Social Network Determinants of Self-Perceived Influence among Minority and Non-Minority STEM Faculty

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DISSERTATION

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MAP

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF FIGURES

SUMMARY

This dissertation sought to address the following research questions: 1) *Does network structure significantly explain the level of self-perceived influence held by academic science faculty in organizational decision making?;* 2) *are there differences in the level of self-perceived influence held by URM academic science faculty versus non-URM academic science faculty;* and 3) *do URM and non-URM social networks explain self-perceived influence in the same way?*

The findings revealed that more career development and mentoring network resources reduced STEM faculty's level of self-perceived influence in organizational decision-making. This is likely attributable to the resource dependency dynamic. Tie strength, external to internal tie ratio and network constraint were found to not only impact the acquisition of network resources, but also have direct effects on self-perceived influence. In particular, the findings suggest that these structural variables enhance STEM faculty member's self-efficacy and visibility, which would subsequently make them feel empowered and confident as well as afford them the privilege of influencing organizational decision making.

It was found that minority STEM faculty's perspective on their decision making power was in fact limited when compared to white STEM faculty. More specifically, while they were not found to have significantly different levels of micro level self-perceived influence, they did have significantly lower levels of macro level self-perceived influence. Minorities were found to have more career development and mentoring network resources. The presence of having a higher ratio of internally situated ties is a unique structural characteristic of minority STEM faculty networks that can be used to help them leverage the self-efficacy and reputation enhancing benefits of career development network resources to enhance their levels of self-perceived influence in organizational decision-making.

1.0 INTRODUCTION AND IMPORTANCE OF STUDY

1.1 Dissertation Overview and Research Questions

This dissertation explores the significance of social networks of academic science, technology, engineering and mathematic (STEM) faculty in determining their amount of self-perceived influence in organizational decision making. Particular focus is placed on understanding how self-perceived influence varies between underrepresented minority (URM) and non-URM STEM faculty. Underrepresented minority groups as defined by the National Science Foundation (NSF) are minority groups that have historically had lower rates of representation in the STEM fields including African-Americans, Hispanics and Native Americans. Overall, the presented research focuses on two goals. First, this research explores the overall role of certain social network structures and network resources in shaping organizational actors' self-perceived influence in making organizational decisions, which is essentially a reflection of their sense of empowerment and ability to engage in two key activities: (1) influencing the development and direction of their respective organizations (macro level decisions); and (2) having autonomy in shaping their own experiences and productivity in their organizations (micro level decisions). Because there is no formal conceptualization of self-perceived influence, the presented dissertation develops such a concept based on classic power and influence literature. This concept asserts that self-perceived influence is essentially the assessment an organizational actor has about his or her capability to exert a force that entails the manipulation, promotion and establishment of institutional and individual interests, processes, behaviors and values. It is important to note that self-perceived influence is not necessarily being assessed as a proxy for actual influence. This is an important construct in its own right because it can be a crucial component in the career outcomes of organizational actors.

The academic STEM environment has been touted as a culture that confers influence and freedom based on merit and skill to contribute towards the development of scientific knowledge and innovation (Merton, 1957; Hargens & Hagstrom, 1967). However, academic environments have increasingly adopted a managerialist culture where more influence resides with academic administrators, which has resulted in negative consequences such as lower satisfaction among faculty (Ginsberg, 2011). Thus, understanding the extent to which faculty perceive themselves to be influential in shaping their environment and managing their productivity can be very telling about the extent to which they will actually exercise their influence and become a more integral part of organizational life, which can have positive consequences on their individual productivity and subsequent impacts on overall organizational outcomes. Furthermore, the functional and socio-emotional value of relationships in the form of collaborations have proven to be an asset in the productivity of academic scientists, which gives rise to the question of what role relationships have in shaping how scientists view their status in the academic organization (Landry et al. 1996; Bozeman & Corely 2004).

Using the findings gleaned from the role social network structures and network resources play in shaping self-perceived influence, the focus will turn towards the second goal of the dissertation, which considers the role of race in determining self-perceived influence among academic STEM faculty. The presented research uniquely contributes to the current discourse on disparities between minorities and non-minorities in the academic STEM environment by addressing how race and social relationships have individual and integrated impacts on the extent to which minority faculty feel valued and engage in substantive expressions of empowerment that can mitigate the barriers they experience. The barriers faced by URMs in the academic STEM environment, which has resulted in them not having comparable status with non-URMs, challenge the prevalence of and adherence to the aforementioned value of strong merit and skill that affords one higher status in the academic science environment. The role of race has been identified as a significant determinant in the value ascribed to academic faculty, where minority faculty feel less valued, more isolated and marginalized than their non-minority counterparts. This is manifested in minority faculty feeling stifled and less integrated in organizational life and development as opposed to their non-minority counterparts. Additionally, race plays a significant part in how social relationships develop, thereby impacting the important resources derived from connections with others that can influence feelings of value.

Given the aforementioned description of the two research goals, the following primary research questions will be addressed using quantitative analysis of large sample size survey data collected from STEM faculty: 1) *Does network structure significantly explain the level of self-perceived influence held by academic science faculty in organizational decision making?;* 2) *Are there differences in the level of self-perceived influence held by URM academic science faculty versus non-URM academic science faculty;* and 3) *do URM and non-URM social networks* *explain self-perceived influence in the same way?* The overall argument of the presented research is that a reduced or increased presence of certain network characteristics of STEM faculty's social network—namely strength of ties among network members, the extent to which ties are located within or outside of the organization and network constraint (which is a reflection of network size, density and hierarchy)—directly shapes the sources of self-perceived influence including self-efficacy, reputation development and resource dependency, thereby determining levels of self-perceived influence. Also, the presented research argues that social network resources provided by network members can enhance the faculty member's sense of self perceived influence by providing functional and socio-emotional support that enhances one's sense of personal value. However, the presented dissertation also argues that race has a direct effect on the extent to which STEM faculty feel influential, where minorities feel less influential due to marginalization in their organizational environments and thus have fewer social network resources. Additionally, the indirect effect of racial minority status is that the unique experiences of minority faculty in the academic environment (namely marginalization that manifests in racism, which is reflected in isolation and limited inclusion in organizational life) results in them having unique network structures that shape their access to social network resources.

1.2 Background of Racial Disparities in STEM

Despite the ethos of conferring promotion, reward and positive recognition through merit, underrepresented groups have experienced barriers to advancement in STEM fields such as unequal access to STEM educational and occupational opportunities; higher rates of attrition in the STEM educational and employment pipeline; and unequal representation and promotion to higher positions in STEM occupations that afford greater privilege, recognition and influence—especially in the academic STEM environment (Burke, 2007; Long & Fox, 1995; Asher, 1985; Berryman, 1983; Oakes, 1990; Oh & Lewis, 2011; Broyles & Fenner, 2010; National Science Foundation). For several decades, researchers, educators, administrators and policy makers have sought to understand and ameliorate deterrents to the advancement of minorities in the STEM fields that have resulted in inequalities related to rates of representation; access to employment and learning opportunities; and advancement and rewards (Berryman, 1983; Landefeld, 2010; National Science Foundation; Burke, 2007). However, the Science and Technology Equal Opportunities Act of 1980 passed by the U.S. Congress was a catalyst in more aggressively addressing inequalities by requiring the NSF to place a concentrated effort to track and provide people in historically underrepresented groups (including women and certain minority groups) equitable opportunities for advancement and inclusion in the STEM fields (Oakes, 1990).

1.3 Research Motivation

There are three key motivations for the presented dissertation. First, the presented research is motivated by the need to understand why and how the STEM professoriate can become more attractive to minorities, especially those who have earned doctorate degrees. While a significant amount of research and policies have addressed improving retention and persistence of minorities in the STEM pipeline, less work has been done to understand racial disparities in a specific portion of the academic STEM labor force, particularly among the higher education STEM professoriate. The increase of overall rates of URMs pursuing advanced STEM degrees has not translated into higher rates of advanced degree holders matriculating to the STEM professoriate. According to the NSF, over the past twenty years the amount of minority STEM faculty has remained at around 7% of the total STEM professoriate despite the increase in the number of minority groups who obtained STEM doctorate degrees—over 100% between 1995 and 2007, alone. Thus, the presented research is motivated by the need to understand why and how the STEM professoriate can become more attractive and accessible to minorities, especially those who have earned doctorate degrees.

Second, the pipeline perspective highlights the role of human capital based resources (e.g., individual intelligence and performance.) in advancing minorities in STEM. However, the presented research acknowledges the relevance of CRT in explaining racial bias and disempowerment, yet takes a slightly different departure by exploring race in the context of social networks, with a particular emphasis on social capital and how network characteristics—that facilitate or hinder access to it—impact career outcomes. The motivation for using a social network analysis approach is that both minority and non-minority faculty realized positive outcomes due to important social and professional relationships (Blackwell, 1989; Sands et al., 1991; Turner, 2002).

The third motivation of the presented research emanates from the need to gain a further understanding into the inner workings of minority networks. Race and social network characteristics (specifically those related to the dynamics of network structure characteristics) have not been extensively explored in tandem to understand how they may differently impact the outcomes of STEM faculty. While research has provided some insights into the unique attributes of minority networks (i.e., higher presence of mentors and the greater propensity to have same-race relational ties due to certain constraints), little is known as to whether other network characteristics are exhibited in unique ways among minorities (Ibarra, 1995; Thomas, 1993).

1.4 Theoretical and Practical Implications of Research

Overall, the aforementioned motivations reflect that this dissertation is both confirmatory and exploratory in nature. In particular, the posited argument of self-perceived influence being lower among minority faculty reflects another way through which to examine the marginalizing dynamics of racism that has been confirmed by core concepts such as CRT. Hence, the findings from the presented research can contribute to more comprehensive theories of race by illuminating how racism goes beyond the external imputation of negative assumptions and behaviors by others, and how denigration of marginalized groups results in them internalizing negative characterizations of their value and worth. Theories explaining the development of one's personal sense of empowerment can become more refined when considering the role of race, which can be particularly relevant when examining how marginalized groups persist and overcome barriers in hostile environments. Additionally, exploring social networks in the context of race can expand current theories concerned with the development and efficacy of social networks by explaining how minorities may have different network structures than non-minorities. In particular, the findings from the presented research can confirm existing theories positing that race makes a difference in how networks are formed. Moreover, exploratory findings from this research can also provide a basis for further exploration and theories of how race results in differences in particular network structures, thereby providing insights into how social network resources are uniquely developed, attained and utilized among varying racial groups.

