Supplementary Social Science Study Document for *The Inclusive Connective Corridor: Social Networks and the ADVANCEment of Women STEM Faculty*

Subtitle: *Department chairs, Networks, Deans, and Senior Administration:*
Do Female STEM Faculty Need to "Have it All" to Succeed?

Women are underrepresented in the sciences, engineering, mathematics, and technology within academe. While part of this underrepresentation is a result of the attrition of women in earlier educational stages and only a small percentage choosing this career path, the social conditions in universities also influence female faculty success. As women tread unfamiliar organizational ground, they may have difficulty developing the network of social supports that their male counterparts take for granted. The organizational science literature has repeatedly identified the importance of social relationships in influencing employee attitudes and performance outcomes (e.g., Sparrowe, et al., 2001). This study will examine how men and women differ in terms of their networks of professional relationships and whether different types of social referents in that network can compensate for each other. For example, if a female STEM faculty member lacks a supportive department chair, can she forge ties with others in and outside her department to counteract this deficit?

I. Disciplinary/Conceptual Framework. This research extends social science literature while furthering the careers of female STEM faculty by asking two overarching research questions:

1. *What is the relative importance of: (a) department chair-faculty member relationships, (b) the strength and content of peer social ties, (c) the perceived support from one's dean and/or, (d) the trustworthiness of central administration in predicting STEM faculty members' employment outcomes and attitudes?*
2. *Can shortcomings with one or more of the above "social referents" be compensated for by other social exchange referents?*

Knowing which elements are most closely associated with positive employee outcomes will ensure that scarce resources are spent in ways that lead to better recruitment, retention, and overall faculty satisfaction for female STEM faculty. For example, if it is found that better supervisory relationships are most closely associated with better employment outcomes, then having better selection procedures for department chairs, improving upon department chair training, and having performance evaluation for department chairs that includes a leader's ability to create and sustain inclusiveness will be better investments than other interventions.

II. Hypothesis Development. The social network perspective, applied in an organizational context, frequently maps and probes the nature and strength of relationships with supervisors, peers, and subordinates. In this study, Social Exchange Theory (SET) has been adopted as a perspective for understanding the nature of individual ties with others in the organizational context. SET has been described as "among the most influential conceptual paradigms for understanding workplace behavior" (Cropanzano & Mitchell, 2005: 874). In their review of SET, these authors suggested that employees distinguish among a variety of social referents, including immediate supervisor(s), co-workers, and even more abstract entities such as employing organizations. Over time, these relationships are subject to rules of reciprocity such that when the first party to the exchange "gives" to another person it is expected that there will eventually be reciprocation. This concept is well-understood in peer networks, but more challenging to transfer into hierarchical settings where seniority is a complicating factor.

This study attempts to categorize four referents (chair, peer, dean, senior administration) along two continua; specifically, this research team suggests that social exchanges can be evaluated with respect to the directness of the relationship with a given social referent. Direct relationships include the faculty member's department chair as well as direct interpersonal ties the employee has with peers in and outside the institution. Indirect relationships (those with the Deans, Chancellor / Provost) are social exchanges through which the employee may have limited interaction with the social referent, but still has opinions

regarding the referents' ability to reciprocate the employees' inputs to the social exchange. In addition, these social referents vary to the extent that the employee considers these contacts to be of a more local, hierarchical nature (corresponding to direct reporting relationships) versus those of a more global nature.

Categorizing Social Exchange Referents: Overview of Study Hypotheses 1-4

		Nature of Contact	
		Local	**Global**
Nature of Relationship	**Direct**	**(H1) Leader-Member Exchange** • Department chair	**(H2) Network Connections** • Department / Peer • Outside department, inside STEM, at SU • In STEM area, but outside SU
	Indirect	**(H3) Perceived Organizational Support** • Academic Dean	**(H4) Trust in Top Management** • Chancellor / Provost

(H1) Leader-Member Exchange: High-quality "leader-member exchange" relationships exist between supervisors and their direct reports, and are characterized by high levels of "trust, respect, and mutual obligation" (Dansereau, Graen, & Haga, 1975; Graen & Uhl-Bien, 1995). Greater "leader-member exchange" is associated with supervisors' providing their direct reports with the advice, resources, and rewards required for better role performance (Brandes, et al., 2004; Klein & Kim, 1998). Responses to Syracuse University's most recent COACHE survey found that STEM women believed that being a teacher, an advisor of students, a good department colleague, a campus citizen, and a member of one's community weighed more heavily in the tenure decision when compared with men's evaluation of those priorities. Women also believed that periodic, formal performance reviews, upper limits on the numbers of committee assignments, and upper limits on teaching obligations were more essential to their success than did males. This is consistent with Monks and Barker (1999), who suggest that academic women gravitate toward administrative/caretaking-type roles, resulting in less time for the research required for promotion. Having high-quality relationships with their chairs may provide women more strategic discretion regarding teaching loads and appropriate levels of service. Note, though, that demographic dissimilarity with one's supervisor may be a barrier that leads to incomplete contemplation of women's career goals.

