Multiplex Ties and Individual Performance:

Interdependence in Networks

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We thank Barbara Lawrence for her extensive guidance. We are grateful for Philip Bonacich’s help with the theory and development of this work, and for Giuseppe (Joe) Labianca and Sanford Jacoby’s advice in developing the paper overall.

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Abstract

Organizational network scholars have found that informal instrumental (i.e., work-based) relationships at work positively affect performance. The networks they study are comprised of both primarily-instrumental ties (that include exchanges of work-related information) and multiplex ties (that include exchanges of both instrumental and social information). The previous organizational network research does not differentiate these relationships because scholars assume that the instrumental component of these relationships drives performance consequences. When we analyze their separate effects on performance, however, we find that only multiplex relationships significantly influence performance. Furthermore, our results indicate diminishing performance returns associated with maintaining too many multiplex relationships. These findings, which we replicate in both student and financial services organizational samples, suggest that our existing understanding of how social networks influence performance needs to include more complex measures that better match the relationships people actually have at work.

Getting things done in today’s organizations requires employees to exchange work-related information through informal relationships with co-workers (e.g. Krackhardt & Hanson 1993). Since these instrumental relationships are “critical” (Ibarra, 1993:56) and “necessary” (Umphress, 2003: 742) for task and job effectiveness, individuals who are most involved, or central, in networks composed of instrumental, work-related relationships outperform those who are less central (e.g. Ahuja, Galletta & Carley 2003; Baldwin, Bedell & Johnson 1997; Cross & Cummings 2004). However, people do not always restrict their interactions with colleagues to discussions of work, but often combine them with exchanges of personal information and social support. These combined interactions produce *multiplex* relationships, defined as multiple ties between individuals (Tichy, Tushman & Fombrun 1979), which simultaneously include both an instrumental and a social component and typify many workplace relationships (Berman, West & Richter Jr 2002). Although there are different types of multiplex relationships (e.g. Boissevain 1974; Gould 1991; Kapferer 1969; Padgett & McLean 2006), we focus our research on combined instrumental and social relationships, since these ties typify many workplace relationships (Berman et al. 2002). Research has shown that multiplex relationships influence consequences including adjustment after transfers (Kramer 1996), group performance (Jehn & Shah 1997), and firm performance (e.g. Ingram & Roberts 2000; McDonald & Westphal 2003; Uzzi 1996, 1997). Although a great deal of research has associated instrumental ties with individual job performance, we know little about the distinct role that multiplex relationships play in affecting this outcome.

Multiplex relationships have been overlooked in previous research because scholars include both primarily-instrumental and multiplex ties in analyses of instrumental networks (as shown in Table 1). By not differentiating these ties, scholars implicitly assume that the instrumental component of relationships is the primary driver of individual job performance, and the social component plays an ancillary role. We challenge this assumption, however, since previous research also finds significant performance effects of social network centrality (e.g. Mehra, Kilduff & Brass 2001; Sasovova 2006). These scholars suggest the reason social ties benefit performance is because these relationships facilitate the flow of work-related information. In other words, the effect is due to the interplay of the social and instrumental relations, which is consistent with our conceptualization of multiplex ties.[[1]](#footnote-1) Furthermore, multiplex ties strongly affect other kinds of organizational outcomes. If multiplex ties also strongly influence individual performance, then instrumental network analyses that did not distinguish between primarily-instrumental and multiplex ties may have overstated the independent role of instrumental relationships and thus, the effects of primarily-instrumental ties. We ask the following research questions: 1) How do relationships in an instrumental network that include both an instrumental and social component affect individuals’ task and job performance? 2) When we distinguish primarily-instrumental from multiplex ties in an instrumental network, do our results support the assertion that the instrumental component is the key driver of performance effects, or are the effects also attributable to the interdependence of the instrumental and social components found only in multiplex ties?

Insert Table 1 about Here

We predict that multiplex ties increase both the benefits and the costs of being central in an instrumental network, relative to primarily-instrumental ties. The presence of the social component in multiplex relationships could improve the functionality of instrumental relationships by promoting exchanges of more and better information (Sias & Cahill 1998; Uzzi 1996), and feelings of security and well-being (Albrecht & Hall 1991; Lazega & Pattison 1999). At the same time, a social element could present a constraint to the instrumental tie by creating normative limitations on behaviors and information access (Granovetter 1985, 1992; Marsden 1981), and conflicting obligations to personal and professional roles (Ingram & Roberts 2000). Thus, multiplex relationships present contradictions not present in previous studies of instrumental networks (Licoppe & Smoreda 2005). Because in multiplex relationships the instrumental and social components influence performance interdependently, we predict that they produce different consequences than primarily-instrumental ties.

 Using both workplace and classroom samples, we find that only multiplex relationships affect performance, indicating that instrumental relationships produce effects *only* in conjunction with a social relationship, not in isolation. Furthermore, the performance effect of centrality due to multiplex ties is curvilinear, with performance decrements associated with maintaining too many multiplex relationships. Thus, we contribute to the organizational networks literature by presenting a theoretical model that accounts for the real-world complexities of workplace relationships and enhances our understanding of the way those relationships influence performance.

MULTIPLEX RELATIONSHIPS

Studying multiplex ties requires acknowledging that multiplex and primarily-instrumental ties fall on a relational continuum (Saint-Charles & Mongeau 2009). There is no objective line in the sand that separates these two relationships. Classifying a given relationship as primarily-instrumental does not mean that a social bond is entirely absent, since individuals can never remove all feeling from interactions (Lewis & Weigert 1985). Some minimal affect does exist in these relationships, which is why we call them “primarily-instrumental” ties.

It is also important to note that multiplex relationships do not mean the same thing as “strong ties,” either. Strong ties have been formally defined as relationships that include frequent interaction, over time, with some emotional bond (Krackhardt 1992). While some scholars describe multiplex relationships as “strong” (Kapferer 1969; Marin 2004; Oh, Chung & Labianca 2004), others use this term to refer to relationships that explicitly exclude an emotional component (e.g. Hansen 1999). We acknowledge that all other things being equal, multiplex ties are likely to be stronger than primarily-instrumental ties, given their richer content (Marsden & Campbell 1984), but they lie somewhere between “pure sentimentality and pure instrumentality” (Ingram & Roberts 2000: 389). However, since there is confusion in the usage and classification of strong and weak ties, and since relationships that include only a single component can be “strong” (Granovetter 1973: 1361; Simmel 1950: 317-29), we distinguish “multiplex” ties from “strong” ones.

