

**HOW HUMAN AND SOCIAL CAPITAL IN ARCHITECTURAL AND COMPONENT
KNOWLEDGE INFLUENCE PROJECT PERFORMANCE:
AN EMPIRICAL TEST FROM THE FILM INDUSTRY**

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ABSTRACT

As firms focus on their particular competencies, they are increasingly using contingent but highly skilled workers. This increased use of externalized labor permits firms in dynamic environments to modify and upgrade their specific technical skills, while retaining and developing skills at organizing outsourced competencies. This increased externalization of highly skilled work in competitive markets raises an important question as noted by Uzzi (1996, p. 64). Do organizations successfully compete on internally generated firm based competencies, or on their ability to access and reconfigure external resources and partners? This research examines the contributions and interactions of firm-based architectural knowledge and network-sourced component knowledge to performance. Our results suggest that architectural knowledge influences project performance through a lead firm's social capital, specifically a firm's brokerage position that enhances its ability to access and configure unique combinations for a project. Component knowledge, on the other hand, influences project performance through human capital, i.e. the experience and expertise of outsourced project members. These results suggest that architectural and component knowledge are complementary and requires the social capital of a lead firm and the human capital (e.g., experience and expertise) of outsourced project members.

Organizational and strategy scholars have increasingly focused on the creation of intellectual capital and knowledge as means to provide competitive advantage to social collectives — be it firms, groups of firms, or economic regions (Kogut and Zander 1996, Gomes-Casseres 1994, 1996, Saxenian 1994, Liebeskind et al. 1996, Powell et al. 1996, Miller and Shamsie 1996, Nahapiet and Ghoshal 1998). A concern for intellectual capital as a means of gaining advantage in increasingly competitive and dynamic markets among firms has led to an increased use of outsourced expertise as firms follow prescriptions to internalize only their particular competencies. Matusik and Hill (1998, p. 685, 689) note that firms based in a dynamic environment “...have the most to gain by using contingent work.” Contingent work permits such firms to rapidly modify and upgrade their specific technical skills, while retaining and developing skills at organizing outsourced competencies. As a result, new means for organizing and externalizing highly skilled work are seen in the increased use of networks of alliances (Gulati 1995), constellations (Gomez-Casseres 1994, Jones et al. 1998), and contingent workers (Davis-Blake and Uzzi 1993, Matusik and Hill 1998). These approaches emphasize the creation of more permeable organizational boundaries and increasing access to external knowledge (Matusik and Hill 1998). *As Matusik and Hill (1998 p. 694) note, "the effects of changing boundary conditions on organizational processes have yet to receive much attention."*

The increased externalization of highly skilled work in competitive markets raises an important question as noted by Uzzi (1996, p. 64). Do organizations successfully compete on internally generated firm based competencies, or on their ability to access and reconfigure external resources and partners? Additionally, we can ask whether and how these two sets of assets might interact to improve competitive advantage. One way to answer this question is to examine the contributions of internal or firm-based competencies versus external or network-based sources of

knowledge to performance. When a firm acts as a coordinator of contingent contracts, firm-based and network-sourced competencies correspond to Henderson and Clark's (1990) typology of architectural knowledge and component knowledge (Matusik and Hill 1998). In project-based industries that employ network-sourced knowledge (Saxenian 1994, Jones et al. 1998), architectural knowledge is focused in firm-based competencies—the lead firm's relationships and managerial experience that are used to identify viable projects, select superior out-sourced resources, and coordinate these outsourced resources with internal component knowledge to generate viable products for an uncertain and competitive market. In this case, a lead firm still coordinates, communicates, and generates relational identity (Kogut and Zander 1996); however, it is with its outsourced contingent workers rather than employees. In contrast, externalized component knowledge is generated through network-sourced competencies—the technical, creative, and functional skills that contingent workers bring to the project.

In industries such as film, garments, and semiconductors that emphasize new product development and outsource production capacities, the production form of component knowledge is separated from the firm. In this context, the challenge in using intellectual capital to enhance performance is in aligning and managing the contributions of firm-based architectural knowledge and network-sourced component knowledge. Of critical importance in such networked models of production processes is the level of analysis and its relationship to knowledge types. From the lead firm's perspective, when production processes are based in out-sourced projects, the selection, assembly, control, and linking of projects to firm-based competencies is accurately characterized as architectural knowledge. It is specific to the firm that organizes the project, is tacit, embedded, and team-based and concerns the best way to organize or “bundle” resources (including human resources) that are available in the marketplace. Not all knowledge of organizing involved with a

project is architectural at all times. While management of the project members and their knowledge, relationships, and interactions during the production process involves organizing skills, these skills represent component knowledge from the lead firm's perspective. For example, the director on a film project must organize and manage the crew and actors, but from the studio's perspective, these specific skills are the director's unique contribution as a component of the overall film project.

Our goal in this research is to examine the contributions and interactions of firm-based architectural knowledge and network-sourced component knowledge in an industry characterized by out-sourced production processes involving highly skilled labor—the film industry. In an industry such as film, projects are collaborative efforts that have measurable architectural and component knowledge inputs resulting in project-level performance outcomes. The film project is constructed according to the architectural knowledge of the studio acting as lead firm and is comprised of outsourced production components for specific competencies. Thus, projects provide the cross-level data needed to discern how architectural and component knowledge contribute to performance. As such, the project is the unit of analysis in our study.

The film industry is particularly appropriate for testing the ways in which architectural and component knowledge influence performance. First, individual films are produced on a project basis, and historical factors have resulted in available secondary data at the project level, which is collected systematically by the industry. Thus, film projects offer the type and range of archival data necessary to understand the different sources of knowledge that result in successful performance. Additionally, both architectural and component knowledge are reflected in film making: architectural knowledge is reflected in the studios' managerial decisions and experience, whereas one form of component knowledge, production processes, is reflected in the experience

and expertise of the out-sourced actors and film crews. We also draw extensively from archival interviews to enhance our understanding of the industry. Although our research uses the film industry, it is applicable to other industries that outsource component knowledge but retain architectural knowledge within the firm, including the music, advertising, architecture, biotechnology, construction, software, and fashion industries.