The presented dissertation also has several implications for policy and practice. First, insights into the extent to which faculty feel influential in organizational decision making can shape human resource management practices—potentially resulting in higher levels of organizational commitment from faculty which, in turn, may lead to lower turnover and higher retention of minority faculty. Second, the presented findings can contribute to diversity management policies that reflect more substantive inclusion of minority faculty, also resulting in higher retention rates of minority faculty, which can mitigate disparities in status between minority and non-minority faculty. Third, findings from the presented research can better inform management practices and policies that promote the creation of more productive and inclusive network structures that provide minority faculty with important resources, which can be beneficial for attracting minority faculty, therefore improving recruitment practices.

1.5 Organization of Dissertation

There are a total of six chapters for the presented dissertation. The second chapter provides the building blocks for the dissertation by reviewing the components of self-perceived influence, social networks and race. First, there is a review of STEM culture, with an emphasis on how certain values and norms provide influence. Next, there is a brief review of the academic science environment and academic governance (which provides insights into how self-perceived influence can be seen among academic STEM faculty), followed by a specific conceptualization of self-perceived influence which is based on power and influence literature. The conceptualization of self-perceived influence is further developed by explaining the specific role of several sources of self-perceived influence including self-efficacy, reputation and resource dependency. Next, there is a review of minority faculty experiences. In particular, this part of the chapter highlights CRT, which has been used directly and indirectly to understand the dynamics behind racial biased in academia. Following is a review of social network theory—more specifically, a discussion of social capital (i.e. social network resources), which the dissertation argues is at the crux of how self-perceived influence is developed. Additionally, there is a brief discussion of the role of network structures, which facilitates the access or barriers to social network resources. The dynamics behind racial bias and how social capital is developed provides a foundation for the last portion of chapter two that reviews literature detailing the unique attributes of minority networks, which reflect racial bias.

The third chapter provides the proposed hypotheses that integrate the previously reviewed concepts in chapter two. In particular, hypotheses are first developed illustrating the impact of faculty's network resources and network structure characteristics on their self-perceived influence. Of particular interest for the dissertation are faculty's social network features including network constraint (and the related factors of network size, hierarchy and density), the strength of ties between faculty's network members and the extent to which network ties are internally or externally situated to the organization. Next, hypotheses are presented illustrating how race plays a factor in the differences in social networks of minority faculty, thereby determining how they develop the aforementioned sources of self-perceived influence. Finally, the third chapter develops a set of hypotheses proposing how faculty's minority status impacts levels of self-perceived influence and variations in network constraint, tie strength and external to internal tie ratio between minority and non-minority faculty.

The fourth chapter describes the data and methods to be used for data analysis. Data for the dissertation comes from a large-scale online national survey funded by the NSF targeting academic STEM faculty identified as practicing in biology, biochemistry, mathematics and civil engineering. The survey gathers information about academic faculty's professional background, first faculty job experience and placement process, service activities, teaching activities, research activities, productivity, workplace satisfaction, perspectives on their work and institutional environment, demographic information and psychometric measures, and networks. Explanations are provided for how dependent variables (race, social network characteristics and network resource), independent variables (macro and micro levels of self-perceived influence) and control variables measured. Next, there is a description of how missing data will be handled, followed by an explanation of how path analysis will employed to determine the direct and indirect effects of the dependent variables on the independent variables.

The fifth chapter describes the findings from the data analysis. First, descriptive data highlighting the variables of interest is provided to detail the distribution of data. Then, the results from the structured equation modeling analysis will be discussed, which entails describing the direct, indirect and total effects of the predictor variables; identifying levels of significance of social network resources, network structure characteristics and minority status on both types of self-perceived influence; and discussing goodness of fit indices to determine how well the data fits the proposed model. The sixth and final chapter of the dissertation interprets the findings from the fifth chapter. In particular, this concluding chapter discusses in detail how the findings are relevant from a theoretical and practical perspective.

The overall findings provide mixed support for the hypothesized relationships. Overall, networks significantly matter in shaping self-perceived influence among STEM faculty. In particular, as faculty members obtain more career development and mentoring resources from the connections in their professional networks, they have significantly decreased levels of self-perceived influence. While network resources are very important, this reflects the presence of resource dependency dynamics. In other words, more resources likely make faculty members feel more dependent upon and responsible to their contacts, thereby inhibiting their ability to exercise their voice and agenda. Specific structural characteristics present in professional networks also have significant direct and indirect effects on faculty member’s self-perceived influence. In particular, the direct effects of network constraint, tie strength and the ratio of external to internal ties are found to impact self-perceived influence most likely by enhancing faculty member’s sense of confidence and worth (i.e. self-efficacy) and reputation. The indirect effects of these structural variables are due to their impact on network resources, whereby certain structural arrangements facilitate the acquisition of resources. Conversely, these structural characteristics can also mitigate resource dependency, therefore increasing self-perceived influence.

When considering the role of minority racial status, it is found that African-American/Black STEM faculty members have significantly less self-perceived influence than White STEM faculty. Thus, the minority STEM faculty members do feel limited in their involved in shaping the academic environment and their experiences in it. This is likely due to the fact that minority STEM faculty are found to have significantly more network resources than non-minorities. While having more network resources is certainly an asset for minority STEM faculty and indicates that they are to some degree included in beneficial networks in the academic environment, this finding also indicates a need for minority faculty to reap the benefits of network resources while mitigating the resource dependency effects. African-American/Black STEM faculty have a significantly higher ratio of internal ties to external ties compared to White STEM faculty, which can be advantageous in mitigating the resource dependency effects that reduce their levels of self-perceived influence. Minority STEM faculty members having significantly more network resources and a significantly higher internal tie to external tie ratio indicates that race is an important consideration when considering the dynamics and application of social network theory.

2.0 LITERATURE REVIEW

2.1 Introduction

The general argument of this dissertation is that individual STEM faculty's self-perceived influence in organizational decision-making is a reflection of faculty members' assessment of their personal value to the organization and is directly and indirectly shaped by two key components. In particular, racial status and social network characteristics hinder or facilitate access to social capital. Social capital helps develop key factors that shape ideas of personal worth and value. While there are a number of other factors that may also impact how faculty members perceive their organizational influence, race and social networks are particularly salient.

In the broader context of the specific academic STEM environment and social network theory, this dissertation offers two contributions. First, by acknowledging the value of relationships and racial bias, it challenges the primacy of individual merit in the academic STEM environment used to boost personal reputation and subsequent notions of personal value among academic science faculty. Second, while this dissertation acknowledges common approaches to understanding racial bias in the academic STEM environment (e.g. marginalizing racial power dynamics and stereotypes that isolate and limit minorities) this dissertation extends current understandings of marginalization of minorities by acknowledging how race plays a role in shaping social networks crucial to the development of reputations and notions of worth among academic scientists.

The goal of this chapter is to establish a foundation for understanding the interrelated connection among race, social network characteristics and self-perceived influence. Essentially, this chapter provides the building blocks for developing the subsequent hypotheses and the empirical model presented in chapter 3 illustrating how individual faculty member's minority status and network characteristics have direct as well as indirect impacts on the extent to which the individual faculty member's assess his or her influence in organizational decision-making, as well as how minority status impacts individual faculty member's networks.

Towards that end, four key tasks will be accomplished in this chapter. First, there is a brief overview of the landscape of racial disparities in the STEM fields as well as how particular disparities in the academic environment have been explained using critical race theory (CRT). In particular, CRT has been frequently used to explain how and why minorities experience barriers in the academic institution that disempower them and lead to them feeling less influential in organizational decision making. Second, there will be a discussion of governance in academia, which elucidates the faculty member's role in organizational decision-making. In addition, this second portion will provide an overview of the academic science culture, with a specific emphasis on how certain norms and values lead to the attainment of influence in decision-making. Considering the nature of decision making in the academic environment and the principles that drive the attainment of influence in the academic science environment, the third task of this chapter provides a specific conceptualization of self-perceived influence and how it is related to the nature of decision-making in higher education institutions, specifically among academic scientists. The conceptualization of self-perceived influence will be discussed in the specific context of classic power and influence literature as well as selected sources of self-perceived influence including self-efficacy, resource dependency and reputation development. In short, self-perceived influence is defined as the extent to which an individual assesses himself or herself as being capable of overcoming resistance or eliciting changes for the purpose fulfilling their interests. Moreover, self-perceived influence is a reflection of an individual's personal assessment of their value and worth to their organization. Fourth, social network literature will be reviewed, with a specific focus on how an individual's social network characteristics facilitate or hinder access to social capital, and subsequently impact the development of an individual's self-perceived influence. Additionally, this section will discuss how racial bias results in variations and unique features in minority's individual social networks. This chapter will end with a conceptual model depicting how minority racial status, social network characteristics and social network resources drive the development of self-perceived influence.