Multiplex relationships differ from primarily-instrumental ones due to the presence of a social relationship. Social relationships are close, positive, amiable ties (Jehn & Shah 1997; Krackhardt 1992), in which people exchange personal information and emotional support (Ibarra, 1992). These relationships are characterized by individuals wanting to do “good”, feelings of attachment (Mayer, Davis & Schoorman 1995), caring for the other (McAllister 1995), and feelings of selflessness towards the other (Clark & Mills 1979). Individuals who share a social relationship tend to be similar to one another (McPherson, Smith-Lovin & Cook 2001) interact frequently (Krackhardt and Porter, 1986; Krackhardt and Stern, 1988; Krackhardt, 1990) and uphold normative expectations (Coleman, 1990). While there is some evidence of the indirect performance benefits of primarily-social ties, such as security and comfort in the job (Kram & Isabella 1985), these relationships “are not needed to drive the work process itself” (Lazega & Pattison 1999).

*Untangled Multiplex and Primarily-instrumental Relationships*

We draw on embeddedness theory to untangle the effects of multiplex from primarily-instrumental relationships, since this research emphasizes the interdependence of social and instrumental exchanges (Granovetter 1985, 1992).[[2]](#footnote-2) Research in this tradition finds that multiplex relationships benefit firm performance differently than primarily-instrumental relationships do because the presence of a social relationship induces exchanges of enhanced information and joint problem solving (Ingram & Roberts 2000; Uzzi 1996). In addition, however, the social relationships may present normative constraints that may limit access to novel information that is required for innovative thought (McDonald & Westphal 2003). Thus, multiplex ties present greater benefits and constraints than primarily-instrumental ties do.

For example, Uzzi (1996; 1997) distinguishes these relationships between garment manufacturers and their suppliers. He describes embedded relationships as “multiplex relationships made up of economic investments, friendship, and altruistic attachments” (Uzzi 1997: 48). One respondent refers to this type of relationship as: “[They are] business friends. You trust them and their work. You have an interest in what they’re doing outside business” (Uzzi 1996: 677). In contrast, he describes primarily-instrumental relationships as “arms-length” ties that include only a work-related tie. A respondent explains that in arms-length relationships, “You discuss only money; one hand doesn’t wash the other” (page 677). Uzzi finds that networks composed of more multiplex relationships produce a negative curvilinear effect on a firm’s survival.

At the intra-firm level, Kram and Isabella’s (1985) research of mentoring relationships identified similar distinctions between multiplex and primarily-instrumental relationships, but did not consider their performance implications. Primarily-instrumental relationships, in their study, are “information” ties, focused largely on work-related information transfer, and are most common among co-worker relationships. One respondent in their study described this relationship in the following manner: “I think it’s just a friendly exchange, very little giving back and forth. It’s primarily informational” (page 119). The authors find that multiplex or “collegial” relationships occur with less frequency and provide work information along with emotional support and feedback. Another respondent in their study provided this characterization: “When one of us has a tough thing we’ll wander over to the other’s office and bitch a little bit and commiserate” (page 121). The authors differentiate these ties since primarily-instrumental relationships may include very limited familiarity and friendship, and much less self-disclosure and emotional support than multiplex relationships.[[3]](#footnote-3)

In sum, these research streams suggest that multiplex ties differ from primarily-instrumental ones due to the interdependence between the instrumental and social components of multiplex relationships. Although the effects of multiplex ties on individual performance have not been studied, we expect that the relative benefits and costs will be consistent with those that have been identified in inter-firm network studies because the same relational distinctions seem to occur at both levels of analysis. We now consider how multiplex and primarily-instrumental relationships affect the association between network positions and individual performance.

CENTRALITY, MULTIPLEXITY AND PERFORMANCE

Network involvement determines access to resources that influence job performance. Centrality, which describes the extent to which an individual is sought out by others in a network, has been associated with individual performance benefits (Ahuja et al. 2003; Sparrowe, Liden, Wayne & Kraimer 2001). A central position in instrumental networks may indicate that others perceive the individual as an expert. Since many others seek out this individual for work-related discussions, she has opportunities to learn useful information from the others (Sparrowe et al. 2001), and may gain psychological benefits, such as increased self confidence, from these interactions (Blau 1964). This elevated status also implies a higher likelihood of being connected to other central people who have learned valuable information in the same way (Ahuja et al. 2003). Increased information access reduces uncertainty and, in turn, decreases performance-inhibiting stress (Kramer 1996).

Previous work consistently finds a positive association between centrality in instrumental networks and performance. For instance, Sparrowe et al. (2001) study work groups within five organizations, ranging from a large university to a small construction manufacturing company. The authors find that people who are sought out most often for advice within their work groups tend to outperform their colleagues. Similarly, Ahuja, Galleta and Carley (2003) find that the members of a virtual research and development organization who exchanged more task-related emails published more (i.e. performed better), relative to those who exchanged fewer task-related emails.

While most work emphasizes the positive association between centrality and performance, recent research indicates diminishing returns to information-sharing (McFadyen & Cannella 2004). People have a finite amount of time that can be allocated to non-work activities (Krackhardt 1994). When this time has been utilized, any additional time and attention devoted toward relationships draws away from essential work activities (Latour & Woolgar 1979). Additionally, if colleagues exchange information with one another, people may begin to hear redundant information when they have many contacts (Rodan & Galunic 2004). Thus, when people have to direct resources away from their work, additional instrumental relationships present diminishing marginal returns to performance. For example, McFadyen and Canella (2004) find an inverted-u association between the number of scientists’ coauthors and the scientists’ publications. The authors suggest that too few relationships may limit knowledge creation, while too many will reduce the attention that people allocate toward their own work.

*Centrality through Multiplex Ties*

 We argue that distinctions between primarily-instrumental and multiplex relationships differentially influence the association between network centrality and individual performance. We expect the complexities of multiplex relationships will amplify the performance benefits *and* diminishing returns to instrumental network centrality. Thus, we expect an inverted-u association between performance and centrality based on multiplex ties.

Increased Benefits. In moderation, multiplex relationships may enhance the informational and psychological advantages of centrality, since the presence of a social relationship may improve the trust (McAllister 1995), reciprocity (Blau 1964), and security (Albrecht & Hall 1991; Lazega & Pattison 1999) of instrumental relationships. Trust is “the extent to which a person is confident in and willing to act on the basis of the words, actions, and decisions of another” (McAllister 1995). Those who share multiplex relationships trust that others will meet professional obligations of competence and reliability, and go *beyond* these expectations due to their emotional, affective bond (Chen, Chen & Meindl 1998; McAllister 1995). In other words, these relationships involve expectations of selflessness and generosity (Chua, Ingram & Morris 2008). Such feelings of affective trust may induce people to share privileged information, even when the parties’ might be better off concealing it (Albrecht & Adelman 1987). Ingram and Roberts (2000), for example, find that Australian hotel managers, in competition for the same customers but linked by multiplex relationships, discuss confidential and strategic information such as room prices and occupancy rates. In contrast, those who share primarily-instrumental ties trust only that others will meet professional obligations, and may not be privy to such classified information.