The paper is organized as follows. First, we describe our theoretical model and show how architectural and component knowledge may influence project performance within the milieu of the Hollywood film industry. Next, we discuss our data sources and measures. Then, we empirically test the contributions of architectural and component knowledge on project performance in that industry. Our results suggest that architectural knowledge influences project performance through a lead firm's social capital, specifically whether it spans structural holes to find the right and unique combinations for a project. Component knowledge, on the other hand, influences project performance through human capital, i.e. the experience and expertise of outsourced project members. Our results suggest that firms compete in the film industry on their ability to configure contingent component knowledge rather than on their internal competencies. Finally, we offer concluding remarks and suggest directions for future research.

INTELLECTUAL CAPITAL IN PROJECTS:

HUMAN CAPITAL, SOCIAL CAPITAL AND KNOWLEDGE STRATEGIES

Intellectual capital refers to "the knowledge and knowing capability of a social collectivity, such as an organization, intellectual community, or professional practice" (Nahapiet and Ghoshal 1998, p. 245). The ability of a social collectivity to capture and use intellectual capital to enhance performance is determined to a large degree by the quality of the human and social capital in its

component knowledge and architectural knowledge. Human capital refers to attributes--the experience, education, and skills of individuals (Becker 1993) seen in their creative, functional, and technical abilities (Miller and Shamsie 1996). Human capital provides the base knowledge and heuristics needed to identify and translate viable ideas into new products and the knowledge stocks upon which intellectual capital and competitive advantage are built. Social capital, on the other hand, refers to the resources created by and accessed through relationships (Coleman 1988, Burt 1992, Nahapiet and Ghoshal 1998).¹ Since social capital links knowledge bearers together through boundary spanners, advice networks, and relationships (Cohen and Levinthal 1990, Matusik and Hill 1998), it is the means by which knowledge flows. Both human and social capital are aspects of architectural and component knowledge.

Architectural Knowledge: Selecting Out-sourced Resources and Coordinating These with Firm-Based Competencies

Architectural knowledge in project-based organizing where production processes are outsourced refers to a lead firm's ability to choose which human and social capital resources to use in a project, how to coordinate these production outputs with the firm's component knowledge (e.g., accounting, marketing, distribution), and how to match resulting products to market demands for viable project returns. Architectural knowledge has been defined as the "ways in which components are integrated and linked together into a coherent whole" (Henderson and Clark 1990, p. 11). This integration is found in the tacit understandings, routines and schemas that have evolved in a firm (Matusik and Hill 1998, p. 684). Architectural knowledge also has been described in terms of "systemic knowledge-based resources" used to coordinate roles and that result from a firm's experience in selecting product ideas and in overseeing projects with large,

¹ We focus on structural aspects of social capital and examine how they transfer and generate knowledge. Nahapiet

nonpermanent production staffs (Miller and Shamsie 1996). According to both of these views, architectural knowledge is made up of human capital as well as social capital inputs.

Human Capital in Architectural Knowledge. Architectural knowledge is required to locate, select, and combine the right mix of components (e.g., production, marketing, financing) for each specific project. In some measure this knowledge is embodied in the individual skills and combined talents of the firm's executives, reflected in their procedural knowledge, and derived from experience (Kogut and Zander 1996). These upper level managers select those with appropriate knowledge stocks and interpersonal dynamics to generate products, understand the larger market conditions into which products are released, and link these products to other components such as marketing and distribution. This architectural knowledge resides with a firm's human capital, i.e., managers' experience in similar projects (Miller and Shamsie 1996).

In the film industry, architectural knowledge is comprised of numerous aspects, including the selection of a compelling screenplay, attracting the best "elements" possible to the film (e.g. director, producer, stars, cinematographer), budgeting and overseeing the financial resources needed for film production, and developing marketing and distribution strategies for a film. When selecting a project, studio executives rely on their experience with prior resource combinations. Mike Medavoy, Chairman of TriStar Pictures (Squire 1992, p. 169), explains the cultivation of architectural knowledge in this way:

I have always immersed myself in the work of the most active writers, directors, producers and principal performers, through seeing their movies, reading their screenplays and meeting with them personally...That's the creative side. From the business standpoint, having negotiated or been responsible for the negotiation of countless talent and picture agreements, there are references to cash and expertise tucked away in memory that are always called upon. Formulas are connected to faces connected to credits. The creative and business disciplines blend via a sort of mental checklist which evolves over years and is the source of intuitive reactions when putting together a motion picture deal.

and Ghoshal (1998) recognize structural, relational, and cognitive dimensions.

These “intuitive reactions” are honed over years of experience, and over time the combined project management experience of studio executives becomes embodied in a firm's structures and information processing (Henderson and Clark 1990, Huber 1991), is procedural (Kogut and Zander 1996) and can be captured in a studio's experience in managing large projects (Miller and Shamsie 1996). Thus,

Hypothesis 1: Projects managed by firms whose executives have more experience in the firm are associated positively with higher performance.

Social capital in architectural knowledge. Social capital in architectural knowledge complements human capital to increase project performance in two ways. The first is through brokerage positions among executives that allow better access to unique resources (Burt 1992). A brokerage position capitalizes on “structural holes”— the absence of a direct connection between a pair of actors that can be exploited by a third actor connected to the other two (Burt 1992). Brokerage positions provide greater access to new talent and novel information, which enhance the creation of intellectual capital in a project (Sutton and Hargadon 1996). In this sense, brokerage positions facilitate "absorptive capacity" of a firm, by bringing in unique resources that improve the quality of a product (Cohen and Levinthal 1990, p. 132).

In film, the benefits of brokerage positions are described by the need to sort through and select good "elements" of a film, e.g., good scripts, directors, producers, and stars. For example, Twentieth-Century-Fox executives each year typically receive 10,000 submissions of screenplays, books, treatments and oral pitches of which they develop 70 to 100, and make 12 movies (Litwak 1987, p. 68). Making these choices crucially depends on having access to vast amounts of information about the industry. Michael Medavoy, Chairman of Tri-Star studios, described the

importance of "relationships with many of the creative people in the business [that help in] selecting which movies we choose to make, figuring out what hasn't been done, making original choices" (Brouwer and Wright 1991, p. 10). Producers and film executives use brokerage positions to enhance new product development by tapping into distinct relations to find new talent, original ideas, and effective project member combinations. Thus,

Hypothesis 2: Projects overseen by studio executives who bridge larger numbers of distinct social groups are associated positively with higher performance.