2.2 Racial Disparities in STEM

According to a report from the U.S. Census Bureau, in 2011, Hispanics and Blacks were significantly underrepresented in the STEM fields as compared to the overall workforce. Moreover, these discrepancies had persisted for 40 years. While Hispanics comprised about 15% of the entire workforce, they only comprised 7% of the STEM workforce in 2011. In 1970, Hispanics represented less than 5% in both the entire and STEM workforce. While Blacks comprised 10% of the entire workforce in 2011, they only represented 6% of the entire STEM workforce. In 1970, they still represented approximately only 10% of the entire workforce and slightly less than 5% of the STEM workforce. Disparities illustrated in the statistics about the STEM workforce are also prevalent in STEM educational outcomes. Statistics provided by the National Science Foundation (NSF), indicate that despite there being a relatively steady increase of minority STEM degree holders over the past several decades, there are still significant gaps between minority and non-minority STEM degree holders. Furthermore, there is variation in the rate of STEM degree attainment by racial group. The NSF reports that between 2000 and 2009, the rate at which Black students received STEM bachelor degrees remained between 8% and 9% of the total amount of STEM bachelor degrees conferred. The difference between Hispanics was slightly higher, where the total amount of STEM bachelor degrees conferred to them increased from slightly lower than 7% in 2000 to approximately 9% in 2009. Native American students have steadily received less than 1% of all STEM bachelor degrees between 2000 and 2009. While the amount of White students receiving STEM bachelor degrees has decreased between 2000 and 2009, they still comprise well over half of the STEM bachelor degrees conferred in this time period, with 71% receiving degrees in 2000 and almost 66% receiving degrees in 2009. However, the rates at which minorities earned undergraduate STEM degrees does not seem to be consistent with rates of total undergraduate enrollment where between 2001 and 2010 Whites only experienced a 13% increase in undergraduate enrollment and Blacks, Hispanics and Native Americans saw an increase of 35%, 40% and 17% respectively. Underrepresented minorities who were permanent U.S. residents increased their percentage of all STEM doctorate degree holders between 2000 and 2009 from 3% to 5%. Among Whites, the percentage increased from 15% to 20%. The lower representation of minorities being awarded STEM degrees indicates a relatively high attrition rate within the

STEM education academic and employment pipeline. While minorities and non-minorities entering the college and university system may have initial comparable rates of intentions to pursue STEM degrees, minorities matriculate at significantly lower rates through the undergraduate, graduate and post-graduate phases and then on to the employment arenas (National Science Foundation). In fact, minorities intending to pursue STEM majors are 40% less likely to complete those degrees than their non-minority counterparts (Jones, 2013). Additionally, only 24% of minorities who initially enter bachelor degree programs complete their programs within six years, as compared to 40% of whites (National Science Foundation, 2010). This means a greater likelihood that there will be fewer minorities to successfully matriculate through the educational pipeline and on to becoming STEM faculty and academic leaders. While the aforementioned statistics provide a more recent account of disparities in the educational and employment outcomes between minorities and non-minorities, they reflect a historical trend that has persisted for decades illustrating that unlike non-underrepresented minorities, Blacks and Hispanics in particular have generally tended not to achieve higher rates of status in STEM education and workplace settings that are reflective of their overall population growth and participation in the general workforce (Lewis et al., 2009). Furthermore, according to the NSF, in 2010 underrepresented minorities only accounted for approximately 7% of all STEM doctorate degree holders, which is only an increase of approximately three percentage points since 1991. Asians and Whites together held more than seven times the amount of doctorate STEM degrees in 2010. The distribution of doctorate degree holders is a particularly relevant figure to consider since the possession of a doctorate degree is a requirement to hold faculty positions. In 2010, underrepresented minorities with

STEM doctorates occupied approximately 8% of all research and teaching faculty positions, whereas non-minority doctorate degree holders represented 90% of all research and teaching faculty positions. Also in 2010, underrepresented minority STEM doctorate holders comprised only 8% of academic leadership positions, whereas non-minorities comprised 90% of those positions.

Four primary reasons motivated the prioritization of mitigating the disparities between minorities and non-minorities in the STEM fields. First, as the United States continuously sought to remain economically viable as well as elevate its competitive and innovative edge on the international science and technology stage, marginalized groups became an increasingly viable source of human capital given that they occupied an increasing presence in the general education system and work force (Burke, 2007; Crowley, 1977; McSherry, 2005). A subsequent result was more attention being given towards elevating the representation and status of marginalized groups as highly sought after STEM labor and leadership that were well educated, equally rewarded, and in positions to shape science institutions who could richly contribute to and mitigate gaps in the STEM workforce (White, 1992; Chubin et al., 2005; Griffith, 2010; Kelly et al., 2004). Second, the history of minority scientists' achievements illustrate how the varied perspectives, input and interests of scientists from marginalized populations served to more pointedly and successfully apply science and technology to addressing quality of life disparities among diverse populations (Ong et al., 2011; Mertens et al., 2006). Third, having a diverse STEM workforce can provide a wide range of perspectives and approaches to conducting research and problem solving (Schultz et al., 2011). Lastly, there was an increased demand to provide minorities with equitable access to participate in the STEM workforce and educational programs, which would advance minorities with an additional opportunity to attain equitable socio-economic status with non-minorities (Metcalfe, 2010). In essence, the motivation towards achieving diversity in the STEM fields reflected how the institution of science evolved to become another platform for achieving social and economic equality on both the supply and demand side of science and technology production.

Towards that end, the NSF and both public and private entities (i.e. educational institutions and private sector research and development companies) primarily addressed inequalities by increasing minority participation and providing them opportunities in the academic and employment pipeline. Research, particularly evaluations of such programs, have demonstrated that diversity and inclusion policies have in fact increased diversification and have led to minorities making important gains in the STEM fields such as increased interest in STEM fields among youth, mentoring opportunities that have been instrumental in grooming minorities to be part of the STEM professoriate and more (Pender et al., 2010). In particular, programs and policies focused on pipeline-centric solutions such as encouraging and providing opportunities to minority students in pre-college, post-secondary and post-secondary settings to pursue degrees and employment in specific scientific areas by providing training, support and real research opportunities; as well as recruit and train minority STEM teachers and prepare non-minority STEM teachers to effectively prepare minorities to succeed in the STEM fields (Mertens et al., 2006; Greene et al., 2006; Chubin et al., 2005; National Science Foundation, National Institutes of Health). One such example is the Minority Access to Research Centers

Undergraduate Student Training in Academic Research (MARC U-STAR) program sponsored by the National Institutes of Health, which provides college campuses with funding as well as additional resources (e.g. supplemental training) for minority undergraduate students pursuing degrees in biomedical and behavioral sciences with the intention of having those students transition to post-graduate medical training. See Appendix A for descriptions of additional list of selected funded diversity-centric STEM programs.

Aside from addressing racial inequalities in the STEM pipeline, researchers have explored the dynamics behind racial bias that have promoted inequalities in the academic environment. In particular, the role of race in explaining disparities in the academic environment has commonly been done so through the indirect and direct use of critical race theory (CRT) (Villalpando & Bernal, 2002; Ladson-Billings, 2009). This concept will be explained in more detail in the second chapter, but a brief explanation can be provided here. Essentially, CRT emphasizes that the organizational practices and culture in the academic institution reflect the embrace and promotion of "whiteness" as the ideal standard for organizational members to attain and adhere to, especially at the expense of denigrating non-whites (Delgado & Stefancic, 2000; Ladson-Billings, 2009). Despite the fact academic institutions purport to embrace diversity, CRT claims that this is limited to the extent that diversity efforts will not weaken or eliminate the power of the dominant group (Ladson-Billings, 1998). The resulting outcome is marginalized minority faculty who are not able to meet the ideal standard of "whiteness" and having limited progress in their efforts to have comparable status and success with their non-minority peers (DeCuir and Dixon, 2004). Furthermore, while URM faculty have recounted their experiences in academia in the context of how they are perceived by others in their environment less is known specifically about how minority STEM faculty perceive and interpret their own status in the academic institution (Johnson, 2011; Blackwell et al., 2009; Turner et al., 2008). The next section discusses the dynamics behind racial bias in academia, which can shed light on the experiences of minorities in the academic STEM environment.

2.3 Racial Bias in the Academic Environment

While there is not a substantial amount of research that specifically explores how minority STEM faculty specifically encounter racial bias in academia, research on general minority faculty experiences at predominately white institutions (PWI's) provide significant insights into how racial bias is expressed in the professoriate and how such bias results in the devaluation and disempowerment of minority faculty in the sense that racism is a disempowering phenomenon resulting in minorities feeling less valued, included, supported and integrated in academic institutions (Johnsrud & Sadao, 1998; Turner, 2003; Aguirre et al., 1993; Fries-Britt, 2000; Maton & Hrabowski, 2004). Overall, research analyzing racial bias in the academic environment implies that due to racially biased institutional practices and norms as well as unwelcoming environments, minorities having a diminished or more limited sense of being able to substantively shape, contribute to or change organizational practices and development than their non-minority counterparts(Banks, 1984; De la Luz Reyes & Halcón, 1988). It is important to note that research exploring and analyzing racial bias in academia makes a distinction in how racism and minority experiences vary by the type of educational institution—particularly PWI's versus minority serving institutions (MSI's) (Butner et al., 2000; Jones et al., 2002; Johnson &

Harvey, 2002; Strayhorn, 2013). The presented dissertation is particularly focused on minority experiences at PWI's, where racial bias is quite prevalent (Moore, 1988; Epps, 1989 ; Allen et al., 2000). In particular, minority faculty at PWI's generally report lower rates of satisfaction and wages than their non-minority colleagues; occupied fewer leadership and higher ranking faculty positions—especially in certain fields such as the physical sciences; experienced more isolation from their peers; did not perceive they had significant institutional support; reported having little guidance and information on attaining tenure; felt overshadowed by non-minority faculty; were burdened by negative stereotypes reflected in how their scholarly work and ability was perceived to be substandard by faculty and students; did not always perceive that there scholarship was conceived as consistent with the research agendas of their institutions; and had excessive service requirements, especially ones related to diversity initiatives (Augirre et al., 1993; Aguirre, 2000; Bourguignon et al., 1987; De la Luz Reyes & Halcon, 1988; Turner, 2002; Turner et al., 2008).