Along with trust, reciprocity also may facilitate greater information flow through multiplex ties (Lazega & Pattison 1999). When one individual asks another’s advice in a multiplex relationship, she can repay the advisor with not only information and admiration, as in primarily-instrumental ties, but also with gossip, personal information, social support, and feedback (Blau 1964; Kram & Isabella 1985). The availability of many more resources may reduce the relational risk associated with sharing information. Empirical evidence supports this effect. Albrecht and Ropp (1984) determine that employees in multiple types of U.S. organizations discuss innovative work ideas, or new techniques or ways of doing work, much more often with colleagues with whom they discuss both work *and* social topics than with whom they discuss *only* work topics. Similarly, Jehn & Shah (1993) find task-oriented groups of business school students exchange more task-related and supportive information when group members share a task and a personal tie than when they were only associated through task relations.

Similarly, people feel more secure in multiplex relationships than in primarily-instrumental ties (Lazega & Pattison 1999). The presence of social support and knowledge of others’ personal information establishes a comfortable environment for colleagues to share knowledge (Fischer 1982). Also, normative constraints in multiplex relationships signal a lower chance that others will be opportunistic (Brass, Butterfield & Skaggs 1998; DiMaggio & Louch 1998; Granovetter 1985). These feelings of security encourage exchanges of tacit, or non-codified information (Hansen 1999). Such exchanges may also involve joint problem solving (Uzzi, 1996), creating innovative solutions that neither participant had previously considered alone (McFadyen & Cannella 2004). Thus, multiplex ties likely benefit performance through a higher quantity and quality of information exchanged between colleagues than in primarily-instrumental relationships.

In addition to these informational effects, multiplex ties foster individuals’ psychological well-being more than primarily-instrumental ties do. Along with the positive feelings and support associated with social relationships, those who have more multiplex relations draw greater energy from (Kacperczyk, Sanchez-Burks & Baker 2009), are less uncertain about (Albrecht & Hall 1991), and glean greater self-worth from their structural positions (Thoits 1983), since these relationships are more intimate and stable than ties that include only a primarily-instrumental component (Minor, 1983). Increased well-being has been associated with higher performance ratings (Wright, Cropanzano & Bonett 2007). Thus, multiplex relationships, due to greater psychological well-being and superior information exchanges, likely enhance the performance advantages associated with becoming more central in networks more than do primarily-instrumental ties.

Increased Costs. At high levels of centrality, however, relationships detract from essential work activities, which may be costly to performance (Krackhardt 1994; McFadyen & Cannella 2004). After people have exhausted their non-work time, each additional multiplex tie will cut into solo work more than will each additional primarily-instrumental tie, since maintaining multiplex relationships requires more resources than does maintaining primarily-instrumental ties. Further, each additional multiplex tie will increase the likelihood of learning redundant information more than additional primarily-instrumental ties will. Thus, we expect that multiplex relationships will compound the performance costs associated with being too central in networks, and present diminishing returns to performance.

Since multiplex relationships involve multiple components, developing and maintaining these ties requires even more involvement than do primarily-instrumental ties (Kram & Isabella 1985). Friendly coworkers tend to interact more often than do non-friends (Albrecht & Ropp 1984; Haythornthwaite & Wellman 1998; Sias & Cahill 1998; Sias, Smith & Avdeyeva 2003), and their interactions may be more prolonged than those who discuss mostly work information. Even when time is limited, individuals who share these ties may need to adhere to normative expectations of generosity, to maintain colleagues’ trust.

Along with time, multiplex relationships may produce psychological strain (Thoits 1983) due to the mixed motives in these relationships (Ingram & Roberts 2000). Since people are required to play both a professional role and an emotionally supportive one, blurring between the roles could create anxiety (Ashforth, Kreiner & Fugate 2000; Valcour 2002) and embarrassment (Gross & Stone 1964). Krackhardt (1999) examined computer service firm employees facing a union vote. The author found one individual paralyzed to voice his own opinions on the vote since multiplex ties bound him both personally and professionally to different groups. Also, Baker and Nelson (2005, p. 346), describe a conflict present in relationships between a manager and his mechanic employees: “Mike Matthews told a variety of horror stories from the early days when he tried to befriend and mentor his mechanics, concluding, ‘After a number of bail bond payments and defaulted loans I decided to take a ‘strictly business’ attitude toward my employees.’” Thoits (1983) proposes a curvilinear association between role conflict and well-being, suggesting that while multiple roles may be provide resources and status that are beneficial, after some optimal number, conflicting roles will decrease well-being due to high levels of stress.

Despite the resource requirements of multiplex relationships, *less novel* information may be exchanged in multiplex ties than in primarily-instrumental ones, due to homophily between friends. In general, individuals tend to form friendships with others who are similar to themselves in their backgrounds, experiences and ideas, and tend to remain friends only when few differences exist (Byrne 1971; Festinger 1954). People also avoid expressing judgments that deviate substantially from those of their friends (Allport 1924; Festinger 1954). Since people in social relationships develop additional standards for attitudes and behavior, a lack of conformity to these standards could result in expulsion from the social group (Festinger, Schachter & Back 1950). For instance, Kilduff (1992) finds that MBA students who share a social relationship are more likely to agree on their preferences for jobs and interviews than those who do not share this relation. Restricted access to differentiated information may limit creativity (Perry-Smith 2006) and innovativeness (Kramer 1996). Additionally, since similar information is shared in these relationships, people may begin to hear even more redundant information from multiplex ties than primarily-instrumental ones (Rodan & Galunic 2004). Indeed, research on team performance has found diminishing returns to multiplex ties (Oh et al. 2004).

In sum, informational and psychological benefits may enhance the performance advantages of centrality, such that additional multiplex relationships benefit performance, in moderation. As the resources required to maintain these relationships begin to infringe upon work, and additional relationships provide redundant information, the time and psychological attention involved in each additional multiplex tie likely increases the costs of centrality.

*Hypothesis 1:* Centrality in instrumental networks due to multiplex relationships will produce a negative, curvilinear association with individual performance.

*Centrality through Primarily-instrumental Ties*

Reduced Benefits. Based on our comparisons of multiplex and primarily-instrumental ties, we expect centrality due to primarily-instrumental ties will have attenuated effects on performance compared to previous work on undifferentiated instrumental networks. Given the relative benefits of multiplex versus primarily-instrumental ties, past research that did not distinguish these relationships may have overstated the positive performance effects of primarily-instrumental ties. When multiplex ties are excluded from the analyses, the performance advantages of more primarily-instrumental ties may be more limited.

Reduced Costs. Primarily-instrumental relationships are likely to be less costly than multiplex ties are, however. Since they lack a social component, these ties involve less homophily than do multiplex ties, suggesting that information learned through primarily-instrumental relationships may be more novel and beneficial to performance than information learned through multiplex ties. Also, having many primarily-instrumental relationships may not divert much attention and resources away from necessary work activities because people do not expect that others will be more generous than what is needed to fulfill their professional obligations. Similarly, colleagues discuss only work in these relationships, limiting the time involvement and psychological conflict involved in these ties. Finally, because there are fewer normative constraints in these relationships, primarily-instrumental ties may foster greater autonomous thought and behavior.