However, brokerage positions alone do not enhance project performance or the creation of intellectual capital. An essential aspect of social capital in architectural knowledge is cultivating relationships through "strong ties" to enhance new product development, especially in industries like film which involve tremendous uncertainty and great risk. Under such conditions, strong ties provide a means to manage uncertainty (Krackhardt 1992), and transfer information and tacit knowledge among partners (Larson 1992, Powell et al. 1996), thus creating intellectual capital (Nahapiet and Ghoshal 1998). For example, Uzzi (1997) found that strong ties, while fewer in number, were critical because they provided thick information sharing, high degrees of trust and reciprocity, and greater incentives for quality work. Additionally, strong ties may help resolve agency problems by establishing identity between exchange partners so that parties act in their mutual best interest (Granovetter 1992). With contingent workers, strong ties may generate a shared identity among parties and allow for learned "focal rules" needed to effectively coordinate interactions (Kogut and Zander 1996).

In film, strong tie relationships are cultivated between studio executives and key talent in the industry. Several studio executives discuss the importance of these strong ties. For example,

Michael Medavoy suggested: "It is the objective of every studio to work with more talented filmmakers" and the studio executive's role is to select "people you trust, whose vision you think is interesting, to convert words on paper into images." (Brouwer and Wright 1991, p. 7). As Paramount's Dave Madden says, "what makes filmmakers devoted to studio X as opposed to studio Y is that they feel comfortable that the person [at studio X] is going to treat them well, is going to be honorable, honest, and have integrity, as opposed to the schmuck at studio Y" (Litwak 1986, p. 67). William Bernstein, a United Artist executive, said: "What ultimately it comes down to is have we bet on the right people. They are the ones who are executing the film and if you guess wrong, if you're dealing with a fiscally irresponsible producer or director, they can hurt you terribly" (Balio 1987, p. 99). Since directors control the film's shooting schedule, they have disproportionate influence in making a studio's movie with a particular vision and within a specific budget. Studio executives need strong ties with successful directors who have proven themselves in other films.

Hypothesis 3: Projects managed by firms in which executives have strong ties to key outsourced talent are associated positively with higher performance.

Component Knowledge in Projects: Integrating Production Resources and Processes

Component knowledge refers to "the knowledge about each of the core design concepts and the way in which they are implemented in a particular [project]" (Henderson and Clark 1990, p. 11). In project-based industries outsourced component knowledge is primarily production knowledge and processes held in the "technical, functional, and creative skills" of individual participants (Miller and Shamsie 1996). Firms relying on contingent workers may outsource specific technical areas or even an entire production process comprised of multiple subroutines (Matusik and Hill 1998). In film, the entire production process—from pre-production (e.g., script

development), to production (e.g., shooting the film), to post-production (e.g., editing, music)—is outsourced; thus the quality of these aspects of the project depends on its production members' component knowledge. Since functional skills include identifying and managing competent creative and technical personnel to implement subroutines, component knowledge requires both human and social capital inputs.

Human capital in component knowledge. Assembling project members with high human capital into a co-specialized bundle is essential to maximize competitive advantage (Chi 1994). A critical form of human capital is experience because experience enhances identifying key information, chunking that information into a relational pattern (Prietula and Simon 1989, Simon 1991) and developing heuristics and rules of thumb for problem solving (Garud and Nayyar 1994). In collaborative projects, where specialties are diffused among multiple parties, members with greater experience have more knowledge to share (Nass 1994) and proximity enhances the transfer of tacit knowledge (Lave and Wenger 1991, Powell et al. 1996, Leonard and Sensiper 1998). This in turn reduces mistakes and variability (March 1991), and can enhance absorptive capacity (Cohen and Levinthal 1991).

In the film industry, experience, represented by prior film credits, suggests a skill level that enhances component knowledge and thus improves a project's performance. For example, director and screenwriter Joan Micklin Silver notes that, "A less-experienced crew requires more rehearsal time, particularly if there is a complicated camera move. The problem is not only the time passing, but also the need for extra crew rehearsals that can tire the actors unnecessarily" (Squire 1983, pp. 40-41). Although the selection of a film's key talent (e.g., producer, director, stars, cinematographer) is made by executives in the lead firm, once the project commences the director is responsible for managing this talent to produce viable outcomes and in choosing his or her

technical crew. Thus, decisions about which crewmembers to use on a project reflect the project's component knowledge. For example, according to director Sidney Pollack, "every director researches the background of a tentative crew member religiously. Not only do their various creative and mechanical abilities contribute to the final effect of the film, but every moment they save you is an extra moment you can spend creatively" (Squire 1983, pp. 24-25). This suggests that more experienced collaborators improve performance.

Hypothesis 4: Projects composed of more experienced members are positively associated with higher performance.

Although experience is desirable, recognized experts are even more desirable for increasing component knowledge. However, since many firms compete for their services, experts are not always available or affordable for a given project. Expertise— exceptional knowledge and skill that is socially recognized (Simon 1991)—is by definition above average and therefore scarce. Scholars recognize that expertise involves both extensive experience and high levels of creativity (Simon 1991, Csikszentmihalyi 1990, Quinn et al. 1996). Expertise enhances performance in several ways: by generating novel solutions that result in better services or products (Maister 1993, Sutton and Hargadon 1996, Jones et al. 1998), by diffusing tacit knowledge to average performing compatriots to lift overall performance (Kelly and Caplan 1993), and by attracting resources that augment collective performance (Zucker and Darby 1997). Thus, expertise enhances performance through superior knowledge generation.

Within the film industry, experts are perceived as more likely to create viable products and enhance project performance. For the director, this means picking the best crew available. "Over ninety percent of the time I want the best tools I can get: actors, writers, lighting men, propmen,

everything,” said director Sidney Lumet (Baker and Firestone 1982, p. 47). Kathleen Kennedy, President of Spielberg's Amblin Entertainment, echoes this concern: "we try to go after the best people available. There's really only a handful when you get down to the technical side of getting a movie made" (Brouwer and Wright 1991, p.19). Stars are another form of expertise that is scarce. As Richard Lederer, who was in charge of Warner Brothers' world wide marketing noted: “There are, after all, only a few actors who seem capable of delivering a larger audience than the ordinary actor” (Squire, 1983: 138). Stars also attract other talent to a film, as well as studio funding. Exemplifying this point, Mel Brooks, director and screen writer, explained that “[20th Century] Fox was more amenable to the idea of *Silent Movie* when I told them there would be stars in it” (Squire, 1983: 35). Hence, stars enhance project performance. For these reasons experts are an important aspect of component knowledge that influences positive project performance. Thus:

Hypothesis 5: Projects composed of members with greater expertise are positively associated with higher performance.