It is worthwhile to note that due to the nature of academia where socialization and professionalization of faculty members begin when they are students. Thus, faculty experiences with and knowledge of racial bias begin and develop well before they actually enter the professoriate (Kirk & Todd-Mancillas, 1991; Austin, 2002; Austin & McDaniels, 2006; Pascarella et al., 1987). During the socialization and professionalization processes, students learn about the academic culture, values, and norms; develop an understanding of what is expected of them as future faculty in the capacity of scholars, teachers and contributors to the community; and gain skills and knowledge to function as faculty members in the aforementioned capacities

(Austin & McDaniels, 2006; Weidman et al., 2001; Austin, 2002; Bess, 1978; Stark et al., 1986). Most importantly, as students go through the socialization and professionalization process, they develop a sense of their capability to become and successfully function as a faculty member who fits in the academic culture (Golde, 1998; Gardner, 2008). While the presented dissertation explores the significance of minority faculty member's social relationships and racial status as determinants of their self-perceived influence rather than their experiences as students, it is nonetheless worthwhile to acknowledge and explore their experiences so as to provide a broader context for understanding how minority faculty develop perceptions of their value in the academic institution.

For minority faculty the processes of socialization and professionalization experienced when they are students are particularly important because it is during this time that they initially become aware of how academic institutions may or may not foster racial disparities and substantively value diversity (Turner & Thompson, 1993; Nettles, 1990). In particular, the marginalization, isolation, unequal treatment, projection of negative racial stereotypes encountered by minority students at PWI's, as well as how academic administrators and professors address such encounters, signal to minority students the extent to which academic institutions address and support minorities in their academic and professional development as well as count them as valued and integrated members of the academic community (Steele, 1997; Hurtado et al.1998; Harper & Hurtado, 2007; Swim et al., 2003). Furthermore, minority students make decisions about entering the professoriate and develop expectations of what they will encounter as well as how they will be treated and valued based upon their observation of minority faculty members (Antony and Taylor, 2001). More specifically, minority students pay attention to the mistreatment and devaluation of minority faculty members, which commonly comes in the form of fewer instances of promotion and tenure; hostility from non-minority peer faculty members or administrators; virtual non-existent appreciation or recognition of their scholarly contributions; limited inclusion in organizational decision making as compared to non-minority faculty members; and a dearth of institutional support in the form of functional resources or professional development can make an academic career seem a rather unappealing or arduous option for minority students (Turner, 2002; Moody, 2004; Trower & Chait, 2002). Additionally, minority students may have fewer minority faculty members as role models and witness minority faculty experiencing more burnout, stress and dissatisfaction with their careers than non-minority faculty due to the tremendous effort they put forth in overcoming racial bias (Phillips, 2002; Smith & Witt, 1993; Thomspon & Dey, 1998; Delgado-Romero, 2007). In short, socialization and professionalization processes prompt minorities to engage in a socio-cognitive process where they decide the pros and cons of pursuing academic careers and develop ideas about how they may be regarded and valued upon entering the professoriate (Antony & Taylor, 2001; Knowles & Harleston, 1997; Tuitt et al., 2007). Consequently, negative experiences in the academic environment can lead to minority students either not deciding to enter the professoriate at all or pursuing faculty positions with a looming sense that despite their interest and ability to perform as faculty members, there will be significant barriers for them to overcome that are uniquely tied to their minority status (Antony & Taylor, 2001; Tuitt et al., 2007; Phillips, 2002). The following section reviews critical race theory (CRT), which has been used as a lens through which to understand the disempowering dynamics behind racial bias and disparities encountered by minority students and faculty.

2.3.1 ***Explaining Minority Experiences in Academia with Critical Race Theory***

The development of critical race theory (CRT) was initially led by legal scholar Derrick Bell in the 1970's as a framework used to understand and explain the continual marginalization of minorities in issues of jurisprudence. Since then, CRT has evolved to be a particularly relevant framework to explain how institutional practices and values manifest in racism, especially as it relates to minority faculty and student experiences in predominately white higher education institutions (Aguirre, 2000; Villalpando, 2002; Ladson-Billings & Tate, 1995; Ladson-Billings, 1998; Dixson & Rousseau, 2005). At the core of CRT is the idea that continual and systematic marginalization and disadvantages experienced by minorities is due to the fact that the past and prevailing cultural and societal values ascribe opportunities for social, educational and economic advancement not via the attainment of human rights; but rather such opportunities are rooted in property rights (Bell, 1992).

There are five key tenants of CRT, which are based on the hegemony of "whiteness" over minority groups (e.g. African-American/Black, Hispanic and Native American). First, CRT asserts that societal values deem "whiteness" as the ultimate property right to be attained (Delgado & Stefanic, 2000). Harris (1992) provides the following four functions that describe "whiteness as property": (1) rights of disposition; (2) rights to use and enjoyment; (3) reputation and status property; and (4) the absolute right to exclude. Essentially, CRT determines that "whiteness as property" reflects the attainment of status and privilege, but it is done so at the expense of denigrating non-whites. Ladson-Billings and Tate (1995) offer clear explanations and examples of these property functions in the context of education. Rights of disposition refer to the transferability of "whiteness", or the standards or norms that have been supremely promoted as desirable by dominant whites. CRT asserts that the current institutional practices promote and encourage minority students and faculty to be rewarded for conforming to those standards or norms (e.g. being smart, speaking properly, dressing a certain way and etc.). In other words, minority faculty and students are sent the message that these standards and norms are not universal, but rather are connected to being white; and any deviation from those standards and norms is unacceptable. Such a message reinforces a negative conception of diverse culture and constructs minorities as being outsiders to the educational institution and therefore a potential threat to the status quo as opposed to productive and equitable partakers and contributors to the institution (DeCuir & Dixon, 2004; Iverson, 2007).

Ladson-Billings and Tate (1995) go on to explain rights to use and enjoyment, which refers to the right to use the privilege of "whiteness". It is this privilege that facilitates the attainment of economic, social and cultural benefits by whites because being "whiteness" is constructed as being "performative and pleasurable" (Ladson-Billings and Tate, 1995, p. 59). In the context of education, such privilege allows for more extensive use of school resources and property by whites as opposed to minorities, which can hamper performance among minorities and promote disparities. This is substantiated by claims of minority college students and faculty who when requesting to utilize space and resources for important capacities (e.g. group studying with minority peers, developing culturally and ethnic-centric groups or centers that provide socio-emotional support and etc.) have experienced hostility and resistance from fellow students, faculty, administrators and campus police officers (Jones et al., 2002).

In their explanation of the third function of "whiteness as property", Langston-Billings and Tate (1995) explain "whiteness" as the ultimate desired status and reputation to attain. In the legal context, to slander or disparage one's reputation or status is to damage an aspect of their property. Thus, to defame "whiteness" is to associate it with things that are not affiliated or identified as meeting the standards of whiteness. For example, in the context of education, a common misconception is that compared to majority education institutions, minority institutions are automatically deemed not as reputable or high-quality just by virtue of the fact such institutions are occupied by mostly minority students and faculty.

Lastly, the absolute right to exclude as explained by Ladson-Billings and Tate (1995) is similar to the aforementioned concept of minorities being considered as outsiders. In the context of property rights, those with legal rights to property have the absolute exclusive right to exclude individuals from using it or giving them permission to use it. Overall, CRT asserts that the constructed supremacy of whiteness as the preferred standard that affords beneficial opportunities for advancement is upheld by the exclusion of minorities to attain or pursue this standard. When applying this to education, this exclusion has manifested itself in denying minority's access to or entry to white schools in the form of overt school segregation, and more recently the subtle segregation of minority and non-minority students via programs that still favor the majority representation of non-minority students, but are presented in seemingly innocuous terms such as “gifted” or “advanced placement” programming. In essence, the right to exclude in the context of education reinforces the “otherness” of minorities and constructs their presence in majority institutions as being permissive rather than a result of equal performance that qualifies minorities to actually be in these institutions.

The second tenant of CRT asserts that racism is an insidiously ingrained aspect of American life and institutions (including structures and processes) that inhibits the progression of minority groups (Bell, 1992; Delgado & Stefanic, 2000). More specifically, institutional norms and values are built on the premise of “whiteness” being of supreme worth (i.e. valued property) that must be protected through processes, procedures, practices and etc. that favor whites over non-whites (Ladson-Billings & Tate, 1996; Bell, 1995;). This is closely related to the third tenant of CRT, which is the critique of liberalism (Crenshaw, 1987). This critique addresses the institutional procedures and practices espousing the dominant ideology of color-blindness, neutrality and meritocracy. However, CRT asserts that such practices and processes (e.g. bureaucratic procedures) serve to uphold the power, privilege, and interests of the racial majority, thereby reinforcing the devaluing of minority groups and exacerbating racial tension (Yosso, 2005). For example, in the educational setting, minority faculty who conduct research that has what is deemed by a university or college as having too much of an ethnic or racial focus may be deemed by the institution as an ill-fit, which from the perspective of the institution may seem to promote the idea of neutrality in scholarship, but really devalues or erases the richness and need of diverse scholarship as well as diminishes the work the minority faculty member (Delgado, 1989; Villalpando & Delgado, 2002). Other research has addressed the negative outcomes of institutional color-blind, race neutral practices for minority students. For instance, when students and faculty experience racism within educational institutions, authority figures (e.g. faculty, administrators) mitigate those experiences by telling the students and faculty that their reactions are overly dramatic or too defensive; or the uniqueness of minority faculty students (which is a source of cultural pride and a catalyst for their experiences) is not acknowledged by institutional authority figures who claim that race is irrelevant and everyone should be treated equally and diversity does not add to the learning environment, especially in majority settings (Milner, 2007; Lopez, 2003; Lynn & Adams, 2002; Iverson, 2007).

The fourth tenant of CRT, which is closely related to the critique of liberalism, is interest convergence, which states that the progress of minorities is promoted to the extent that it supports, converges with or does not threaten the interests of the white majority (Bell, 1980; Taylor, 1999). Research on the racial climate of school campuses illustrates how this happens when non-minority administrators and leaders promote the rhetoric of diversity in order to develop an institutional reputation of being open and progressive (e.g. through affirmative action programs); however, higher academic institutions are ineffective in actually implementing institutional programs that increase representation (Morfin et al., 2006). Additionally, once minority faculty and students enter academic institutions, little is done to truly acknowledge their contributions and integrate them into the environment in a way that does not entirely erase their uniqueness (Dixson & Rousseau, 2005; Yosso & Smith, 2009;

Soloranzo et al., 2000). Additionally, diversity on college campuses has been found to be promoted not as a means for total enrichment of the entire student body or faculty, but only for the enrichment of the white majority; thereby prioritizing the needs of the majority, which are automatically expected to be addressed and deemed of tantamount importance because of their constructed supremacy that serves as the absolute standard for progress (Yosso & Smith, 2009; Grillo & Wildman, 1995; Lopez , 2003; Lynn & Adams, 2002; Iverson, 2007).