> **H1:** Women will experience lower quality "leader-member exchange" relationships with their department chairs than men and hence, will experience less positive employee outcomes and attitudes.

(H2) Peer Network Connections: Literature in change management suggests that female academics often experience "a sense of isolation" (Monks & Barker, 1999). Female academics that attended leadership development workshops "gained a great deal from meeting women at other universities" and came to "[realize] the value of informal networking both within their own universities and with women in other universities," yielding positive effects that endured a year after training (Monks & Barker, 1999: 537). Some ADVANCE IT recipients have prefaced their projects on network perspectives. Recent recipients at Brown University and University of North Carolina, Charlotte have focused on increasing women's ties to outside university senior scholars, hoping that these senior colleagues will become collaborators, role models, and informal mentors for female faculty. Helping women create these ties is particularly critical, given that faculty members tend to co-author in same-sex patterns, which can put female faculty at a disadvantage in promotions (McDowell & Smith, 1992). Under these circumstances, women may be forced to produce more sole-authored work, and / or may not have the luxury of serving on projects where they may only be doing "1/n" of the work. Similarly, interviews with "high-flying" female faculty (i.e., those achieving full professor by age 48) suggested that relationships made during their graduate studies were important and were extended and maintained through (1) attendance at

professional meetings, (2) international research collaborations, (3) consulting on steering committees, (4) research sabbaticals, and/or (5) joint projects at other institutions (Ismail & Rasdi, 2007). Other recipients have sought to increase female STEM faculty-member ties with others on campus. For example, North Dakota State's project links senior female STEM faculty members with junior faculty members, as same-gender mentorship relationships are generally associated with better outcomes. Grounding their project in the work of Ibarra (1993), the University of Lincoln, Nebraska, is investigating differences between departments by comparing women and men's outcomes as a function of specific social network patterns. In the Inclusive Connective Corridor project social networking will be expanded further by using interdisciplinary research centers and work at the academy-industry interface. The study will proceed in this context and address:

> **H2a:** A denser collaborative network (in and outside the university) will be positively related to employee outcomes and attitudes, and male STEM faculty will have more of these ties than female STEM faculty.
> **H2b:** Having denser inside-university ties will be more positively related to employee outcomes and attitudes, and male STEM faculty will have more of these ties than female STEM faculty.

(H3) Perceived Organizational Support: Recent work in organizational science has offered a third important variety of social exchange, namely, employees' "global beliefs concerning the extent to which the organization values their contributions and cares about their well-being," called "perceived organizational support" (Eisenberger, et al., 1986). Citing the work of Eisenberger et al., (1986) and Levinson (1965), Wayne, et al., (1997) suggests that employees "personify" their relationships with their employers, similarly to more direct interpersonal social exchanges. Employees that view their employer as considerate of employee views, opinions, working conditions, and concerns feel stronger obligations to their employer, and reciprocate with better employee performance and commitment (Wayne, et al., 1997). Although chairs often have input into resource allocations, deans frequently make the major decisions regarding funding, equipment purchases, travel allowances, research budgets, leave, teaching loads, raises, directorships, and research chair appointments. Consequently, it is suggested that a powerful social referent in this exchange is one's Dean, as he or she most directly controls faculty rewards and incentives.

> **H3:** Female STEM faculty will report less perceived dean support than male STEM faculty, which will be associated with worse faculty outcomes and attitudes.

(H4) Trust in Top Administration: Recent work in organizational transformation and change has focused extensively on top management credibility. The social distance of an employee from top management influences his or her beliefs about top management support (Labianca & Brass, 2006). Kim, et al., (2009) recently found that employee perceptions of top management competence and trustworthiness affected employee cynicism and job performance. Employees who question the competence and trustworthiness of top administration perceive lower quality-social exchanges in which they reciprocate less, and actually have worse job performance (Brandes, et al., 2004). Conversely, employees who believe in senior leadership's abilities are more likely to reciprocate in the form of greater work efforts toward organizational goals.

> **H4:** Social distance and distrust in top administration will be negatively related with employee outcomes and attitudes.

(H5) Overarching Hypotheses: The following hypotheses seek to extend previous social exchange research by investigating the relative importance as well as potentially interactive (i.e., compensatory) effects of the four social exchange referents (chair, peer, dean, senior administration) (Brandes, et al., 2004).

> **H5a:** Local social exchanges (i.e., those with department chairs and direct interpersonal network ties) will be more important than global social exchanges (perceptions of deans and senior administration) in predicting female STEM faculty member outcomes and attitudes.

H5b: Local relationships will interact with global relationships such that low-quality local relationships will be compensated for with high-quality global relationships among female STEM faculty members.

H5c: Increases in the favorability of the four social exchange referents will be associated with better outcomes and attitudes for female STEM faculty over time.

