautions against the possible downsides of entrepreneurs' systematic tendency during team composition to seek out familiar alters, as well as those with whom they already have strong interpersonal relationships, while avoiding strangers (Ruef, Aldrich and Carter, 2003).

Recent research on the relationship between team composition and innovation (e.g., Perretti and Negro, 2007) found that teams with higher incidence of newcomers are more likely to be innovative because of their higher propensity to engage in exploration as opposed to exploitation. Our paper builds on but also differs from this stream of research in some important respects. First, our dependent variable measures team commercial performance not innovation. Second, and more importantly, while we recognize that new employees usually have the potential to make a viable contribution to team performance by providing fresh new ideas and perspectives, we also acknowledge the challenge of integrating newcomers with old-timers more explicitly. Previous research argues that the successful integration of newcomers is contingent on the nature of the task or work being performed (Lee and Allen, 1982). In the case of research activities, for instance, newcomers are less likely to experience language barrier problems because "the terminology and standards in research are not organizational-dependent …" and the "[…] socialization and integration of newcomers in research activities is thus a less difficult problem for management" (Perretti and Negro, 2007: 567). Similarly, in cultural industries, especially those (like the movie or music industry) that are organized around temporary organizations, work coordination is typically achieved through shared values (Jones, 1996; Perretti and Negro, 2007) and/or structured role systems (Bechky, 2006) that shape the context where work is accomplished and coordinated. However, hypothesizing the existence of a linear relationship between innovation (or any other outcome measure) and relative incidence of newcomers in a team risks overlooking the costs of reconciling potentially conflicting ideas and perspectives. In other words, the benefits of assembling teams with an increasingly large number of newcomers are likely to taper off, and even be more than offset by the corresponding costs, past a certain threshold. In this sense, our paper attempts to elucidate the incidence of newcomers on team performance by delineating more precise boundary conditions.

Finally, our paper complements and extends recent work by Cattani and Ferriani (2008) who used the same data structure to investigate the relationship between an individuals' position within the core-periphery continuum of the field and their creativity (measured by the number of awards won and/or nominations received). Despite commonalities in the data, our study is different in at least two important respects. First, we only focus on producers, not all professionals (producers, directors, writers, cinematographers etc.), and the composition of the team they assemble to pursue a new investment opportunity. Second, given our interest in a producer's commercial as opposed to creative (or artistic) performance, we opted for a different analytical approach. In theoretical terms, the core-periphery approach adopted by Cattani and Ferriani (2008) is better suited to estimate the degree of an individual actor's embeddedness in the field and hence its propensity to conform to the values and norms of that particular field. Given our focus on the performance implications of being connected, and in particular the downside of being overconnected, using a core-periphery approach would have been inconsistent with our theory. While all actors in a core are highly central as calculated by virtually any centrality measure, the converse is not always true because "not every set of central actors forms a core … This is because each actor may have high centrality by being strongly connected to different cohesive regions of the graph and need not have any ties to each other" (Borgatti and Everett, 1999: 393). This implies that a core-periphery specification could potentially provide an incomplete characterization of the opportunity space available to individual producers. Viable investment opportunities might indeed reside in regions of this opportunity space that are distant from its core. In a network characterized by the presence of two or more components, for example, an individual might be central in a particular region of the social network, but rather distant from its core. The use of a (global) network centrality measure is better suited to define the opportunity space because it does not depend on the existence of a cohesive core within the social field. A global centrality measure has in fact the interesting property of accounting for the case in which an entrepreneur is centrally positioned, and therefore has access to a broader set of opportunities (ideas with commercial potential, resources, etc.), but without being necessarily in the core of the social network.

Finally, we wish to make a few remarks on the relevance of the research design for empirical work on entrepreneurship. One of the persistent obstacles to doing empirical research on entrepreneurship is the difficulty of obtaining suitable data. Acquisition of appropriate data can be especially challenging if the researcher is interested in studying the formation of a particular type of organization, in which case entrepreneurial events may be sufficiently rare to impede robust statistical inference (Stuart and Ding, 2006). Compounding this problem, it is often hard to establish a measure of entrepreneurial success beyond firm survival as it may take several years before new ventures start reaping the fruits of their business effort. Insofar as project-based industries are representative at least of a particular class of entrepreneurial events, namely the creation of short-term enterprises, the study of project-entrepreneurship appears well suited to circumvent these problems. Archival data on project-based enterprises formation and performance over time are widely available for a variety of market-governed project networks such as music, architecture, theater, TV, advertising, and other settings where projects represent as many instances of entrepreneurial opportunities and individuals' social linkages can be tracked by means of their affiliation structures.