Hypothesis 6: Projects with a greater number of stars are positively associated with higher performance.

Social capital in component knowledge. Social capital complements human capital in component knowledge by making it easier to locate project members with desired skills and behavioral attributes. One form of social capital is extensive ties that provide access to resources and opportunities. Prior research shows that teams with more external contacts are more successful (Ancona 1990) and more productive (Katz 1982, Katz and Allen 1982, Trent and Monczka 1994). These external relations leverage individual and organizational absorptive capacity. Specifically, social capital creates an "awareness of where useful complementary

expertise resides...of who knows what, who can help with that problem, or who can exploit new information” (Cohen and Levinthal 1990, p. 131).

In the film industry, a project whose members have a wider range of contacts can access a broader set of strategic and complementary resources. For example, a producer may know some key players, whereas a cinematographer may know other critical talent. This range of contacts provided by project members’ enhances matching the right talent for the project. Director Taylor Hackford describes how once the script is done, “you’re ready to go out and try to match the unique talents of other artists with the qualities of the script” (Brouwer and Wright 1991, p. 34). This matching process is enhanced because work is obtained on the basis of whom one knows. In the film industry, “Everyone knows everyone. If they don’t know them, they can normally find out about them,” noted an experienced production manager (Jones and DeFillippi 1996, p. 92). Projects whose members have many contacts are more likely to have prior experience with or in-depth knowledge of freelancers enhancing the likelihood of good matches and better performance.

Hypothesis 7: Projects whose members have a greater number of social relations are positively associated with higher performance.

Using attribute and network measures to capture human and social capital aspects of architectural and component knowledge, we test the contributions of architectural and component knowledge on project performance in the film industry. We describe our data and measures next.

RESEARCH DATA AND MEASURES

Data

We use data from films produced and distributed in the United States during 1977 - 1979 to test the hypotheses given above. We use data from this time period for two reasons. First, film

historians argue that by the mid-1970's the film industry had established its outsourced production system (Ellis 1990, p. 437-439); and second, the increasing use of the VCR in the 1980s created a secondary market that includes films produced for video but not theatrical distribution (Williams and Shapiro 1986). Measures of theater box office rentals from before the mid-1980s capture film performance more completely. For example, in 1995 the rental income from videos was estimated at almost two-and-a-half times that of box office revenues (Wall Street Journal, Sept. 15, 1995).

Data collection occurred in several iterations. First, we selected films on which to gather performance data. The selection criteria were threefold: (1) we used all films distributed in the United States in 1979, (2) except animated films, documentaries and pornographic films, (3) which involved directors or producers who made two or more films the previous two years (1977-1978) in order to compare directors and producers who had experience in film production, focused on commercial films, and had the potential for recurring relationships with film studios and project members. Since we wished to compare the outcomes of experience and expertise, we set stringent selection criteria. In the film industry, 50% of directors and 64% of producers have only a single credit. Indeed, seven per cent of Hollywood directors made 40% of films and seven percent of producers made 33% of films over a 15-year period (Faulkner and Anderson 1987, p. 894). Animated and documentary films were excluded because roles of key subcontractors are not comparable to those of other types of films. Pornographic films were excluded because they were not listed in Willis Screen World for 1978 and 1979, making it impossible to derive the social capital measures. The selection criteria yielded 144 films, which served as the cases in our regression analyses.

Second, we collected human capital data for executives and for project members. The operationalization for each of our measures is given in the following section. We were careful to

follow industry standards by choosing the most reliable sources and complete sources for these data. Specifically, to identify each studio executives' project management experience, we utilized archival records from the *International Motion Picture Almanac*, which is an annual industry-standard list of all executives in every managerial role at all major and minor film studios. To collect data on project member's experience we utilized the filmographies of each subcontractor for the 609 films in 1977 - 1979. These filmographies are documented in specific reference sources for each subcontracted role, including (1) *Film Directors: A Complete Guide* (Beverly Hills: Lone Eagle Publications, 1985), (2) *Film Producers, Studio, Agents, and Casting Directors Guide* (Los Angeles: Lone Eagle Productions, 1992), (3) *Cinematographers, Production Designers, Costume Designers and Film Editors Guide* (Los Angeles: Lone Eagle Productions, 1993), (4) *A Guide to American Screenwriters, Volume 1* (New York; Garland Publications, 1984)

Project member's expertise was defined in two ways: (a) formal recognition of excellence by professional peers, through academy award nominations and all other published awards for the each of the subcontractors and actors in the film crew and (b) recognition of a star's ability to attract an audience defined by *Willis Screen World* as any actor or actress who is a top-25 box-office revenue generator. These data were collected through (5) *The Academy Awards: the Complete Categorical and Chronological Record* (Westport, CT: Greenwood Press, 1993), (6) *International Film Prizes: An Encyclopedia* (NY: Garland Press, 1991), and (7) *Willis Screen World's* listing of top 25 Box office revenue generators, 1977 and 1978.

In order to identify strong ties between studio executives and directors, we examined the filmographies for all 1979 directors and identified which studio distributed each of the films or television productions they had been involved with from 1960 – 1978. These data were available through *Internet Movie DataBase* (www.imdb.com), which has extensive historical records.

In order to measure social capital, we collected data on key subcontractor and executive roles for films distributed in the U.S. during 1977, 1978 and 1979. Although films typically involve hundreds of actors and film crew members, we focused on eight key technical roles whose creative inputs are seen as critical by film historians (Monaco, 1979) and film subcontractors. William Goldman, screen writer on *Butch Cassidy and the Sundance Kid*, *All the President's Men*, and *The Princess Bride*, explained: “There is a group of six to eight technicians who are essential to the collaborative process: the writer, director, cinematographer, cutter [editor], production designer, producer, production manager, and sometimes the composer” (Squire, 1983: 53). We used essentially these same roles: producer (including executive producer), associate producer (or production manager), director, assistant director, screenwriter, cinematographer, editor, and production designer. *Willis Screen World* is the source for the subcontractors’ roles, credits and the films distributed. We identified 2970 subcontractors involved in 609 films.