To summarize, previous research may have overstated the relationships between primarily-instrumental ties and performance since these relationships may provide less, and lower quality information and psychological benefits than do multiplex relationships. Centrality due to these ties affords only non-complex information and psychological benefits limited to feelings of prestige. On the other hand, the costs of primarily-instrumental ties are lower than those of multiplex ties because the information accessed may be more diversified, the resources requirements may be more limited, and the normative constraints may be reduced compared to multiplex ties. Involvement in many of these relationships, thus, may not draw many resources away from essential work time. We, therefore, anticipate a positive, linear association between centrality associated with primarily-instrumental ties and individual performance:

*Hypothesis 2:* Centrality in instrumental networks due to primarily-instrumental relationships will be positively and linearly associated with individual performance.

METHODS

 We tested our hypotheses in two organizations. For our first test, we study a sample composed of middle managers enrolled in two class sections of a fully-employed master of business administration (FEMBA) program in a US university (“sample one”). We used this sample for an initial study of our hypotheses for several reasons. The middle managers in these sections are all currently employed in US organizations, and their experience, education level, age and outside pressures are likely comparable to others who work as middle managers. Many respondents are financially motivated by their organizations’ pledge to reimburse tuition, contingent upon the students’ academic performance. Further, the program’s explicit lack of hierarchy, undifferentiated task structure, and consistent performance assessments isolate the effects of informal relationships within a single “job,” allowing for direct comparisons. In contrast to field-based research, this provides for greater control and less noise in our predictions. Unlike lab research, however, the individuals studied here interacted together without any manipulations or artificiality. Since this sample is relevant to our topic and the subjects are representatives of the population we study (Ferber 1977), we believe this site is appropriate for our first look at multiplex relationships and their effect on job performance. Recognizing that hierarchy and task structure may affect individuals’ relationship development in many organizations, however, we also look at a larger, hierarchical organization (“sample two”) to establish the generalizability of our findings in our second sample.

*Sample One*

We sampled two class sections of business school students. Of the 111 individuals sampled, 105 (95%) agreed to participate in the research. The sections included 45 and 60 students. They are 29.6 years old (*s.d* =3.76) and have 6.9 years (*s.d* = 5.49) of post-graduate work experience, on average. Seventy-one percent are male. Thirty-nine percent of respondents are White, while 57 percent are Asian (including South Asian). The remainder is Black, Hispanic, American or multi-ethnic. Our respondents’ average Graduate Management Aptitude Test (GMAT) score was 683 (*s.d.* = 52).

We collected whole network data within each section using web-based questionnaires. The whole network method samples all individuals in a bounded network. While completion of the surveys was required for class curriculum, students had the option of including their responses in the research study. Questionnaires included a randomized list of every student in a section. The admissions office provided information on sex, ethnicity, age, work experience, and GMAT scores.

*Measures*

We asked two network questions: *Instrumental network*: Respondents were asked to indicate the frequency with which they approach others for help and advice on class work-related matters. This applies the Sparrowe et al. (2001) measure to a business school environment: “Do you go to [name] for help and advice on work related matters?” Answers are requested on a scale of 1 (never), 2 (once or twice), 3 (once a week), or 4 (many times a week). This information was entered to form an instrumental network matrix. *Social network*: Respondents were asked to indicate their social relationships with others in the section, on a scale of 1 (do not know), 2 (acquaintance), 3 (know well), 4 (close friend) (Krackhardt & Stern 1988). To limit ambiguity, we defined close friends as “people with whom you frequently discuss personal matters, non-class related.” This information was entered to form a social network matrix.

In order for us to differentiate primarily-instrumental relationships from multiplex ones, we dichotomized individuals’ network responses, such that responses of 1 and 2 were coded 0 and responses of 3 and 4 were coded 1. This coding scheme was consistent with respondents’ comments after the survey that they had trouble differentiating between the highest two categories, but easily distinguished between categories two and three. We conducted sensitivity analyses by relaxing the dichotomization in the instrumental network, such that instrumental network responses of 1 were coded 0 and responses of 2, 3 and 4 were coded 1, we found the same pattern of results.

Independent Variable. We measured centrality due to primarily-instrumental and multiplex relationships using an indegree centrality measure. This measure counts the number of students in the section who indicate that they have a relationship with the focal individual. We chose indegree centrality, as opposed to outdegree centrality, since indegree limits the bias associated with self-reports (Sparrowe et al. 2001).

We separately measured primarily-instrumental and multiplex relationship indegree centrality. To determine primarily-instrumental centrality we counted the number of people who report an instrumental tie with no social tie to the focal individual. For multiplex centrality, we count the number of people who report an instrumental tie *and* a social tie to the focal individual. To allow for comparison across sections, we used z-scores, centered on the mean of each section.

Dependent Variable***.*** We measured individual performance using each student’s overall course grade. The grade is based on two individual assignments (case write-ups) worth 34 percent of the final grade, a final exam including a case write-up and short essay questions worth 25 percent of the final grade, completion of surveys worth 10 percent of the final grade and in-class participation from each class, cumulatively worth 15 percent of the final grade. A group assignment that was worth 16 percent of the final grade is excluded from this variable. We used the aggregated grade because it is a more accurate indication of actual performance than is any single assignment (Polzer, Milton & Swann 2002; Rothstein 2004; Slack & Porter 1980). We use a mean-centered performance variable to correct for any differences in grading strictness between professors, and then pool the data from the two sections.

Control Variables***.***Since previous research finds a relationship between performance and friendship network centrality (Mehra et al. 2001; Sasovova 2006), it is possible that primarily-social relationships, along with multiplex ones, contributed to individuals’ performance. Thus, we included z-scores of “primarily-social” indegree centrality, which measures the number of others who choose the focal individual for a social relationship but not an instrumental one.

We also considered controlling for several other variables. First, we considered the effects of including sex (coded 1 for men) and ethnicity (coded 1 for Asian and 0 for White, Hispanic, Black, etc.) since scholars suggest individuals’ involvement in multiplex relationships differs for women and minorities (Ibarra 1992), as does the structure of networks (Brass 1985). While sex was not significant in any of our models, and did not change the pattern of results, ethnicity did. Thus we retained the latter.

Also, we considered experience, measured as months of post-graduate work experience, since those with more experience may have been exposed to more organizational behavior issues at work, which could impact their performance on class assignments in this organizational behavior class. This variable was not significant and its inclusion did not change the pattern of results.

Finally, we tested a control for cognitive ability, since there is an established association between cognitive ability and educational performance or grades (Ree & Earles 1991). We followed Baldwin, et al. (1997) and included cognitive ability using the respondents’ scores on the GMAT as a proxy. This variable does affect our analyses and was retained. Thus, our analyses include controls for primarily-social indegree centrality, ethnicity, and GMAT scores.