The fifth tenant of CRT is the use of the counter-narrative—also known as counter-story telling--by minorities, which is essentially an analysis tool that "aims to cast doubt on the validity of accepted premises or myths, especially ones held by the majority" (Delgado and Stefancic, 2001, pg. 140). The value of this tool is that minorities provide first-hand experiences, which challenges the dominant values and discourses of the white majority that have promoted the evolution of white privilege by shaping the dynamics of racial relations in their favor and promoting negative stereotypes and myths of non-whites (Matsuda, 1995; Matsuda et al., 1993; DeCuir & Dixson, 2004; Soloranzo & Yosso, 2000; Iverson, 2007). Moreover, the value of the counter-narrative is that it offers a voice and validity to marginalized groups who through institutional practices elevating liberal values as well as some sociological research focused on rigid statistical empiricism are often silenced or ignored, thereby serving an instructive purpose that reveals the reality of the minority experience (Matsuda, 1995; Aguirre, 2000). It is important to emphasize that the counter-narrative is not the mere collection of anecdotes that can be easily dismissed as isolated events or anomalies in a supposed post-racial, color neutral environment, but rather a systematic approach that places the experiences of minorities in “into temporally meaningful episodes" (Richardson 1990, p. 118). Thus, through the counter-narrative a richer understanding of racism in higher education can be understood via the detailed accounts of minority students and faculty experiencing racism through the interaction with their peers and environment, which is particularly relevant in institutions where diversity and acceptance is espoused but poorly practiced.

Counter-narratives from minority faculty and students commonly reveal they experience isolation from their non-minority peers due to negative stereotypes about their ability, which subsequently leads to minority faculty and students feeling invisible, devalued and rejected by peer students and faculty alike (Strayhorn, 2013; Gloria & Castellanos, 2003; Hurtado, 1992; Harper & Hurtado, 2007). Through a counter-narrative of a minority faculty experience, Aguirre (2000) offers an example of how the implementation of institutional practices promotes racism in academia when he relays the story of a minority faculty recruit’s experience with an affirmative action hiring program at a university. Ironically, although an academic department expressed interest in the minority prospect and placed him with the general applicant pool, the academic department requested that he that he be considered as an affirmative action hire through an institution wide diversity program that essentially had a quota system for hiring minority faculty, which would increase his chances to be hired. Unfortunately, this recruit eventually did not get hired because the diversity program had reached its quota for minority faculty hires and the academic department had already made a direct offer to another applicant while waiting for the decision from the diversity program so as to not appear that the minority hire was given an advantage by essentially being considered for two positions (one with the academic department and one with the diversity program). Ultimately, the academic department felt that by keeping this minority recruit's application in the general pool and being considered as a diversity hire would be perceived as a reverse discrimination by the majority applicants. Additionally, excluding this minority applicant from the general pool of majority applicants reduced the competition for those majority applicants, thereby defining meritocracy on terms that benefited the majority. Aguirre (2000) summarizes this story as illustrating how bureaucratic practices, institutional values and shifting of responsibility for attaining diversity from one organizational unit to another served to promote the interests of the majority. Beyond limiting the representation of minority faculty, such practices as the one just described may also be interpreted as an institutional culture that favors the limited inclusion of minority faculty in organizational life, which can therefore make minority faculty feel less influential in decision-making.

The previous discussion about CRT describes the dynamics behind the racism encountered by minorities at PWI's. These dynamics are manifested in common negative experiences and outcomes reported by minorities at PWI's. However, recruitment and retention strategies targeting future and existing minority faculty at some PWI's have centered on socializing minorities to the professoriate in such a way that would help them overcome the aforementioned barriers and provide them with incentives that make academic careers just as--if not more--attractive as non-academic careers, as well as helping minority faculty feel more empowered and included in organizational life (Jackson, 2004; Aguirre, 2000; Tierney & Rhodes, 1993; Turner et al., 2008; Turner, 2003). Thus, more higher education institutions have developed programs and policies specifically designed to prepare minorities to transition from graduate to Ph.d. programs, and then on to the professoriate. The NSF funds two prominent programs that have been successful on PWI campuses to attract and retain minority STEM degree seekers for the purpose of encouraging and preparing them to pursue STEM faculty positions that have been successful at PWI campuses: the Alliances for Graduate Education and the Professoriate (AGEP) and ADVANCE Programs[1]. A key aspect of these types of programs include providing future and current minority faculty with mentors and institutional resources that can aid in successfully completing doctorate degree requirements in timely manner; offer valuable collaboration opportunities; guidance about navigating the social and political landscape of their departments; offer insights for attaining promotion and tenure that will place them in more influential positions; and managing potentially excessive service requirements that can reduce one's capacity to produce research (National Science Foundation; Reed & Tull, 2012). Examples of other programs can be found in Appendix A of this dissertation. Additionally, many colleges and universities have implemented policies and practices that help new, junior minority faculty get acclimated to academe and facilitate their productivity such as mentoring and funding programs. Researchers such as Tuner (2003) and Smith et al. (2004) state that such policies and practices include encouraging mentoring between senior and junior faculty, whereby senior faculty can provide junior faculty with collaboration opportunities to produce scholarship, provide insights into how to navigate the

[1] The ADVANCE Program specifically targets women, but has been instrumental in providing support to minority women in STEM.

organizational landscape and give them explicit advice about how to succeed in the promotion and tenure process, which is particularly more elusive for minority faculty members to attain.

While insights of CRT are certainly valuable in revealing how and why racial disparities exist in academia, the presented dissertation takes a slight departure in illuminating the inner workings of racism by examining the individual and interrelated impacts of race and social resources from relationship on how faculty members perceive their value within their organizations. In order to provide a more specific context for understanding racialized differences in self-perceived influence among STEM faculty, the following discussion provides a review of factors shaping influence in the academic STEM environment.

2.4 Norms and Values Shaping Influence of Academic Scientists

This section of the dissertation briefly describes the culture of academic science, with a particular emphasis on the values and practiced norms that drive and shape how individual influence is attained. The institution of academic science has historically been revered as a primary source of scientific knowledge, innovation and STEM labor, which has larger implications for societal and economic progress (Shapin, 2009; Whitely, 2000). Overall, the culture of science reveres the advancement of scientific knowledge and innovation, meaning that the currency through which academic scientists are esteemed, rewarded, recognized, sought after and subsequently allowed to wield influence is based upon the particular cultural imperative of productivity (Merton, 1973; Merton, 1957; Hargens & Hagstrom, 1967). Ultimately, individual reputation based on knowledge production and innovation dictates how academic scientists are valued and rewarded and thus subsequently how they perceive their own ability to shape and dictate outcomes in their specific organizations and within the larger institution of science (Stephan, 1996). The following discussion focuses on the following interrelated key values and norms in the academic science culture associated with knowledge production and how scientists embody them: meritocracy, competition, collaboration, individual reputation and organizational prestige.

The production of scientific knowledge and innovation that advances (either incrementally or monumentally) scientific paradigms and its subsequent applications is the ultimate goal of any academic scientist. Thus, academic scientists are in a constant state of competition to develop new and ground-breaking knowledge. For academic scientists, proof of such production comes mostly in the form of peer reviewed publications and patents. Essentially, achieving this goal is a reflection of the academic scientist's merit (i.e. technical ability, skills, high order cognitive ability and etc.). Thus, scientists who produce more and receive more citations are viewed as valuable and competitive (Merton, 1973; Hagstrom, 1965). Academic departments utilize the productivity of academic scientists as a signal of organizational reputation (and vice-versa), resulting in attracting more talent and resources (Long, 1978; Long & McGinnis, 1981; Su, 2011; Long & Fox, 1995; Hagstrom, 1971). Moreover, as scientists are able to consistently prove such merit, they are able to attain more resources that will further enable them to boost their reputations (as well as those of their organization) as being productive and contributory to the scientific community (Allison & Stewart, 1974; Crane, 1965; Su, 2011). This process is known as the Matthew Effect in the scientific culture whereby scientists with more are able to attain more (Merton, 1968, 1988). Resource attainment in the form of grants is particularly relevant for academic scientists as these grants enable scientists to gain the inputs necessary to conduct research; but beyond that, consistent attainment of grants (especially those that are large and competitive) is valued by the academic institution as it is used by the institution as an additional signal to communicate organizational prestige (Leggon, 1997).

Ironically, despite academic scientists being driven to engage in competition for productivity and resources as well as producing profit from individual efforts that can lead to common practices such as secrecy and withholding information, collaboration is a value celebrated and necessary in the academic science institution and thus important in reputation development (Leggon, 1997; Bozeman & Corely, 2004; Oettl, 2011). Collaboration among academic scientists is essentially an outgrowth of two factors: the collegiality that is celebrated in the academic culture and the desire for scientists to align themselves with productive peers as well as non-academic science institutions (Merton, 1973; Stuart & Ding, 2006; Oettl, 2011; Wagner & Leydesdorff, 2005). The latter factor has become increasingly prevalent among academic scientists as the pooling and sharing of resources and capacity can mitigate the stresses of competition and increase efficiency (Wray, 2002). Moreover, as university administrators increasingly value connections to non-academic institutions such as government and private sector organizations for the resources they can offer, academic scientists who can foster relationships with such entities are highly valued (Lam, 2007; Etzkowitz, 1983, 2004, 2010). Moreover, the reputations of academic scientists are further promoted through direct and indirect connections that come by way of collaborations (Cronin et al., 2004; Cronin, 2005). In other words, scientists with the valued reputation of being productive and resourceful can further promote that reputation through the people they work directly with, who can then further communicate that reputation to others. Additionally, scientists can boost their own prestige just by virtue of being connected to reputable peers.