5.2 Implications for practice

Project-ventures bring together participants who supply complementary resources that are combined to satisfy the resource requirements for the project vision. Identifying lucrative opportunities and putting together the right team members for turning that opportunity into a successful project is the project-entrepreneur's central task (DeFillippi and Spring, 2004). Our study suggests that understanding the social structure of project-entrepreneurship may inform targeted efforts to perform this task. The successful project entrepreneur needs to be richly connected to the referral network of the industry to stay abreast of the opportunities that percolate through its interstices. For instance, in the context of the film-making industry better access to the social network information may allow producers to either pursue promising ideas with the hope of securing the rights before rivals become aware of the opportunity, or recognize the value in a project whose true potential the market has not yet fully appreciated (Sorenson and Waguespack, 2006). Yet project-entrepreneurs should also be guarded against the potential risks of becoming too entrenched in their social system. For example, the Weinstein brothers—founders of Miramax—epitomize the case of producers who have become so entrenched within the system that their ability to generate a successful project has diminished significantly over the years. After having enjoyed repeated critical and commercial success from the mid till the end of the nineties, Harvey Weinstein, who displays on average the highest centrality values over the study period, experienced a significant decrease in his performance. As a former Miramax executive recently observed: "Harvey Weinstein became like a drug addict trying to support his habit. In the end, he went naive. He wanted to be another big player in Hollywood. He used to be a real outsider. And now he and Bob want to be let into the club."[7]

By the same token, project leaders should be wary of the possible downsides of creating project teams with the same partners. Team composition is an option from a set of possible choices, and managers need to minimize the risk of wrong team configuration. Besides discussing the

[7] The quote comes from an October 11, 2004, New York Magazine article that goes on to explain: "When we did the original Miramax deal, they [the Weinstein brothers] had a formula that was very appealing" says one movie executive. "Do these $10 million movies, and maybe on some you lost a little, and on some you made a whole lot. The Weinsteins became emboldened by their success. They had become a major studio disguised as an independent film company." We thank one anonymous reviewer for bringing this article to our attention.

benefits that typically accrue to teams consisting of past collaborators, such as trust or development of a common language facilitating the exchange of information and knowledge, we stress the importance of looking into the potential problems caused by the lack of new collaborators. While assembling a team, project leaders should consider each member's potential for bringing new lifeblood as an input into the group composition decision. Striking a balance between individuals with whom the project-entrepreneur has familiarity and individuals who are new to the collective, and therefore more adept at promoting change, might help achieve the optimal project-team configuration. This emphasis on newcomers as opposed to old-timers makes especially sense because, even though many determinants of new venture performance may be beyond management's control (e.g., market conditions and competitor response), the entrepreneurial team is a relatively controllable entity. If well understood, the process of team formation could be shaped to enhance ventures' chances of success (Forbes et al., 2006).

5.3 Limitations and directions

The study suffers from obvious limitations that represent opportunities for future research. On the one hand, the feature film industry is an interesting empirical setting for the analysis due to its entrepreneurial nature, the vital importance of networking activities and prior lack of large-scale network based research (for an exception, see Sorenson and Waguespack, 2006). On the other, in many ways, the industry represents an extreme instance of project setting. Because in this industry development costs are sunk very early the project-entrepreneur has to move speedily from project formation to project execution in a manner that allows only a few changes along the way. The project "deal" that is consequent on prior opportunity identification and the assembly of appropriate project-members is therefore highly consequential for subsequent performance. It should also be emphasized that film ventures operate under highly volatile circumstances (De Vany, 2004), where economic and critical outcomes are only loosely tied to capitalization and marketing strategies, carefully designed production and distribution techniques may have completely unexpected consequences, and the competitive pressure for creative inputs (i.e., plays, actors, directors, and so forth) is extremely high (Faulkner and Anderson, 1987). It is under these conditions that social networks conveying knowledge and identity become critical in shaping legitimacy and patterning access to critical resources. So, while it seems plausible that the patterns we unveiled might just as well hold in other project-based industries (e.g., construction or software), additional research testing the validity of our hypotheses in such industries is needed.