*Analysis and Results of Sample One*

Table 2 contains means, standard deviations and zero-order correlations for the variables included in our models. In these sections, individuals were sought out for instrumental relationships by an average of 5 others (*s.d*. = 1.96). Of these, multiplex ties made up 84.2 percent (*m* = 4.21, *s.d.* = 1.83) of ties, primarily-instrumental ties composed 15.8 percent (*m* = .79, *s.d.* = .92). Individuals were sought out for primarily-social ties by approximately 7 others (*s.d*. = 7.0) on average.

Insert Table 2 about here

Model 1 of Table 3 shows that the control variables explain 13% of the variation in individual performance. GMAT scores are positively associated with performance (*β =*.02, *p* < .05). We find significant performance differences between Asians and other ethnicities (*β =* -2.01, *p* < .05), indicating that Asians tend to perform at lower levels than others, and primarily-social indegree centrality is negatively associated with performance, albeit marginally (*β =* - .79, *p* < .10). Thus, the more people seek out an individual for primarily-social purposes, the lower that individual is likely to perform.

We first tested our sample for consistency with previous research that finds a significant and positive linear association between centrality in undifferentiated instrumental networks (called “Instrumental Network Centrality”) and performance. As in previous work, we measure instrumental network centrality as a count of the number of people who report an instrumental tie, primarily-instrumental *OR* multiplex, to the focal individual. With our controls in Model 2, we do not find a linear relationship between instrumental network centrality and performance (*β =* .08, *n.s.*). In Model 3, we do, however, find that there is a significant negative, curvilinear association between instrumental network centrality and individual performance (*β =* -.79, *p* < .01).

Hypothesis 1 states that centrality in instrumental networks due to multiplex relationships will produce a negative, curvilinear association with individual performance. In Model 4 of Table 3, we find no significant linear association between multiplex indegree centrality and performance (*β =* .34, *n.s.*), but we do find a significant, negative curvilinear effect (*β =* -.93, *p* < .01) in Model 5, in support of this hypothesis.

Hypothesis 2 states that centrality due to primarily-instrumental relationships will produce a positive association with individual performance. The results presented in Model 6 show no linear performance effects of primarily-instrumental indegree centrality (*β =* -.47, *n.s.*). We tested for curvilinear effects (not shown) but found none for this variable (*β =* .32, *n.s.*). The curvilinear effect of multiplex centrality remains significant (*β =* -.91, *p* < .01) in Model 7, where we include all of our centrality measures.

Insert Table 3 about Here

*Sample One Discussion*

While previous work assumes that that performance effects can be solely attributed to the instrumental component of relationships, suggesting no difference between multiplex and primarily-instrumental ties, we find that only multiplex relationships affect performance. These results indicate that instrumental relationships produce effects only in the presence of a social relationship, not in isolation, as shown on the left side of Figure 1. Respondents who maintain a moderate number of multiplex relationships outperform others. In this sample, those who performed highest maintained four to five multiplex ties. Multiplex ties may benefit students’ performance in moderation due to exchanges of useful insights, perhaps based on work experiences, on readings and lectures with their classmates. Conversely, respondents who have too many multiplex ties likely devote too much time and energy to their multiplex relationships, rather than their studies, and learn little new information from the additional multiplex relationships.

Insert Figure 1 about Here

Surprisingly, these results suggest that instrumental relationships, in isolation, do not affect performance. This may be because in classrooms, any information that is not tacit would likely be available to everyone equally from the professor or assigned readings. Thus, students’ primarily-instrumental relationships likely do not provide any novel information. Since these relationships presumably do not enhance individuals’ information base, and cost little time and energy to maintain, they do not positively or negatively influence performance. Additionally, the negative performance effect of primarily-social ties suggests that social relationships require resource investments to maintain, which may draw away resources from grade related goals.

Although previous studies have found a positive, linear association between centrality in instrumental networks, using a measure that includes both multiplex and primarily-instrumental ties, and performance, in our consistency check we find a negative, curvilinear association. These results reflect the diminishing returns associated with instrumental relationships. Further, given that the majority of individuals’ instrumental relationships are multiplex in this sample, we would expect that the instrumental centrality would be associated with performance in the same way as multiplex centrality is. This effect may differ in samples in which multiplex ties make up a smaller proportion of instrumental ties.

Through this particular sample, we are able to test the association between relationships and individual performance with greater control than would be possible in a traditional organizational environment since there are no differences in individuals’ task requirements, hierarchical rank, and tenure. For instance, we are able to rule out the alternative explanation that the association between network variables and performance may very well be a result of cognitive ability, rather than relationships. Our analysis shows that network relationships explain variance in performance, even after controlling for the effects of cognitive ability based on GMAT scores.

Given the limitations of our sample, however, we wanted to replicate our analyses in a larger organization in which hierarchical, tenure and task differences are more prevalent and in which multiplex relationships may be less common.

*Sample Two*

Our second sample is drawn from an international corporate bank that has offices in the US, Asia and Europe. The bank provides financing for investment and equity funds, corporations and other financial institutions. We study the largest legal entity in one of the European-based branches, encompassing various types of specialist financing functions, including customer service and support. This research is part of a larger study of the informal networks in this firm.

Of the 216 employees, 204 (94%) responded to the survey. We used all 204 people to generate the network variables that we study here. However, our performance analyses were more restricted. Since this legal entity did not use formal performance evaluations, two managers who had day-to-day managerial responsibilities in this branch provided evaluations of those employees with whom they were most familiar for this study only. Forty-eight people were not rated due to the supervisors' lack of familiarity with their performance. These individuals, therefore, were dropped from the analytical sample.[[4]](#footnote-4) Additionally, as is common in network research, we removed one person who had no instrumental relationships. Finally, we removed one individual who had undue influence on our analyses.[[5]](#footnote-5) Thus, our final sample for the performance analyses is 154. Respondents are 41.7 years old (*s.d.* =9.57) and have been with the firm for 6.32 years (*s.d.* = 6.58), on average. Two-thirds are male. They are distributed across three ranks, department head (14%), group head (10%), and non-managers (76%).

Employees were contacted by their department head by email and asked to fill out an online questionnaire. The survey utilized a whole network, roster method, in which individuals clicked a button when they indicated a given relationship existed with a colleague in the whole networks. Research suggests that this method of research provide a reliable view of interaction and interaction frequency (Kashy & Kenny 1990). The organization’s human resource department provided information on sex, hierarchical rank, age and tenure.

*Measures*

The survey questions used to develop our independent variables are the following: *Instrumental* *network*: “With whom do you, on at least a weekly basis, discuss work-related issues?” *Social network*: “With whom do you, on at least a weekly basis, discuss non-work-related issues?”[[6]](#footnote-6) The responses to each question are dichotomous, with 1 representing a relationship present when the respondent reports it exists, and 0 representing the lack of a relationship.