What benefits are reaped by scientists who can build their reputations by successfully competing to significantly produce and innovatively apply scientific knowledge, secure resources, engage in substantive collaboration and enhance the prestige of their academic institutions, particularly as it relates to influence? Reputable scientists are rewarded with more freedom and promotion to more senior faculty positions, which can afford them a more profound sphere of influence (Whitley, 2000). Despite more recent changes in academia where more authority has been vested into university administrators, the cultural imperative in the specific realm of academic science that bases the reputations and subsequent promotions of academic scientists on their productivity, thus allowing them greater influence, is still rather strong (Marcson, 1962; Ginsberg, 2011; Kurek et al., 2007; Reis, 2012). Ultimately, reputations built upon productivity afford academic scientists the opportunity to secure their academic freedom, which allows them to wield their influence. What is specifically afforded to the academic scientist with influence? The following discussion on academic governance speaks to academic science faculty's sphere of influence, which sheds light on their role in organizational decision-making.

2.5 Faculty Influence in Organizational Decision-Making in Academia

Literature about academic governance can provide a more concrete context for understanding faculty's role in organizational decision-making and the extent to which they feel influential in those decisions based upon the aforementioned sources of self-perceived influence. Both faculty and administrative leaders have developed perceptions of their influence in organizational decision-making based on legitimate, informational, expertise and knowledge bases of power. Additionally, the manifestation of these sources varies depending upon key variables such as the type of decision, faculty rank and as well as the type of department and academic institution (Beyer & Lodahl, 1976; Brown, 2001). For example, because of the values and norms of the academic culture that exalt the expertise of faculty in knowledge development, senior faculty (i.e. associate and full professors) appear to feel less influential than deans and department heads in decisions related to administrative activities and allocations from institutional budgets (Finklestein et al., 2011; Finklestein, 2012). However, faculty feel more influential than senior administrative leaders in hiring and promotion decisions of departmental leadership and other faculty, curriculum design and admission of new students (Finklestein et al., 2011; Finklestein, 2012). Faculty in disciplines or departments deemed as being hard or applied areas (e.g. engineering) may view themselves as having more influence than faculty in soft or less applied areas such as physics due to the practicality and visibility of the harder, more applied disciplines (Knight et al., 2011).

Historically, higher education institutions have operated under a top-down, hierarchical management model where influence and power in organizational decision-making was generally concentrated among higher level presidential and administrative leadership. They tended to have more influence and power in macro level decisions effecting the organizational environment such as overarching operational policies and standards, allocation of institutional budgets, selection of leadership, and the shaping of culture, public affairs and etc. (Bensimon & Neumann, 1993; Bensimon et al., 1989; Pfeffer & Moore, 1980; Dykes, 1968). While faculty have had some influence in macro level decisions, their professional authority resulting from their disciplinary, scholarly and teaching expertise has generally resulted in their influence being confined to micro level decisions such as educational program and curriculum development, management of research agendas, securing of outside funding (i.e. grants), faculty promotions and new hires as well as student admissions (Johnston, 2003; Dykes, 1968; Finklestein, 2012; Kenen & Kenen, 1978). However, new managerialist ideals focused on economy, efficiency and the dominant role of the manager in decision-making and problem solving meant that administrators asserted a more prominent role in making decisions that were traditionally under the purview of faculty (Meyer, 2002; Larsen et al., 2009).

Overall, this has resulted in an historic tension between faculty and administrative leadership where there is lack of trust and poor communication between both parties (Dykes, 1968; Tierny & Minor, 2003; Del Favero & Bray, 2010). More specifically, while faculty feel that their input should be considered, they perceive themselves to be stymied by as well as dependent upon administrative power and thus less influential (Ginsberg, 2011; Klein & Dunlap, 1994; Kenan & Kenan, 1978). In particular, lower ranking faculty's dependence upon higher ranking administrators for key resources such as funding illustrates the role of resource dependency in administrator's perception of their influence (Salanick & Pfeffer, 1974; Hills & Mahoney, 1978; Pfeffer & Moore, 1980).

Nevertheless, many colleges and universities have adopted a more participatory style of management that garners involvement in decision-making from all organizational actors (Keller, 1983; Kezar, 2001). One of the primary goals of such a management approach is to help organizational actors feel empowered (Kim, 2002; Honold, 1997; Hougton & Yoho, 2005). This is reflected in studies such as the one done by Finklestein et al (2011) illustrating how U.S. faculty reported increases in their influence in organizational decision-making between 1992 and 2007. The same study also reported how faculty and deans reported increases in their amount of governance power over a twenty year period. However, even with participatory management and shared authority practices designed to include multiple organizational actors in all aspects of decision-making--which are designed to mitigate the marginalization of organizational actors-- minority faculty in majority settings still report feeling less influential, especially in majority settings such as PWI's (Kezar, 2001; Brown & Miller, 1998; Olsen et al, 1995). Essentially, a common perspective used to explain the reason for minority faculty reporting lower levels of influence is the racial bias that leads to isolation from organizational life and devaluation of their work and performance (Turner et al., 2004).

Like academic faculty in other disciplines, academic scientists wield influence in the aforementioned areas of formulating research agendas, curriculum development, selection of students, appointment of faculty, selection of leaders and selection of their service assignments. However, there are a few areas where influence is particularly important for the reputational development of academic scientists. Scientists can boost their reputations and sphere of influence by translating the development of their research agendas into the establishment of labs as well as running university research institutes (Shapin, 2009; Whitley, 2000). Additionally, academic scientists can enhance their reputations and influence by engaging in entrepreneurial activities resulting in their knowledge production being converted into commercial products. It is important to note that critical inputs to successful labs, research institutes and commercial outputs are labor and resources. As mentioned previously, scientists are charged with securing grants, which boosts their reputation and helps with acquiring resources for production. In addition to grants, scientists rely heavily upon students and post-docs to contribute to outputs (Stephan, 2012). Thus, in the long-term, it is critical for academic scientists to have influence over which and how many students and post-docs are selected to work for them.

Lastly, for minority STEM faculty, having the aforementioned types of influence has benefits above and beyond reputational development and productivity enhancements. For minority STEM faculty, being more involved or influential in larger organizational decision-making may help in developing an organizational environment and culture that mitigates racial bias. In particular, the involvement of minority STEM faculty in organizational development may highlight the more insidious presence of institutionalized racial bias that is a product of organizational practices and policies as well as values belonging to organizational members. Additionally, by having more influence in and control over their personal productivity and how they wield their professional authority, minority STEM faculty can mitigate the career limitations that come with organizational expectations regarding their activities (i.e. service work). Overall, the potential outcome of minority STEM faculty having more influence in organizational and individual decisions is the provision of more opportunities to increase their status in the academic science environment, leading to more equitable participation and recognition. With an idea of what contributes to influence in academic science and the nature of decision-making in academia, a more detailed conceptualization of self-perceived influence can be provided.

2.6 Conceptualizing Self-Perceived Influence in Organizational Decision-Making

There is no formal, widely-accepted conceptualization or theory of self-perceived influence. Thus, this portion of the dissertation will systematically develop a conceptualization and working definition of self-perceived influence by addressing three primary questions. First, what does it mean for an organizational actor to have influence? Second, what are the sources of influence for organizational actors and exactly how does the use of these sources create particular organizational outcomes? Lastly, what does it mean for an organizational actor to have a personal awareness of their influence? This last question is particularly important for this study as it reflects an individual perception of influence and thus an organizational actor's perception of their ability to contribute to the development of their environment as well as shape their personal experiences in the environment.

For the purpose of this study, the conceptualization of influence will follow the path of generally accepted literature asserting that influence and power are similar constructs. In particular, power and influence are the exercise of an individual's ability to exert a dominating force that enables them to overcome (and even prevent) resistance as well as achieve and dictate desired outcomes (Dahl, 1957; Pfeffer, 1998; French & Raven, 1959; Pfeffer, 1993). The exercise of both power and influence in organizational decision-making essentially results in changes among and establishment of behaviors, policies, processes and culture that essentially defines the course and development of the organization and its members (Patchen, 1974; Pfeffer, 1998). Some literature makes nuanced differentiations between power and influence, where influence can induce changes without the force of sanctions or punishment that power carries (Willer et al., 1997). Nonetheless, the core function of power and influence to elicit change is the focus of the presented research. Thus, for the purpose of the dissertation, self-perceived influence is an individual's personal assessment of their ability to overcome resistance to or elicit changes in behaviors, policies, processes, and culture to the extent that such resistance or changes impact the course of organizational development in a way that reflects the intentions and interests of the particular individual. Furthermore, such a personal assessment is rooted in a personal evaluation of one's value, ability and resourcefulness. The following discussion provides a more elaborate and systematic review of concepts that are used in developing this meaning of self-perceived influence including general theories of influence and power as well as self-efficacy, reputation and resource dependency.

French and Raven's (1959) initial theory of power and Raven's (1965, 1993, 1992) subsequent work on social influence and power provide a basic comprehensive framework for understanding the dynamics behind how influence is developed and exercised in organizations. Moreover, French and Raven's work has been the basis of other modern theories and frameworks explaining power and influence in organizations. According to French and Raven, influence is essentially an outcome of relational processes whereby organizational units (e.g. individual actors, departments and etc.) leverage asymmetries existing between them and other organizational units to their advantage. Leveraging results in the unit in the enhanced state as opposed to the diminished state (i.e. asymmetry) having their interests fulfilled. Based on French and Raven's work, influence is a reflection of asymmetry in the following areas, which they refer to as bases of power: giving or withholding rewards, mediating punishments, exercising legitimate authority or behavior, using expertise or knowledge, managing uncertainty, taking advantage of interpersonal identification and using verbal persuasion (i.e. information or logic). These bases of power in the organizational context can be illustrated with the following examples, which have been further developed in subsequent theories of power and influence.