Using these data, we were able to construct the network of past collaboration among all 2970 subcontractors and 39 studio heads that existed just prior to the making of each film in the sample. This network of up to 3009 participants (recomputed for each film) was then used to compute two of our three social capital measures.

Measures

A complete list of measures appears in Table 1. Here we briefly specify how each variable was operationalized, following the same order presented in the theoretical section of this paper.

Insert Table 1 about here

Dependent variable: project performance. Project performance is operationalized by box office rentals. Box office rentals are widely reported and used as an indicator of success in the film industry. Rentals are the only available performance measure since profit and cost data for films are a closely guarded secret in the industry and are unavailable (Kent 1991). The data for box office rentals were tabulated by tracing each film in the weekly list of "Top 50 Grossing Films" list published by *Daily Variety*, a widely respected trade journal. Every film was tracked from the week it was released until the last date it ever appeared on the list, which ranged from one week to 18 months. The final figure of "cumulative rentals" was used as the film's total rentals.² In general, the distribution of box office receipts is highly skewed since the vast majority of films are not very successful. Thus, a square root transformation was used to make rentals more closely approximate a normal distribution.

Architectural knowledge: human and social capital. Human capital is measured by *Managerial Experience* which is defined as the number of years that studio executives worked for a specific firm throughout 1973 - 1978, divided by total number of executives who worked in the studio during those six years.³ This measure ranges from a high of 6.0—in only two studios which experienced no executive turnover throughout those six years—to a low of 0.5, which designates studios that existed for less than a year before 1979. Social capital is measured by two measures. The first is *Studio Head's Brokerage role*, one of Burt's (1992) structural hole measures -- specifically, the one Burt (1992, p. 56) calls Effective Size. To compute this measure for a given film, we identify the set of individuals that the studio head in charge of the film has previously collaborated with, and then examine the pattern of ties among this set. A film receives

² A telephone interview on March 11, 1997 with Leonard Clarity, box office analyst for *Daily Variety*, determined that this was the most accurate measure of box office rentals available in the industry.

³ Prior project experience and size of projects by a firm was highly correlated with all network measures so this measure of experience was not in the study.

a high score to the extent that the studio head in charge has many past collaborators and these collaborators have not collaborated with each other. The second measure of social capital is *Strength of Tie*, a relational measure based on frequency of interaction and duration of a relationship (Granovetter 1973, Krackhardt 1992). We assessed the frequency and duration of a studio-director relationship i.e. repeated collaborations between studio executives and the 1979 films' directors. Specifically, we counted how many productions (film or T.V.) the individual had made with the 1979 studio and divided the frequency of ties by the length of time (e.g., from first collaboration until 1979). For example, two directors with five credits with a studio have different ratios if these credits are spread over five years (e.g., 1) versus ten years (e.g., .5). We examined directors' credits with studios over the previous 18 years (1960 – 1978) to derive our measure which ranged from 0 to 4.

Component knowledge. Component knowledge is comprised of human and social capital inputs. One form of human capital is *Project Member Experience*, which is measured as the total number of film credits for each freelancer on a film.⁴ Our second human capital measure is *Project Member Expertise*, measured as the total number of prior industry prizes awarded to all members of a project (crew and stars) for each of the 1979 films. Our third human capital measure is *Stars*, which we operationalized in a 1979 film as actors or actresses who were listed as a top 25 box office revenue generating films in 1977 and 1978.

For social capital measures we assessed project members social relationships on a project. *Project Members External Contacts* assesses the number of people that a film's production team is connected with. For a given film, it is computed by counting the total number of distinct individuals that any member of the project team has collaborated with prior to the current film

(during the 1977-1979 study period). The measure is high to the extent that each member of a given project has large personal networks, and these personal networks do not overlap (thereby reaching many distinct individuals).

Control variables: seasonality and rating. In the film industry two seasons--Summer and Christmas--are seen as high demand times during which ticket sales peak and then drop in "off-season" months. As Studio Executive Michael Medavoy points out: "In order to build a program of movies, you must first put into motion three summer films--then your Christmas films. These films must be strong enough to compete with other such big pictures and successful sequels" (in Brouwer and Wright 1991, p.6). We coded films a 1 when they were released in high demand months and a 0 in low demand months to capture the exogenous effects of predictable consumer demand shifts. *Rating* is our second control variable. Past studies indicate a relationship between ratings and film rentals (Medved 1993, Prag and Casavant 1994). Ratings indicate the studios and key team members' decision to target films to certain markets and is a proxy for a marketing strategy of broad versus narrower audience appeal (Orwall 1999). PG ratings are considered the most desirable, R ratings more restrictive, and G ratings problematic. Film historian Richard Randall (1987) explains that: "The economic consequences of a more restrictive rating can be formidable. The 'PG' rating is usually the most sought-after prize, since it involves no box office restriction and at the same time, avoids the sexless 'Disney' stigma many believe associated with a 'G' rating" (p. 527). We control for the impact of ratings by providing dummy variables for movies rated with the less desirable ratings of "R" and "G."

⁴ We tested various measures of experience-- sum of prior credits, double weighting director's prior credits and averaging prior credits for a project. There was no difference between these measures in the regressions so we used the sum of prior credits for a project's members.

DATA ANALYSIS AND RESULTS

Table 2 presents the descriptive statistics and bivariate correlations for the variables included in the analysis. The bivariate relationships reveal that all of the independent variables except for Strength of Tie are significantly related to Project Performance in the predicted direction. For the most part, the relatively low, even when significant, correlations between independent variables suggest that multi-collinearity is not a significant problem with these data. An exception, however, is the large (0.72) correlation between Brokerage Role and Project Members' External Contacts. Brokerage Role is based on the studio head's ties while Project Members' External Contacts is a measure of all project members' direct external ties. Since the studio head is also a member of the project team, there is overlap between these variables at a construct level. This overlap is more pronounced on smaller teams, where each individual's ties make up a greater percentage of total team's ties. Multi-collinearity can create difficulties for accurately estimating parameters in a regression model. One common solution is to drop one variable. In this case, though, the two variables measure the effects of two conceptually different variable types – one is architectural knowledge, the other component knowledge. Therefore, we retain both variables for further analysis. Despite the collinearity we can make inferences about the effects of these variables on Project Performance by testing these two variables separately in different regression models and then testing them jointly in hierarchical regression models as we report below.