Another important limitation is that project-based affiliation structures capture only a subset of relevant interpersonal relations, i.e., those that are evident in the trail left by movie credits. Although several studies have adopted this approach to reconstruct, for instance, network of collaborations among scientists (Singh, 2005), artists (Uzzi and Spiro, 2006), or scholars (Newman, 2001), it is likely that in our sample other interactions took place among crewmembers that were not captured by the lists of movie credits. Moreover, relationships among members of a professional community direct the flow of everything from task-relevant information to advice, gossips, opinions, and referrals. In archival affiliation-type data, it is not possible to achieve the degree of granularity that is needed to disentangle the specific social mechanisms that generate the observed network effects. Another approach could then be to examine interactions through the collection of primary data via surveys. Surveys, however, depend on recall, and the responses are subjective, not to mention that compiling substantial datasets based on pure sociometric questionnaires is very time-consuming and costly. Future research that combines both primary and secondary data to generate new measures may provide additional insight.

We would like to emphasize that our information-based conceptualization of the social network-opportunity nexus is based on a probabilistic argument in that it points to the sociostructural conditions under which promising opportunities are more likely to be discovered (or disregarded) without directly measuring the discovery process or the value of such opportunities. To establish if the opportunity has value in the first place, the project-entrepreneur (the producer in our case) must conjecture that once presented with the actual project-outcome (the movie) the market will respond positively to it. In other words, the project-entrepreneur must attempt to foresee the characteristics of future markets to determine *ex ante* if the opportunity has potential value (Eckardt and Shane, 2002). Making such a prediction with certainty is impossible because it requires individuals to possess information that does not yet exist when an opportunity is discovered (the only reliable confirmation that a previously unseen or unknown valuable opportunity does in fact exist occurs when a market has materialized that attaches value to the project). Yet our theory holds that a favorable position within the social network will increase the probability of identifying lucrative opportunities. More fine-grained data on the decisions and choices underlying the search for new projects, but also a different research design (e.g., a combination of textual and historical analysis), are needed to enhance our model through a finer characterization of the discovery process.

Our evidence points to the importance of balancing the contribution of old-timers and newcomers to the project-effort. An interesting problem for future research on team formation and human resource management in general would be the identification of effective ways to promote such a configuration. Two reasons suggest that this might be a challenging task. First, as routines and practices become imprinted in an organization, old-timers are likely to resist new members' attempts to change them. Resistance is likely to ensue because those efforts might not only jeopardize the functioning of existing routines and practices, but also question the truce, i.e., the presence of an implicit understanding reducing the conflict between the divergent interests among organizational members (Nelson and Winter, 1982). Second, theories of social categorization and homophily suggest that when they are given the choice, individuals prefer to interact with people with whom they already have familiarity, even when rational explanations might call for such commonalities to be overruled by a need for more diverse knowledge and experience (McPherson, Smith-Lovin, and Cook, 2001; Ruef et al., 2003). How to navigate the tension between old-timers and newcomers is a question that deserves further research.

Finally, while we have focused on social conditions affecting the mean performance of project-entrepreneurs across multiple projects, other interesting questions surround the dispersion of such a performance. Looking at performance variance antecedents seems especially fruitful in project settings fraught with great market uncertainty as is the case with the film-industry. For instance, do social structures and team assembly mechanisms that lead to higher mean performance differ from those that lead to variance enhancing effects? Do team configurations that encourage relational continuity tend to reduce the dispersion of performance due to improvement in coordination and routines? Do increasingly central project-entrepreneurs in the social network have a higher propensity towards embarking in risky-ventures thus resulting in significant inordinate profits or losses? These are just a few among the many questions that wait for the attention of scholars interested in the intersection of project-entrepreneurship, social networks and team assembly mechanisms.

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Table 1

Descriptive statistics

Variables	Mean	Std Dev	Minimum	Maximum
Movie Box Office (log)	16.54	1.99	7.68	20.35
Family Rating	0.50	0.49	0	1
Sequel	0.08	0.22	0	1
Adapted Script	0.35	0.46	0	1
Release Date	0.32	0.45	0	1
Number of Stars	3.03	3.11	0	18
Co-producers	0.89	0.30	0	1
Major	0.39	0.47	0	1
Team Quality	0.46	0.95	0	11.67
Critical Reception	5.53	1.39	0.7	9.5
Previous Year Movie Box Office (log)	16.54	2.04	7.68	20.35
Producer Industry Tenure	14.52	10.74	0	72
Producer Structural Holes (1-lag)	0.06	0.09	0	0.55
Producer Centrality (1-lag)	0.01	0.02	0	0.53
Percentage Old Ties	0.05	0.07	0	0.71