Independent Variable***.*** We used these whole networks (using data from all 204 respondents) to calculate multiplex and primarily-instrumental centrality through the indegree centrality independentand controlvariables as described in the previous sample description. All of our network variables are standardized for consistency with our previous sample.[[7]](#footnote-7)

Dependent Variable***.*** We measured individual performance as supervisor ratings (1=below average, 2=average 3=above average). Three level performance ratings are consistent with other field-based network research (Burt 2004, 2007). Ratings are the most common method of performance measurement and are generally estimated by supervisors (Mitchell, Daniels, Borman, Ilgen & Klimoski 2002). To prevent any correlation associated with network involvement, the two supervisors who provided ratings were not included in the networks studied here. The managers rated performance for the 154 employees with whom they were most familiar. The two managers both were familiar with the performance of 40 of these individuals, and so both managers rated the performance for these people. Since these data are ordinal, we use Kendall’s tau-b, rather than kappa, to measure the agreement between the two raters (equal to .45, *p* < .01).

In cases where the supervisors did not agree, they differed by only one rank (1 vs. 2 or 2 vs. 3). To deal with such cases, we considered creating a five-level ordinal performance variable by averaging the ratings when managers disagreed, creating a 1.5 and 2.5 category. However, the small number of observations in these two categories resulted in a violation of the parallel regression assumption, which requires a uniform relationship between each pair of outcome groups in ordinal logistic regression (Long & Freese 2001). Therefore, we collapsed categories by categorizing cases of disagreement in the higher of the two ranked categories. Respondents were distributed across the three performance categories as follows: below average (n=20), average (n=96) and above average (n=38).We conducted sensitivity tests by categorizing cases of disagreement in the lower of the two ranked categories, and found our results unchanged.

Control Variables***.*** As in the previous site, we included a primarily-social indegree centrality variable. We also include hierarchical rank, since people may have different patterns of relationships to their co-workers depending on their rank in the organization (Lin 1992). Our rank variable has three levels, non-managerial, deputy/group heads and department heads. Also, we accounted for the number of years the individual has worked in this organization (tenure) since people develop more social relationships as their time working within an organization increases, and this tenure may influence the pattern of their relationships (Mehra et al. 2001). Finally, we include a control for sex (coded 1 for males). Ethnicity data were unavailable.

*Analysis and Results of Sample Two*

Table 4 contains means, standard deviations and zero-order correlations for the variables in our models. Individuals were sought out for instrumental relationships by an average of 14.71 others (*s.d.* = 7.35), which reflects the larger size of this sample compared to the business school sample. On average, multiplex ties made up 36.5 percent (*m* = 5.37, *s.d.* = 2.69) while primarily-instrumental ties made up 63.5 percent (*m* = 9.34, *s.d.* = 5.80) of all instrumental relationships. People in the bank sample developed many more primarily-instrumental ties than did those in the classroom sample, probably because of there were more people available in the financial institution than were students in sample one. Additionally, individuals were sought out for a primarily-social relationship by an average of 4.37 others (*s.d.* = 2.57).

Insert Table 4 about Here

We tested our hypotheses through ordinal logistic regressions. Ordinal logistic regression assesses the likelihood that an individual would be categorized in the higher performance-rating category versus the lower ones. All of our analyses are robust to the parallel regression assumption, which requires a uniform relationship between each pair of outcome groups. Our tables include odds-ratios for easier interpretation.

In Model 1 of Table 5 we entered in our control variables. Our results show individuals with higher tenure were less likely to be rated as high performers (*β =* -.07, *p* < .01). However, people higher in the managerial hierarchy were likely to be rated as higher performers (*β =* 1.00, *p* < .01). We find no significant effects of primarily-social relationships or sex.

Checking for consistency with previous research, we assessed the relationship between centrality in the instrumental network (combined primarily-instrumental and multiplex ties) and individual performance. With our controls in Model 2, we find a significant and linear association (*β =* .41, *p* < .05), similar to previous research. Based on our findings from the previous sample, we also checked for curvilinear effects and in Model 3 find the squared term significantly and negatively associated with performance (*β =* -.31, *p* < .05). Thus, our results show that centrality in the instrumental network has an inverted-u shaped effect on performance, reflecting the diminishing returns associated with having too many relationships.

In our first hypothesis, we proposed a negative, curvilinear association between centrality due to multiplex relationships and performance. In Model 4 of Table 5, we show a marginal positive linear effect (*β =* .35, *p* < .10), and in Model 5 we find a negative, curvilinear effect (*β =* -.48, *p* < .01). Thus, as in the business school sample, our first hypothesis was supported in this larger, financial institution.

In our second hypothesis, we proposed a positive association between centrality due to primarily-instrumental relationships and performance. As shown in Model 6, our data show the linear effects of primarily-instrumental indegree centrality are non-significant (*β =* .33, *n.s.*). We also find no curvilinear effects (*β =* .03, *n.s.*). Thus, as in the business school sample, our second hypothesis is not supported. Finally, in Model 7 of Table 5, when we enter all of our network terms into the model, only the linear and squared multiplex terms remain significant, (*β =* .57, *p* < .01 and *β =* -.49, *p* < .01, respectively). These results again echo our findings from our business school sections. The results are graphed on the right side of Figure 1.

Insert Table 5 about Here

*Sample Two Discussion*

Consistent with the results from the business school sample, we find performance effects of centrality due only to multiplex ties, but not primarily-instrumental relationships, even after taking into account hierarchical rank, task and tenure differences in an organizational sample. The likelihood of being rated as a high performer was maximized when individuals had seven multiplex ties, more detracted from performance.

Again, contrary to previous research, our results show that primarily-instrumental ties have a limited effect on performance. Although we anticipated an attenuated effect compared to past, undifferentiated instrumental research, we still expected that the information learned through primarily-instrumental ties would benefit performance, especially in this sample where those kinds of ties are the dominant relationships. However, it may be possible that the quality and quantity of information exchanged through these ties is simply not valuable enough to enhance performance without a social component to the relationship.

OVERALL DISCUSSION AND CONCLUSION

Contrary to the predominant assumption in the existing literature on the effects of instrumental network centrality on individual performance, we find that instrumental ties only affect performance in conjunction with social ties, but not in isolation. In two business school sections and a large financial institution, we find that centrality due to multiplex ties, composed of instrumental and social components, produces negative, curvilinear performance effects, while centrality due to primarily-instrumental ties does not influence performance. Our findings suggest that social network studies that examine networks independently (one network at a time) without considering multiplex ties may be confounding the effects of very different relationships. Further, while previous work consistently finds a linear and positive effect of instrumental network centrality, in both samples, a deeper look into the effects reveals that instrumental relationships actually have a negative, curvilinear effect on performance, reflecting the diminishing returns to having too many relationships. In both samples this effect seems to be driven largely by multiplex relationships, and very minimally by primarily-instrumental ties.