We also tested for the effects of outliers by examining the standardized residuals and Cook's distance measure for the effect of each independent variable on the dependent variable. The analyses showed no significant effects of outlier values in the independent variables on project performance.

Insert Table 2 about here

Testing the Influence of Architectural Knowledge and Component Knowledge

We assessed the hypotheses sequentially in the series of OLS regression models presented in Table 3. Project Performance was the dependent variable in each of the models. We first tested the hypotheses for architectural and component knowledge separately and then tested them jointly.

Model 1 presents the results for the base model, which included only the control variables i.e. the seasonality and ratings dummy variables. Model 2 tested the regression of performance over the set of three architectural knowledge variables, and compared the R^2 change with Model 1. Model 3 tested the regression for the set of component knowledge variables, and again compared R^2 change with Model 1. Model 4 provided tests for all the variables jointly, showing the combined effects of architectural knowledge and component knowledge and provided the changes in R^2 compared to both Model 2 and Model 3.⁵

Insert Table 3 about here

All four models presented in Table 3 are significant overall as indicated by the F-tests ($p < .05$ for Model 1; $p < .01$ for Models 2 - 4). Further, each model showed a significant increase in R^2 over its comparison model. These findings indicate that the architectural and component knowledge variables taken as sets provided significant additional explanation of Project Performance. The increased in R^2 of .134 for Model 2 indicates that the set of architectural variables explained significant ($p < .01$) additional variance over the base model. The increased R^2 of .367 for Model 3 indicates that the set of component knowledge variables also explained significant ($p < .01$) additional variance over the base model. The R^2 change of Model 4 over Model 2 (R^2 Change = .263) suggests that component knowledge increases the explanation of Project Performance beyond architectural

⁵ The full model was run entering the Architectural Knowledge variables first, followed by the Component knowledge variables, and vice versa to check increases in explanatory power, with the outcomes as indicated.

knowledge by a significant amount ($p < .01$). The increase in R^2 of Model 4 over Model 3 (R^2 Change = .030) shows that architectural knowledge contributes much less additional explanation to variance in Project Performance compared to the component knowledge variables; however this increase was still significant ($p < .05$).

Testing the Individual Hypotheses

For the control variables, both Seasonality and the G-Rating dummy variable were positive and significant in each model tested. This indicates that films produced in high demand months tend to perform better and, contrary to industry norms, so do the G-rated films in our sample. An R-rating did not have a significant effect on Project Performance.

Hypotheses 1 through 3 predicted a positive influence of architectural knowledge on project performance received varying support. Hypothesis 1 predicted a positive relationship between Studio Executives' Experience and Project Performance. The results in Table 3 offer mixed support for this hypothesis. When only the architectural knowledge and control variables were estimated in Model 2, the coefficient for Studio Executives' Experience was not significant. However, when the full model was considered (Models 4), this variable was moderately significant ($p < .10$).

Hypothesis 2, which predicts a positive impact on Project Performance from Brokerage Role, receives consistent support. The coefficient for Brokerage Role was positive and significant ($p < .01$) when the architectural knowledge variables were entered together in Model 2. This indicates that films with studio executives in higher brokerage positions tend to perform better at the box office. Despite the relatively high (.72) correlation between Brokerage Role and Project Members' External Contacts, Brokerage Role remains significant when the full model was considered ($p < .05$). The high correlation between the two variables made it problematic to obtain a precise estimate of the effect of

Brokerage Role on Project Performance. However, the result in Model 4 indicates that Brokerage Role made a significant unique contribution to the variance explained in Project Performance, even in the presence of component knowledge variables.⁶ The effects of these variables are discussed below.

Hypothesis 3 predicted that the Strength of Ties between the studio and director would have a positive effect on Project Performance. No support was evident for this hypothesis. The coefficients for this variable in the regression models were not significant, nor was the bivariate correlation.

Hypotheses 4 through 7 predicted the positive influence of component knowledge on project performance. Consistent support was found for three of these hypotheses but only mixed support for the fourth one. Hypothesis 4 predicted that films with more experienced project members would perform better. This prediction was supported ($p < .01$) when the component knowledge variables were considered alone (Model 3) and when component and architectural knowledge variables were estimated together (Model 4).

Consistent support was also evident for Hypothesis 5, which predicted that films with more expertise among project members would perform better. The coefficient for this variable was significant ($p < .01$) in the predicted direction in each model where it was included.

Hypothesis 6 --the impact of Stars on Project Performance-- was supported consistently, with the coefficient for Stars positive and significant ($p < .01$).

Hypothesis 7, which concerned the relationship between Project Members' External Contacts (component social capital) and Project Performance, received mixed support. The correlation in Table 2 between this variable and Project Performance is .253 (significant at $p < .01$). Further, when the component knowledge variables were tested together in Model 3, this variable was positive and

⁶ Hierarchical regressions of the full model, entering Brokerage Role last in one and Project Members' External Contacts last in the other, also make the same point. Alone each is significant, but the Brokerage Role variable supplants the project level social capital variable when they are used together.

significant ($p < .05$). However, when included in the full model, Project Members' External Contacts was not significant. These results are discussed more fully below.

DISCUSSION

The primary goal of this study is to examine the contributions of architectural and component knowledge on project performance. Our analyses provide some important insights into the relationship between architectural and component knowledge and also between human and social capital. Specifically, we ask whether organizations competed on internally generated firm-based competencies or on their ability to access and reconfigure external resources. Our analyses suggest that component level human capital, measured in terms of project member experience and expertise and of star presence, explains the greater portion of performance variance than any other set of variables. Architectural knowledge contributes to performance primarily by having a well-positioned studio executive who is able to assemble a more skilled film project team than one with fewer distinct connections. These results suggest that firms compete on their ability to access and configure external resources rather than on firm-based and firm-specific skills.

An additional question we ask is whether and how these two sets of assets--architectural and component knowledge-- might interact to provide competitive advantage. Our findings suggest that architectural knowledge and component knowledge are complementary rather than sequential assets. That is, both types of knowledge inputs work together to increase performance, as opposed to a sequential ordering in which the importance of architectural skills would be supplanted once the project team is assembled. This finding is confirmed because when both sets of knowledge variables are tested (in Model 4), architectural knowledge still contributes significantly to project performance.