Table 2
Pearson correlation coefficient

Variables	1	2	3	4	5	6	7
1. Movie Box Office (log)	1						
2. Family Rating	0.25***	1					
3. Sequel	0.09***	0.10***	1				
4. Adapted Script	0.09***	0.08***	0.02	1			
5. Release Date	0.18***	0.17***	0.04**	0.06***	1		
6. Number of Stars	0.46***	0.20***	0.04**	0.09***	0.23***	1	
7. Co-producers	0.03*	-0.02	-0.05***	0.01	0.01	0.10***	1
8. Major	0.15***	0.06***	0.02	0.07***	0.01	0.07***	-0.04**
9. Team Quality	0.22***	0.01	-0.05***	0.13***	0.15***	0.34***	0.03
10. Critical Reception	0.14***	-0.13***	-0.10***	0.16***	0.14***	0.11***	0.01
11. Previous Year Box Office (log)	0.17***	0.09***	0.04**	0.01	0.04**	0.20***	0.00
12. Producer Structural Holes†	0.08***	0.01	0.06***	0.04**	0.04**	0.14***	-0.07***
13. Producer Industry Tenure	0.12***	0.02	0.02	0.10***	0.04**	0.10***	-0.03*
14. Producer Centrality†	0.10***	-0.01	0.00	-0.03	0.04**	0.10***	-0.01
15. Percentage Old Ties	0.17***	0.05***	0.13***	-0.04**	0.09***	0.26***	-0.06***

Table 2
Pearson correlation coefficient (cont'd)

Variables	8	9	10	11	12	13	14	15
1. Movie Box Office (log)								
2. Family Rating								
3. Sequel								
4. Adapted Script								
5. Release Date								
6. Number of Stars								
7. Co-producers								
8. Major	1							
9. Team Quality	0.00	1						
10. Critical Reception	-0.01	0.34***	1					
11. Previous Year Box Office (log)	0.03	0.10***	0.00	1				
12. Producer Structural Holes†	-0.03	0.11***	0.06***	0.04**	1			
13. Producer Industry Tenure	0.07***	0.14***	0.04**	0.06***	0.05***	1		
14. Producer Centrality†	0.03	0.08***	0.03	0.11***	0.08***	0.05***	1	
15. Percentage Old Ties	-0.02	0.21	0.05	0.13	0.27	0.05	0.15	1

† The variables are lagged by 1 year

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$ - Standard errors are heteroskedastic-consistent ("robust")

Table 3
Determinants of Movie Box Office – Random Intercept Regression Models

Variables	Model 1		Model 2		Model 3		Model 4	
	Coeff.	Std Err	Coeff.	Std Err	Coeff.	Std Err	Coeff.	Std Err
Intercept	13.180***	0.460	13.229***	0.462	13.155***	0.459	13.201***	0.461
Year (dummies)	Yes		Yes		Yes		Yes	
Movie Genre	Yes		Yes		Yes		Yes	
Family Rating	0.645***	0.067	0.649***	0.067	0.651***	0.067	0.654***	0.067
Sequel	0.268**	0.135	0.271**	0.135	0.255*	0.135	0.262*	0.135
Adapted Script	0.030	0.064	0.031	0.064	0.039	0.064	0.038	0.064
Release Date	0.212***	0.065	0.212***	0.066	0.194**	0.065	0.195**	0.065
Number of Stars	0.198***	0.011	0.196***	0.012	0.198***	0.012	0.197***	0.012
Co-producers	0.123	0.098	0.120	0.098	0.117	0.098	0.114	0.098
Major	0.392***	0.063	0.390***	0.063	0.387***	0.063	0.384***	0.063
Team Quality	0.142***	0.037	0.140***	0.037	0.152***	0.037	0.151***	0.037
Critical Reception	0.258***	0.023	0.257***	0.023	0.259***	0.023	0.258***	0.023
Previous Year Movie Box Office (log)	-0.017	0.014	-0.018	0.014	-0.016	0.014	-0.017	0.014
Producer Structural Holes†	0.707**	0.320	0.584*	0.324	0.493	0.330	0.401	0.332
Producer Industry Tenure	0.011***	0.003	0.010***	0.003	0.010***	0.003	0.010***	0.003
Producer Centrality†			7.297**	2.726			6.752**	2.734
Producer Centrality2†			-14.747**	6.985			-14.404**	6.980
Percentage Old Ties					3.809***	0.814	3.667***	0.817
Percentage Old Ties2					-1.539***	2.485	-11.452***	2.489
-2 Log Likelihood	12683		12667.7		12655.6		12641.3	
AIC (smaller is better)	12687		12671.7		12659.6		12645.3	
AICC (smaller is better)	12687		12671.7		12659.6		12645.3	
BIC (smaller is better)	12698.1		12682.8		12670.6		12656.4	
# Individual-Year Observations	3559		3559		3559		3559	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$ – † 1-year lag – Standard Errors are heteroskedastic-consistent (“robust”)