Given these results, it also seems likely that the significant performance effects of involvement in friendship networks,(e.g. Mehra et al. 2001; Sasovova 2006) may be due to the effects of multiplex ties, rather than primarily-social ones.

*Future Research*

Our study raises several questions for future research. Given that people have limited time to allocate to informal relationships, how should people combine their relationships in a way that will be most beneficial to their performance? Post-hoc analyses (not reported) found no support for interactive effects of primarily-instrumental and multiplex ties in either sample. We expect that individual performance will be maximized when people balance their ties depending on the tasks being performed and the collaboration required and rewarded in their positions. Future research should study people who have been identified as having multiplex and primarily-instrumental ties to see what distinguishes these individuals, these relationships or their roles.

Also, previous research suggests that men and women’s multiplex relationships may influence outcomes differently (Ibarra 1993). Though men's and women’s performance did not vary in either sample, we wondered whether men’s performance is maximized at different values of multiplex relationships than women’s performance. Including interaction terms of multiplex relationships by gender in our models (not shown) produced minimal differences between the genders in the classroom samples. Both men and women’s multiplex relationships had a negative and curvilinear association with performance and both men and women’s performance was maximized when they had four multiplex relationships. We were unable to test this effect using our model from the financial institution, however, because our model for women violated the parallel regression assumption of ordinal linear regression. Since hierarchical rank is significant in our model, and only six women out of 52 are in managerial positions, there are too few women in that category to test these effects. Thus, we leave the important question of gender effects to future research.

Also, we have merely theorized the mechanisms of information, psychological effects and maintenance obligations that underlie the distinct effects of these untangled network relationships. Future research is needed to confirm these mechanisms, for instance, by measuring attributes of information, such as the quality, quantity and differentiation of information flowing in different types of relationships. We expect more and superior information flows through multiplex ties, as we described in our hypotheses. Since we concentrate only on the consequences of multiplex relationships, future work may build upon previous research that studied antecedents of multiplex and primarily-instrumental ties (Ibarra 1992; Kacperczyk et al. 2009; Lazega & Pattison 1999). Finally, a great deal of research has considered alternate measures of network position (Freeman 1979), future work may consider how multiplex relationships influence the association between different measures of centrality and performance.

*Limitations*

Our research is limited in several areas. As would be expected in a cross-sectional research design, we cannot explain a causal link between centrality and performance. While research suggests network relations may be an antecedent of individual performance (Brass, Galaskiewicz, Greve & Tsai 2004), it is possible that the inverse relationship holds. It is also plausible that these effects co-evolve, such that those who have many relationships perform well and also attract more relationships. Studying these effects over time would clarify the dynamic nature of this process.

For our analyses, it would have been ideal to collect network and performance data across many types of businesses, industries, and sizes of organizations. Due to limited resources we were only able to test our results in these two samples. However, since we tested our hypotheses in very different samples, the consistency in our results suggests that the performance effects of multiplex and primarily-instrumental relationships may be generalizable to other organizations, with some caution. While we acknowledge that academic and work performance are not equivalent, previous work shows a correlation between these constructs (Kuncel, Hezlett & Ones 2004). Thus, the findings from our first sample may be relevant to smaller US organizations, since our class sections are made up of sixty and 45 students, respectively and the median organization employing Americans includes approximately fifty full-time employees (Kalleberg and Spaeth, 1996: 49). Similarly, while acknowledging that our field study includes only one organization, we believe our results may be generally applicable in large firms with hierarchical and tenure distinctions.

While our classroom data allow us to test our models using an objective measure of performance, our performance measure in the financial institution is more subjective. We could not use objective or pre-existing measures of job performance, but rather relied on managers’ ratings at the time of survey. This may skew performance ratings toward managers’ recollection or perception, rather than actual performance. In addition, the limited number of performance outcomes reduced the variance in our dependent variable, potentially masking important outcome differentiation. However, we find precedence in network research for our three level measures, as we mentioned above (Burt 2004, 2007).

Our research is also potentially limited by our inclusion of only positive networks. Despite the attention given to instrumental and social interactions, negative “interactions” also affect resource access by limiting the transfer of information (Labianca & Brass 2006) and social support. By excluding these relationships in our work, we may be masking some relational influences on performance. Unfortunately, including relationships in a negative network, and any relationships created by the overlap between a negative network and the two positive ones we study there would simply be unwieldy, and was outside the bounds of our study. Given our work in this paper, however, we believe studying multiplex ties that include a negative component may be a fruitful avenue for work in the future. Our work provides an initial look into the effect of one type of multiplex tie on individuals’ performance.

CONCLUSION

Our research highlights the complexities of individuals’ actual workplace relationships. While early network scholars suggested that studying networks meaningfully requires distinguishing among them and analyzing each independently (Fombrun 1982), our results suggest that studying network effects this way artificially isolates different aspects of individuals’ relationships, which may result in an unclear understanding of the impact of these relationships on their performance.

Overall, the consequences of multiplex relationships remain understudied. While we see that beginning to change in the literature (c.f. Ingram & Roberts 2000; McDonald & Westphal 2003; Uzzi 1996), we look forward to much more research of this topic, especially at the individual level. People have many different types of relationships with their co-workers, all of which contribute together to their positions in status hierarchies and likely influence their access to valuable resources. We can only truly appreciate the effects of informal networks when we recognize that people simultaneously maintain many types of relationships with their co-workers, and together, these all influence the way people work.

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Figure 1: Associating Instrumental Network Centrality with Performance and Distinguishing Relationships

Table 1: Categorizing Instrumental Network Relationships Based on Instrumental and Social Components

|  |  |
| --- | --- |
| **Relationship Includes:** | **Social Component** |
| **Yes** | **No** |
| **Instrumental Component** | **Yes**  | ***Multiplex*** | ***Primarily-instrumental*** |
| **No** | ***Primarily-social*** | ***No Tie*** |

**Table 2: Sample One - Means, Standard Deviations and Correlations in Business School Sections**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Mean** | **S.D.** | **Min** | **Max** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1. Individual Performance (section-centered) | 0 | 4.33 | -11.35 | 8.42 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Cognitive Ability | 682.26 | 51.99 | 550 | 770 | .19^ |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Ethnicity (1=Asian) | 0.52 | 0.5 | 0 | 1 | -.21\* | .19^ |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Primarily-social Centrality | 0 | 1 | -1.47 | 5.31 | -.20\* | .05 | .12 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Instrumental Network Centrality | 0 | 1 | -2.49 | 2.95 | .04 | .03 | -.05 | .01 |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Multiplex Centrality | 0 | 1 | -2.52 | 2.1 | .09 | .02 |  -.04 | .02 | .88\*\* |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 7. Primarily-instrumental Centrality | 0 | 1 | -1.05 | 3.27 |  -.09 | .03 |  -.03 |  -.01 | .30\*\* | -.19^ |   |
|  |  |  |  |  |  |  |  |  |  |  |  |
| n=105 |  |  |  |  |  |  |  |  |  |  |  |
| ^<p<.10, \*p<.05, \*\*p<.01 |  |  |  |  |  |  |  |  |  |  |
| Network and performance variables are standardized |  |  |  |  |  |  |  |