2.6.1 Examples of the Bases of Power and Influence

Rewards such as financial compensation or bonuses, formal or ceremonial acknowledgment of work, promotions and allocation of surplus resources are critical mechanisms used by individuals in the organizational environment to motivate and manage organizational actors to work towards certain outcomes. Thus, influence used to illicit certain behaviors and outcomes is predicated on the individual's ability to determine to whom and how rewards will be developed as well as distributed (Jenkins et al, 1998; Bacharach & Lawler, 1980; Conger & Kunungo, 1998; Etzioni, 1975; Lawler, 1971). In the academic environment, these types of rewards by be found in co-authorship in collaborative research, acknowledgements in publications, financial incentives to engage in entrepreneurial work (e.g. patenting) and the provision of promotion and tenure.

Key examples of punishments that an organizational actor can exact on other subunits include withholding of resources and rewards, verbal reprimanding and assignment of excessive or undesirable work tasks. The very knowledge that such punishments can be experienced may influence subunits to avoid and prevent outcomes that are undesirable to those with the ability to determine the extent, type and reason for punishment. This ability places an individual in a rather influential position to realize preferred outcomes, especially when the individual mediating punishments can do so in a way that is most relevant to the subunit. For example, an organizational actor can exercise their influence through the punishment of decreasing budgetary allocations to a research department that greatly depends upon funding for materials and resources (Greene & Podsakoff, 1981; Salancik & Pfeffer, 1974; Yukl, 1994).

Influential positions can be realized through the legitimate authority or behavior typically sanctioned and determined by formal and informal norms and rules within the organization. In particular, hierarchal structure dictates superior-subordinate relationships whereby the superior organizational actor is in a formal position of power that may provide him or her with prescribed leeway and allowances in exercising influence that dictates a less powerful subordinate's behavior. For example, the organizational structure at academic institutions allows the university president to bound key behaviors and functions of faculty members with less rank (Salancik & Pfeffer, 1974; Fairholm, 2009; Yukl, 1994). Additionally, informal rules, norms and values rooted in organizational culture serve as criteria for success and subsequently offer a means for organizational members who effectively fulfill such criteria to attain informal positions of authority and influence. For example, because grants are an important sign of productivity in the academic culture, faculty members with successful grant writing rates (irrespective of their formal position) may use their productivity success to influence other organizational members such as faculty wanting a share of grant funds (Lee & Bozeman, 2005; Jacob & Lefgren, 2011).

Technical expertise, knowledge and organizational information related to principle work functions, processes and policies are valuable resources for an organizational actor. For example, faculty members with significant professional knowledge and experience in their field are able to create key production outputs such as research, grants and patents—all of which require technical skill as well knowledge of processes that facilitate the creation of those outputs (Dietz and Bozeman, 2005). Furthermore, more senior faculty members have more institutional knowledge of key processes such as how to attain promotion and tenure as well as the political landscape (Schrodt et al., 2003; Sands et al., 1991). Such expertise and knowledge can increase an individual's productivity, resulting in organizational advancement and increased visibility. A subsequent result is that faculty with such knowledge and expertise are sought after by others to share useful information, thereby creating a dependency by others (Bozeman & Corley, 2004; Bozeman et al., 2001; Mathews, 2003).

The power base of interpersonal identification is also referred to as referent power. Essentially this means that an individual is able to exercise power and influence over another individual due to a sense of identity or commonality between the two in addition the ability to engender personal respect from others. For example, a senior faculty member may be able to exercise their influence over a junior faculty member not only because of hierarchical or knowledge superiority, but also because the junior faculty member has common interests, backgrounds, goals and admires the senior faculty member (Sands et al, 1991). The benefit of commonality is that when trying to attain organizational goals, a faculty member can create a stronger, collective power base through compliance by other organizational actors by leveraging their admiration and pointing to how working together towards achieving an organizational goal will favor the common needs and desires of those in the group. For example, when selecting a particular new faculty member or leader, individuals can persuade others to choose that new member or leader by indicating how this selection will help promote their common interests and goals (Barbuto, 2000; Yukl et al, 1996; Yukl & Tracey, 2003; Zey-Ferrell & Ervin, 1985; Kipnis et al.,1980).

Potential Versus Expressed Influence

While a significant portion of literature affirms that influence is only relevant when it is realized through action (such as the ones described above), some literature recognizes the importance of potential, unexpressed influence. In other words, the potential alone for an organizational actor to exact influence tactics that are perceived (or predicted) to engender desired outcomes and behaviors is powerful in its own right (Mowday, 1978; Raven, 1993). It is the potential, unexpressed influence that provides a basis for conceptualizing self-perceived influence. Empirical research has identified that organizational actors are automatically attributed influence based upon their mere access to and possession of various bases or sources of influence (Aldrich & Herker, 1977; Hinkin & Schriesheim, 1990; Erez et al., 1996; Fandt & Ferris, 1990). The various attributes of these sources entitles or allows those with access to or possession of them to exercise various levels of force within their organization (Somech & Drach-Zahavy, 2002). For example, legitimate power provides higher ranking department chairs and deans the designated authority afforded by organizational hierarchy within their institution to direct the actions of faculty and allocation of funding. Not only is this formal authority recognized by the individuals who possess it, but also by other organizational actors who can benefit or suffer should that authority be exercised (Jackson, 1975). Furthermore, the mere knowledge that a higher ranking organizational member has the capability to impact organizational development and outcomes that affect other organizational actors drive the behavior and actions of those actors. Thus, self-perceived influence is the personal assessment an organizational actor has about their mere capability to exert a force that entails the manipulation, promotion and establishment of institutional and individual interests, processes, behaviors, values and norms. Such knowledge is informed by how the attributes of varying sources of influence can uniquely shape organizational development and experiences of organizational actors. This knowledge is gathered through the results of actually exercising influence tactics as well as cognitively processing informational cues in their environment about how sources of influence may result in certain outcomes (Mowday, 1978; Raven, 1992; Bruins, 1999; Yukl & Falbe, 1990). The next section discusses specific sources of self-perceived influence.

2.6 Sources of Self-Perceived Influence among Organizational Actors

The following section discusses how theories about self-efficacy, resource dependency and reputation development are critical in shaping self-perceived influence.

2.6.2 Self-Efficacy

Self-efficacy is an important source of self-perceived influence because it reflects an individual's personal assessment of their value, worth and ability (Bandura, 1993, 1982). At its core, self-efficacy equates to the extent that one assesses his or her personal ability to achieve goals and perform important tasks (Bandura, 1982). The ability to perform successfully subsequently enhances personal feelings of self-esteem, which in essence elicits a high sense of value, worth and confidence in an organizational actor—all of which contribute to an organizational actor perceiving that he or she can substantively contribute and shape organizational development (Gardner and Pierce, 1998). Having a high assessment of personal value likely results in individuals having higher levels of confidence in exercising how and the degrees to which they use the aforementioned bases of influence, particularly in the context of organizational decision-making (Mowday, 1979). For example, a junior faculty member with a high level of self-efficacy about their ability to conduct research can be a contributing factor towards how he or she exercises their influence in making decisions regarding research agendas in their respective department, lab or research institute. A more detailed explanation of self-efficacy is offered below, including how sources of self-efficacy can contribute to the confidence necessary for developing personal perceptions of influence.

In the context of how an organizational actor functions within their environment, self-efficacy essentially reflects the personal belief in one's capability to impact their role in the organization and organizational outcomes. This perspective of self-efficacy is substantiated by research generally affirming a positive correlation between self-efficacy and job performance (Tierney & Farmer, 2002; Stajkovic & Luthans, 1988; Judge & Bono, 2001). Bandura (1982) identified several particular sources of self-efficacy—performance attainments, verbal persuasions and vicarious experiences—contribute to building belief in personal value and empowering organizational actors to influence organizational outcomes by using the aforementioned sources of influence. Performance attainments refer to mastery of skills and are the most influential source of developing self-efficacy because it is based on authentic experiences. "Successes heighten perceived self-efficacy; repeated failures lower it, especially if failures occur early in the course of events and do not reflect lack of effort or adverse external circumstances" (Bandura 1982, p. 126). Vicarious experiences are the next influential source of self-efficacy. Essentially, individuals make assessments of themselves based on the performance of similar others. "Seeing similar others perform successfully can raise efficacy expectations in observers who then judge that they too possess the capabilities to master comparable activities. By the same token, observing others who are perceived to be of similar competence fail despite high effort lowers observers' judgments of their own capabilities" (ibid). Verbal persuasions and other types of social influences (e.g. encouragement from others) are externally derived sources of self-efficacy whereby others impact an individual's belief in their abilities to achieve outcomes by appraisal processes. "To the extent that persuasive boosts in self-efficacy lead them [individuals] to try hard enough to succeed, such influences promote development of skills and a sense of personal efficacy" (ibid). Lastly, one's physiological state provides information that develops self-efficacy in that one assesses their visceral arousal in challenging circumstances and makes decisions about their vulnerability to dysfunction. "Because high arousal usually debilitates performance, people are more inclined to expect success when they are not beset by aversive arousal than if they are tense and viscerally agitated. In activities involving strength and stamina, people read their fatigue, aches, and pains as indicants of physical inefficacy" (ibid). For example, for a STEM faculty member, pleasant, low-stress collaborative experiences with other scientists that are not likely to result in severe physical manifestations of stress (e.g. headaches, ulcers, and etc.) and can provide useful feedback about their performance and hence shape their perceptions of personal ability, value and worth will likely result in higher evaluations of self-efficacy.

The concept of empowerment also undergirds the use of self-efficacy to explain the development of self-perceived influence in organizational decision-making. Employee empowerment accounts for extent to which an employee influence the direction of the organization, as well as the role of organizational support in facilitating employees to wield influence (Fernandez and Moldogaziev, 2010). An operational definition of empowerment is the development and execution of a vision about organizational goals and direction shared between the organization and employees that is supported by an organizational structure and governance, facilitated by the pursuit and application of knowledge and learning, and undergirded by institutional recognition. "[Empowerment is] a process of enhancing feelings of self-efficacy among organizational members through the identification of conditions that foster powerlessness and through their removal by both formal organizational practices and informal techniques of providing efficacy information" (Conger and Kunungo, 1988, p. 474). In essence, this statement means that employees feel empowered to influence organizational life as they successfully complete tasks and work relevant to their organization's mission. Furthermore, the execution of employee activities is facilitated by positive organizational feedback and rewards and opportunities for learning, both of which boost an employee's confidence in their ability to perform and make an impact in his or her organization.