Our results also provide some insight into the relationship between human and social capital. We speculate that in both architectural and component knowledge that social capital complements human capital. Indeed, scholars (e.g., Cohen and Levinthal 1990, Larson 1992, Nahapiet and Ghoshal 1998) suggest that social capital is the means through which knowledge flows. Cohen and Levinthal (1990) suggest that this knowledge flow is most useful for managerial boundary spanners (e.g., those who link an organization to its environment or link subunits to one another). In contrast, Nahapiet and Ghoshal suggest that the "mosaic of social ties" linking parties together, ostensibly across various levels and in a variety of roles, is critical to the development of intellectual capital. By examining both social and human capital and architectural and component knowledge in the same model, we attempt to sort out this relationship. Our analysis suggests that social capital is most important for boundary spanners, as Cohen and Levinthal argue, and is associated with architectural knowledge whereas human capital, in the form of expertise and experience, is most critical for component knowledge. These two forms of capital may play differential roles and have a differential impact on architectural and component knowledge. Our results suggest that social capital for boundary spanners enhances knowledge flow to generate competitive advantage and that social capital for more technically or functionally oriented personnel may not have the same effect on enhanced project performance. An implication is that social capital does not have generic or unilateral effects across all relationships for enhancing intellectual capital and competitive advantage.

The interpretations above require several caveats. First, our social capital measure at the project or component knowledge level is not consistently significant. Specifically, Project Members' External Contacts do not contribute significantly to explaining Project Performance when Brokerage Role is considered simultaneously. Given the high correlation of this variable and Brokerage Role, however, it is difficult to disentangle precisely how much each contributes to Project Performance.

The fact that the component level social capital becomes non-significant in the combined model suggests that social capital at the component level plays no real role in our model. A possible interpretation is that Project Members' External Contacts reflects networking that could be considered to be largely architectural-knowledge; thus it is better modeled directly by the Brokerage Role variable. This finding emphasizes the strong complementary roles of social capital as architectural knowledge and of human capital as component knowledge on project performance.

A second caveat is that the lack of significance of these variables may reflect statistical conditions of multi-collinearity among variables that are nominally independent but are constructed in such a way as to have elements in common. The fact that the studio head is included as a member of the project may explain the correlation between the two predictors, and could be the sole source of what explanatory power Project Members' External Contacts does demonstrate. Another possible explanation for this high correlation may reflect the social stratification within the industry. As Faulkner's (1987) research on longitudinal ties between directors, screenwriters, producers and composers shows, those with similar experience levels tend to work together, stratifying the industry. In a different longitudinal study, Jones and Walsh (1997) examine the careers of above and below the line personnel over a ten year period and found that a freelancer's initial position within the industry core or periphery determined project opportunities ten years later. Thus, our high correlation between brokerage role for architectural knowledge and external contacts for component level project members may reflect the social stratification found in the film industry.

A third caveat is that the lack of significance for firm-based competencies in terms of managerial experience may result from our choice of dependent variable. Box office sales are the accepted measure of performance in the film industry, and the only measure that is practically available. However, receipts represent only revenue stream, not costs or returns. Thus, input

measures that might reflect efficiency or cost saving will not necessarily explain a performance measure that only relates to sales. Thus, architectural knowledge about cost controls, project management, financial acumen and so forth, very possibly tied to studio executive experience, might be very useful in explaining levels of profitability, but could even have a reversed relationship with revenue stream (a tight budget might result in a less popular, but more profitable, film). The non-significant role of human capital at the architectural level may be an artifact of enforced variable selection more than its actual unimportance to overall performance.

Finally, we predicted a significant role for strong ties between studio and director that is not supported by the data. On the surface, this appears to indicate that frequency of interaction over time has no effect on project success. An alternative explanation, though, might be that some consequences from Strong Ties can be negative and others positive. For example, some repeated interaction might improve understanding and trust, leading to a superior film, but in other instances extensive relationships could lead to the selection of a director more for the relationship or sense of obligation than for skill in a particular genre or for a particular audience. Portes and Sensenbrenner (1993) note that social capital can constrain freedom in economic exchanges. If studio executives are caught in a “networking trap”, by which directors with lower skill levels are hired when they have strong relationships to the executives, the resulting films could be poorly made and generate low box office revenues. Thus, some strong ties are functional while others are dysfunctional. Without being able to distinguish between the two a priori, it is likely that the aggregate result of strong ties would be insignificant even though they may play an important role in either enhancing or hindering project performance. Functionally, intermediate relationship levels might provide the best combination of valuable directorial skill and problem-minimizing personal relationships.

CONCLUSIONS

Our study extends the prior work on architectural and component knowledge by examining their contributions at the firm-project interface. We establish the value of thinking of architectural knowledge at the level of the firm, where organizing relates to complex groups of people, not to single assets and workers, and component knowledge is likewise complex, intuitive, and tacit. This is a useful contribution, since earlier studies of these knowledge types have functioned at different levels of analysis. For example, Henderson and Clark (1990) operationalize component knowledge in terms of specific technical skills in a project, whereas they see architectural knowledge in terms of project-level organizing skills. Matusik and Hill (1998) examine component knowledge in terms of the use of individual contingent workers by firms, rather than as a project-based industry system. It seems that architectural knowledge at one level may be seen as component knowledge from a broader perspective. Thus, architectural knowledge and component knowledge should not be seen as mutually exclusive categories, but rather as related to each other according to their level of analysis. This logic may be applied to other contexts such as corporate parents as architectural knowledge and individual business units as possessing component knowledge about operating in their specific industries, in order to identify various knowledge contributions to corporate performance.

Our study suggests several directions for future research. First, we have not established consistent evidence for the role of lead firm operating competencies. An important area for future research is the role of firm human capital, specifically in operating competencies. Further empirical work in other industries, particularly ones that have alternative measures of performance, would be most enlightening. A related question is what are a firm's competencies when they primarily outsource production processes? Do firm-based competencies still involve identity, coordination and learning (Kogut and Zander 1996) or other sets of competencies?

A second direction is in examining the role of strong ties. Specifically, Uzzi (1996) argued that a portfolio of strong and weak ties was optimal for enhanced firm survival. An important question is which enhances performance: a mix of tie strength (e.g., combination of weak and strong ties with various partners) or an intermediate level of tie strength in a relationship that balances commitments with freedom, exploration with exploitation (March 1991). Additionally, the benefits and costs of tie strength may also depend on environmental conditions. Krackhardt (1992) argues that strong ties help adjust to exogenous shocks (e.g., unionization attempts). However, it is not clear whether strong ties are as beneficial in environments where future outcomes are routinely unpredictable, as in the film industry. A test of effect of tie strength across different levels and rates of environmental uncertainty would when tie strength provides adaptive versus maladaptive effects.