III. Proposed methods: Please see Table 1 below for an overview of study variables, measurements, and collection dates. Potential study participants include all STEM faculty members at Syracuse University (approximately 250 people); all of whom can participate in various Inclusive Connective Corridor activities described in the main proposal. A consensus strategy, rather than a sampling strategy, will be used given the limited population size. A formal "control" group will not be used to avoid depriving some individuals of career interventions that may have positive effects. Some archival data (i.e., publication and promotional data) from individuals who decline to participate in the survey will be analyzed post hoc and derived from public records, such as faculty websites and online CVs. Chi-square tests will be conducted to test the representativeness of survey participants with that of all STEM faculty members. Confidentiality will be assured through the use of ID codes known only to the researchers, and results will be reported only in aggregate fashion. The research will be vetted through Syracuse's Institutional Review Board, and we will integrate feedback and recommendation from the group of expert consultants retained for the project, Some attitudinal data (i.e., that is provided through the Association of American Universities Data Exchange (AAUDE) Survey in which Syracuse University is expected participate during fall 2010) will come from the partnership with the Office of Institutional Research and Assessment.

Both employee attitudinal and sociometric (network) data will be collected early in year 1 in the form of a survey before the formal interventions begin in order to serve as a baseline for future comparisons. In recognition of their participation, respondents to the survey will be provided: (1) an individualized report that includes how the respondent's data compares to those of others (e.g., race, ethnicity, sexual orientation, US vs. Non-US nationality, and/or disability, as respondents choose to provide data and as is statistically possible without compromising respondent identity), and (2) the opportunity to attend a 1-2 hour personalized program that will discuss career networking as well as give respondents some strategies for change that they may want to pursue. The program will be developed and facilitated by Co-PI Brandes and the Scientific Advisor Mergel, in addition to consultancies with previous IT recipients and/or experts.

These data will be collected again in years 3 and 5 of the project. These repeated assessments will (1) permit us to observe any changes in attitudes, (2) detect the potential emergence of new leaders (male and/or female) who may be champions and role models, (3) quantify the creation and sustainability of newly developed ties over time, (4) provide data to test hypothesis 5c, and (6) indicate changes to each respondent's sociometric map. Follow up will include one-on-one interviews with selected individuals to clarify quantitative findings. Repeated-measures regression for attitudinal dependent variables and hazard analyses modeling for promotion and turnover data will be used.

IV. Expected Findings. Beyond the specific hypotheses above, it is predicted that women's career confidence will increase with each program element, that women's employment outcomes (tenure, promotion) will improve, that attitudinal measures will improve over the years of the grant and that female overall job satisfaction will increase. In terms of sociometric data, it is expected that STEM women's networks will expand both on campus and off, and that this will be a major factor in increasing women's local embeddedness as well as their access to unique career opportunities. While the number of network ties alone is not necessarily an indicator for a higher degree of local embeddedness, the type and content of social network ties for female faculty members can have an effect on their outcomes.

V. Results Dissaggregation: Detailed above in Section III, paragraph 2.

Table 1: Illustrative Study Variables, Measurements, and Collection Dates

Proposed Study Variable	Year of Collection					Data Type	Items	Reference
Independent Variables	1	2	3	4	5			
(H1) Leader-Member Exchange	X		X		X	Perceptual	7	Graen & Uhl-Bien, 1995
(H2a) Ties In STEM; Outside SU	X		X		X	Sociometric	NA	Knoke & Yang, 2008
(H2b) Ties Inside Department	X		X		X	Sociometric	NA	Knoke & Yang, 2008; Zwijze-Koning and de Jong, 2005
(H2b) Ties Outside Department, Inside STEM	X		X		X	Sociometric	NA	Knoke & Yang, 2008; , Zwijze-Koning and de Jong, 2005
(H3) Perceived Dean Support	X		X		X	Perceptual	9	Eisenberger, et al., 1986
(H4) Trust in Top Administration	X		X		X	Perceptual	8	Kim, et al., 2009
(H5a-b) Interactive effects	X		X		X	Perceptual	NA	Aiken & West, 1991
Dependent Variables: Attitudinal								
Intent to quit	X		X		X	Attitudinal	3	Landau & Hammer, 1986
Organizational Commitment	X		X		X	Attitudinal	9	Porter et al., 1974
Willingness to engage in Scholarship in Action	X		X		X	Attitudinal	?	To be developed
Climate for equity and inclusion	X		X		X	Attitudinal	?	To be selected with consultants
Job Satisfaction	X		X		X	Attitudinal	11	Schnake, 1983; Stanton et al., 2002
Dependent Variables: Employee Outcomes								
Turnover within the year (not due to denial of tenure or retirement)	X		X		X	Objective	NA	NA
Promotion within the year	X		X		X	Objective	NA	NA
Controls:								
Attendance at STEM Advance IT activities	X		X		X	Objective	NA	Workshop attendance records
Family / Domestic Help and/or support	X		X		X	Perceptual	index	Brandl, et al., 2008
Career Stage (Assistant, Associate, Full)	X		X		X	Objective	1	Human Resources Data
Demographics (e.g., gender, race, ethnicity, sexual orientation, US vs. Non-US nationality, disability, age range)	X					Self-report	NA	NA
Parent / Caregiver status	X		X		X	Self-report	1	NA
Use of family leave in previous year	X		X		X	Self-report	1	NA

NA = not applicable

References for Five Page Supplement

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