**Table 3: Results of Regression Analyses Predicting Individual Performance**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Model 1** | **Model 2** | **Model 3** | **Model 4** | **Model 5** | **Model 6** | **Model 7** |
|  |  |  |  |  |  |  |  |
| Cognitive Ability | 0.02\* | 0.02\* | 0.02\* | 0.02\* | 0.02\* | 0.02\* | 0.02\* |
|   | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Ethnicity (1=Asian) | -2.01\* | -2.00\* | -1.49^ | -1.98\* | -1.66\* | -2.04\* | -1.70\* |
|   | (0.83) | (0.83) | (0.83) | (0.83) | (0.81) | (0.83) | (0.81) |
| Primarily-social Centrality | -0.79^ | -0.79^ | -0.83\* | -0.80^ | -0.78^ | -0.80^ | -0.78^ |
|   | (0.41) | (0.41) | (0.40) | (0.41) | (0.39) | (0.41) | (0.39) |
| Instrumental Network Centrality | -- | 0.08 | 0.31 | -- | -- | -- | -- |
|   |  | (0.41) | (0.40) |  |  |  |  |
| Instrumental Network Centrality-squared | -- | -- | -0.79\*\* | -- | -- | -- | -- |
|   |  |  | (0.29) |  |  |  |  |
| Multiplex Centrality | -- | -- | -- | 0.34 | 0.29 | -- | 0.22 |
|   |  |  |  | (0.41) | (0.39) |  | -0.4 |
| Multiplex Centrality-squared | -- | -- | -- | -- | -0.93\*\* | -- | -0.91\*\* |
|   |  |  |  |  | (0.32) |  | (0.32) |
| Primarily-instrumental Centrality | -- | -- | -- | -- | -- | -0.47 | -0.36 |
|   |  |  |  |  |  | (0.40) | (0.40) |
| F |  4.99\*\* | 3.72\*\* | 7.39\*\* | 3.91\*\* | 5.01\*\* | 4.10\*\* | 7.96\*\* |
| R-Squared | 0.13 | 0.13 | 0.19 | 0.14 | 0.2 | 0.14 | 0.21 |
|  in R-squared |  | .00 | .06\*\* | .01 | .07\*\* | .01 | .01 v. Model 5 |
|  |  |  |  |  |  |  | 0.07\* v. Model 6 |
| n=105 |  |  |  |  |  |  |  |
| ^<p<.10, \*p<.05, \*\*p<.01, standard errors in parentheses |  |  |  |  |  |
| Network and performance variables are standardized |  |  |  |  |  |

Table 4: Means, Standard Deviations, and Correlations in the Financial Institution

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Mean** | **S.D.** | **Min** | **Max** | **1**  | **2**  | **3**  | **4**  | **5**  | **6**  | **7**  | **8**  |
| 1. Individual Performance | 2.12 | 0.6 | 1 | 3 |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Sex | 1.34 | 0.47 | 1 | 2 | 0.00 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Tenure | 6.32 | 6.58 | 1 | 30 | -.14^ | .09 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Hierarchical Rank | 1.37 | 0.71 | 1 | 3 | .25\*\* | -.22\* | .20\* |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Primarily-social Centrality | 0 | 1 | -1.7 | 3.74 | .08 | .18\* | .07 | -.12 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Instrumental Network Centrality | 0 | 1 | -1.73 | 2.76 | .21\* | -.12 | .33\*\* | .45\*\* | .03 |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7. Multiplex Centrality | 0 | 1 | -1.99 | 3.58 | .17\* | -.19\* | .19\* | .19\* | .10 | .70\*\* |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8. Primarily-instrumental Centrality | 0 | 1 | -1.61 | 2.87 | .19\* | -.07 | .33\*\* | .48\*\* | -.01 | .94\*\* | .42\*\* |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| n=154 |  |  |  |  |  |  |  |  |  |  |  |  |
| ^<p<.10, \*p<.05, \*\*p<.01 |  |  |  |  |  |  |  |  |  |  |  |  |
| Network variables are standardized |  |  |  |  |  |  |  |  |  |  |  |  |

Table 5: Results of Ordinal Logistic Regression Analyses Predicting Individual Performance



1. In our empirical analyses, we also consider the performance effects of primarily-social ties, though researchers suggest these ties are not necessary for work (e.g. Lazega & Pattison, 1999). [↑](#footnote-ref-1)
2. This research also considers the effects of structural embeddedness, which is beyond the scope of our paper, since we focus on direct relationships. [↑](#footnote-ref-2)
3. The authors also identify “special” relationships, which we would categorize as primarily-social ties. [↑](#footnote-ref-3)
4. Neither of the two managers who rated performance was familiar with the work of these 48 individuals, likely because these 48 subordinates were significantly younger and newer to the organization than those who were rated. Those who were not rated had an average tenure of 3.6 years (*s.d.* = 3.8), which is significantly less than that of those who were rated, averaging 6.32 years (*s.d.* = 6.58) (*t* = 3.6, *p* < .01). Non-rated individuals were on average 38 years old (*s.d*. = 9.9), significantly younger than those who were rated, averaging 41.7 years old (*s.d.* =9.57) (*t* = 2.43, *p* < .05). Further, over 85% (42) of the 48 individuals were in non-managerial positions. Controlling for tenure, these individuals did not differ from those who were rated in their incoming multiplex ties (*β =* .29, *n.s.*), but they did have fewer exclusively instrumental ties (*β =* 1.81, *p*<.10), and fewer exclusively social ties (*β =* 1.00, *p*<.05). We discuss this limitation in our discussion section. [↑](#footnote-ref-4)
5. This individual was an outlier in primarily-instrumental relationships. This person had 38 incoming primarily-instrumental ties, which is greater than the mean by over 4 times the standard deviation of this value (*m* = 9.53, s.d. = 6.22). Because of the undue influence of this single respondent on our results, we removed this observation from the analysis. [↑](#footnote-ref-5)
6. Since the questionnaire was distributed in both Danish and English, the term “non-work-related” eliminated translation difficulties associated with “friendship’ or ‘social.’ While the phrase 'non-work-related’ does not explicitly identify social relations, since both work related and non-work related associations were elicited in a single survey, we expected these to be differentiated by the respondent. [↑](#footnote-ref-6)
7. Results are no different when we use non-standardized variables, and are available from the authors upon request. [↑](#footnote-ref-7)