A third direction for future research is discerning the effects of image management on perceived expertise. For example, an industry player may try to bolster perceptions of expertise by affiliation with high status others (Podolny 1993) or use their social capital to gain awards or award nominations ostensibly reflecting expertise. However, Kelly and Caplan's (1993) research shows that those recognized by both management and fellow employees as experts had different cognitive schema for knowledge strategies than did those who were more concerned with image management (and who tended to be average performers). An important study is at the micro-level examining knowledge strategy schemas, and whether these led to differences in who is socially recognized as an expert and performance outcomes (e.g., patents, publications, hit movies etc.).

Finally, an important future research direction is disentangling the relationship between human and social capital in creating intellectual capital. Conventionally, human capital is knowledge internal to a single individual, whereas social capital is the individual's position in a network of relationships. However, our empirical work suggests that separating these types of capital for

measurement is not simple. Although prior conceptual work suggests that social capital leads to the development of human capital (e.g. Coleman 1988), attributes that create individual know-how seem as likely to increase the individual's desirability and sense of value in their wider network. If the individual (or the collectivity, if we look at the firm level) possesses an internal skill in identifying, pursuing, maintaining, and exploiting valuable relationships, it seems likely that this learned human capital skill will be seen in the size, intensity, and value of the individual's network and of one's position in it. Is this human or social capital at work? We note in our results that the architectural human capital measure is correlated with brokerage role implying that the longer studio executives are in the business, the more they become networked with others also in the business. While experience may have many consequences, our analysis suggests that one important aspect of time-in-a-position is increased social capital. We see a similar correlation of experience and networking at the project team level. Perhaps longitudinal studies examining incremental enhancements in knowledge and skills relative to social contacts throughout one's career may tease out these relationships.

By examining the contributions of various forms of knowledge and of capital on project performance, we show how architectural knowledge influences project performance primarily through social capital in the form of brokerage positions that provide access to high quality outsourced component knowledge. Component knowledge influences project performance through its human capital--the experience and expertise of contingent workers. These two forms of knowledge and capital complement one another. Yet, our study also raises some important questions and suggestions for future research to enhance both our scholarly and practical understanding of what generates competitive advantage, especially in rapidly changing and competitive markets.

Table 1: Measures and Operationalizations

COMPONENT/ Capital	Hypo- thesis	Variable	Operationalization
ARCHITECTURAL KNOWLEDGE			
Human Capital	H1	Studio Executives' Experience	Total years of managerial experience divided by number of managers, from 1973 to 1978.
Social Capital	H2	Brokerage role	Burt's Structural hole measure for studio executive.
Social Capital	H3	Strength of Tie	Frequency of tie between studio and director, divided by years of tie.
COMPONENT KNOWLEDGE			
Human Capital	H4	Project Member Experience	Sum of prior film credits in each subcontractor's career, through 1978.
Human Capital	H5	Project Member Expertise	Recognition of expert status by peers, i.e. nominations of Academy Awards and all other industry prizes for each project member (including stars).
Human Capital	H6	Stars	Number of stars in film project.
Social Capital	H7	Project members' External Contacts	Reach measure of all component weighted by status of prior credit of component members' direct ties.
DEPENDENT MEASURE		Project Performance	Box office revenues. Daily Variety Weekly Top-50 grossing films for 1979 films, tracked for as long as each movie showed up on the charts (ranged from 1 week to 18 months).
CONTROL VARIABLE		<i>Seasonality</i>	1 if film was released in high demand month, 0 if not.
		<i>Rating</i>	Dummy variables for PG, G and R.

Table 2: Descriptive Statistics and Correlations

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11
1. Project Performance	54.74	53.11	1.00										
2. Seasonality	.49	.50	.21***	1.00									
3. G-Rating (Dummy)	.07	.26	.15**	.00	1.00								
4. R-Rating (Dummy)	.37	.48	-.03	-.03	-.21***	1.00							
5. Studio Executives' Experience	2.68	1.13	.15**	-.04	-.06	-.11	1.00						
6. Brokerage Role	136.17	127.20	.36***	.13*	-.09	-.16**	.26***	1.00					
7. Strength of Tie	.26	.55	.04	-.12*	.13*	-.16**	.11*	.03	1.00				
8. Project Member Experience	36.76	30.14	.39***	.15**	-.01	-.06	.08	.28***	.04	1.00			
9. Project Member Expertise	.60	2.11	.44***	.08	.03	.00	.01	.21***	-.01	.19**	1.00		
10. Stars	.15	.43	.43***	.00	-.03	-.07	.02	.14**	-.02	.20***	.25***	1.00	
11. Project Members' External Contacts	281.11	255.81	.25***	.09	-.16**	-.15**	.21***	.72***	-.04	.28**	.18**	.07	1.00

. * p < .10; ** p < .05; *** p < .01 (two-tailed tests).

Table 3: Summary of Regression Analyses Predicting Project Performance

	1	2	3	4
Control Variables				
Seasonality	.212***	.174**	.142**	.142**
G-Rating Dummy	.154**	.203***	.198***	.198***
R-Rating Dummy	.013	.091	.076	.098
Architectural Knowledge				
Studio Executives' Experience (H1)		.084		.098*
Brokerage Role (H2)		.344***		.182**
Strength of Ties (H3)		.025		.027
Component Knowledge				
Project Member Experience (H4)			.217***	.201***
Project Member Expertise (H5)			.271***	.262***
Stars (H6)			.317***	.307***
Project Members' External Contacts (H7)			.153**	.012
R ²	.068	.202	.435	.465
Adj. R ²	.048	.167	.406	.425
Change in R ² (over model 1)		.134***	.367***	
Change in R ² (model 4 over model 2)				.263***
Change in R ² (model 4 over model 3)				.030**
F	3.391**	5.765***	14.974***	11.568***
N	144	144	144	144

Standardized Coefficients are reported.* p < .10; **p < .05; *** p < .01 (one-tailed tests).

For Models 2 and 3 R² change is compared to Model 1; Model 4 R² change is compared to Model 2 and to Model 3.

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