Higher levels of self-efficacy have been found to motivate individuals to be more aggressive and intentional in taking on challenging career positions and paths requiring significant skill sets, knowledge, and capability to thrive in stressful job environments[2] (Bandura, 2000; Gist, 1987; Stajkovic & Luthans, 1998; Judge & Bono, 2001; Hackett & Betz, 1995; Betz & Hackett, 2006; Betz, 2004). As organizational actors sense themselves as thriving in challenging environments, which is mediated by task complexity, environment, accumulated experience of success, and outside feedback, they are more likely to persist through tasks that are important for their

[2] Studies have often focused on the dual role of self-efficacy career interest in career choice and decision making. While interest is a strong predictor, self-efficacy is a significant driver as well. However, self-efficacy has proven more predictive than interest in an individual's persistence with career choices and decision making (i.e. overcoming obstacles).

function, but also overall organizational development. The increase in higher job performance can result in higher levels of confidence, which is expressed by using influence tactics reflective of the bases of power. Thus, academic STEM faculty who successfully produce highly revered science outputs (e.g. publications, patents and etc.), engage in successful collaborations and secure resources in a competitive environment while also fulfilling teaching and service duties—all of which build their reputations--are more likely to enhance personal ideas of confidence, which means they are more apt to wield their influence.

2.6.3 Resource Dependency

Resource dependency theory, which emerged from power-dependency theory originally developed by Emerson (1962), is also a critical source of self-perceived influence. Pfeffer and Salanick (1978) initially developed resource dependency theory as a means to explain control and power-dependence between organizations. However, it is has since been used to explain individual level power-dependence relationships within organization (Salancik and Pfeffer, 1978). It has some commonality with French and Raven's theoretical framework as well with regards to how power is developed. According to Emerson, a power-dependence relationship is created when an individual controls significant resources that are key to the function and existence of another individual, resulting in the ability to manage and control that other individual. In the context of exercising influence in organizational decision-making, individuals who are in control of significant resources are particularly influential because they can make decisions impacting the allocation and availability of key resources to individuals, thereby dictating the extent to which those individuals can perform and complete tasks and how the organization will operate (Mackenzie, 1986; Hillman et al., 2009). This is particularly true when resourceful actors can manage and contribute to organizational welfare in times of uncertainty such as when organizational changes occur or the organizational environment (either internal or external) is threatening the survival or function of the organization (Mackenzie, 1986; Pondy, 1977; Hickson et al., 1971; Salancik & Pfeffer, 1978). Such influence is further augmented when the controller has a high level of independence (i.e. not needing to rely upon other organizational actors for survival or function). In other words, organizational actors become more independent by easily securing or generating necessary resources for task and job performance; and their position as a core provider of resources becomes more solidified as those resources become rare. In short, individuals who are largely self-sufficient and are primary (if not sole) providers of vital organizational resources make other organizational indebted to them (Ulrich and Barney, 1984). Moreover, highly resourceful individuals are able to make greater contributions to their organizations and thus influence organizational development as well as have greater control over their personal productivity and outcomes—particularly advancement within the organization (Tharenou,1997). For example, an academic science faculty member can make peers more dependent upon him or her if that member has access to coveted grants, materials, equipment and labor that peers find necessary for their production.

2.6.4 Reputation

As mentioned previously, reputation is the currency used to develop and determine the worth of academic scientists (Stephan, 1996). In general, an individual's reputation can be thought of as the by-product of a feedback loop where organizational actors develop and manage their identities and images among other individuals through accomplishments and performance, and receive responses about their identities from other individuals (Whetten and Mackey, 2002). Ferris et al. (2003) offer the following succinct definition of personal reputation that encompasses its various conceptions across multiple disciplines.

“Reputation is a perceptual identity reflective of the complex combination of salient personal characteristics and accomplishments, demonstrated behavior, and intended images presented over some period of time as observed directly and/or reported from secondary sources” (p. 215).

Personal reputation is a particularly important source of self-perceived influence. This is because reputations reflect the extent to which organizational actors are aware of how they can actually and potentially use various bases of influence (Gamnson, 1966; Gioia & Sims, 1983; Pfeffer, 1992). Additionally, and similar to self-efficacy, personal reputation reflects the confidence that organizational actors have in their ability to contribute to organizational development. This confidence is further shaped by personal performance and the feedback from other individuals. Feedback (or signals) from other organizational actors can come in various forms such as behaviors and verbal affirmations or disapproval (Pfeffer, 1992). Reputations are especially relevant when there is incomplete information about an organizational actor. Individuals may often base their feedback on their conceived notions or perceptions about one’s identity or image, essentially using their notions and perceptions as proxies or filler for missing information about the actual performance of another organizational member (Kreps and Wilson, 1982). Feedback shapes how organizational actors subsequently manage their reputations within and outside of their organization in that they tend to engage in activities that will build their reputations, thereby placing them in positions of influence (Ferris et al, 2003; Pfeffer, 1992).

The development and proliferation of reputations and subsequent self-perceived influence are also fueled by visibility among other individuals. In other words, as actors engage in activities that contribute to their bases of power and those activities are increasingly communicated directly and indirectly to others (both internal and external to the organization), those actors will receive more feedback about their identity, worth and value in the organization (Bromley, 1993). Personal images and identities also develop as a result of the reputations of those in one's network (Kilduff and Krackhardt, 1994). In other words, there is a halo effect derived from connections (i.e. social networks), whereby individuals accrue positive or negative reputational advantages by merely being associated with highly reputable or disreputable others.

The following examples illustrate the previously discussed dynamics of reputation development and its relationship with self-perceived influence among academic scientists. For academic scientists, reputations are proliferated through the informal feedback loop of accolades from the scientific community and the formal feedback loops that include the peer review process through which the validity of production outputs and promotion-tenure are determined as well as acknowledgements and citations in outputs (Arora et al, 2000; Stephan, 1996; Makino, 1998). As academic scientists' reputations are communicated through promotion and tenure, citations, acknowledgements, accolades, positive verbal recognition from colleagues, and successful grants, their confidence to perform increases, which is essentially a reflection of self-efficacy. Additionally, as reputations develop, academic scientists will be sought after by other peers who may have an interest in utilizing the resources of a productive academic scientist as well as wanting to leverage the halo-effect of working with a well-known individual. Thus, the reputable scientists can place himself or herself in a position of being depended upon for resources and reputation development, meaning that they can develop a greater sense of confidence in the value of their knowledge and technical ability as well as resources. The enhanced sense of confidence will likely make them feel more able to exert their expert knowledge and resources in shaping organizational development at the macro level (e.g. strategies, research agendas and etc.) and the micro level (e.g. career outcomes for fellow faculty members).

This section can be summarized as follows. Self-perceived influence for the presented dissertation is conceptualized as an organizational actor's personal assessment of their capability to overcome resistance or modify behaviors, actions, values and outcomes among other organizational subunits in a way that meets expectations and desired outcomes of that actor. An actor evaluates that ability based on their actual experiences with exerting influence as well as intellectually processing how attributes of various sources of influence can result in possible desired outcomes. Self-efficacy is a particularly important source of self-perceived influence as it develops a sense of confidence in their value and effectively using other sources of influence. Resource dependence shapes self-perceived influence by assuring individuals that as they exert control over key resources needed by other actors and can independently generate resources for themselves, they have the potential to influence behaviors, processes and outcomes. An individual's reputation, which is a reflection of the self-management of one's image in conjunction with feedback from others about that image, contributes to self-perceived influence by communicating to an individual what others believe those individuals have the potential and actual ability to towards shaping the organization. Additionally, the interconnectedness of these sources of self-perceived influence can be seen in the following way. Reputation development can essentially be viewed as an outcome of self-efficacy in that personal assessment and feedback of one's performance drives how individuals and others manage and communicate their image about their influence in organizational development. Individuals with reputations of influence are in a position to attain more resources that can be sought after by others, thereby creating dependency and subsequently more influence. The next section discusses the role of interconnectedness in developing self-perceived influence in the context of social networks.

So far, this chapter has laid a partial foundation for understanding the role of race and self-perceived influence among academic STEM scientists. The academic STEM environment values reputational development based upon merit (i.e. productivity), which empowers STEM faculty and affords them the opportunity to assert their influence in the academic environment. However, this dissertation asserts that reputation is only one important factor in developing a sense of empowerment that makes STEM faculty feel more influential in their organization. In particular, it is argued that self-efficacy and resource dependence are also factors that contribute to the extent to which academic STEM faculty perceive themselves to be influential.

Moreover, self-efficacy and resource dependency are constructs consistent with the values promoted in the academic STEM environment. Self-efficacy essentially builds confidence in STEM faculty member's ability to perform and produce scientific knowledge. Resource dependency affords academic scientists to place themselves in influential positions as they become key holders of resources crucial for science production. Thus, self-perceived influence is argued to a product of reputation development, self-efficacy and resource dependency. However, this chapter also posits that racial barriers experienced by minorities in the overall academic environment (e.g. isolation, negative stereotyping, lack of recognition and etc.) may prevent them from achieving parity with non-minorities in terms of organizational inclusion and empowerment. Given the disparities between minorities and non-minorities in the STEM fields—especially among professorial ranks in academic STEM institutions--it is reasonable to assume that minority STEM faculty would experience more challenges in developing a sense of empowerment and involvement in their organizations than non-minorities. The next section expands the theoretical framework for the dissertation with a review of how social networks serve to enhance self-perceived influence. Moreover, it lays a foundation for how self-perceived influence may vary by racial status due to the variations in minority and non-minority networks.

2.7 Social Networks and Self-Perceived Influence

This section provides a brief overview of social capital, network structure and their role in developing self-perceived influence. A more thorough explanation of the function of social capital and network structure characteristics (i.e. network constraint, tie strength and external to internal tie ratio) will be provided in the next chapter, which provides hypotheses illustrating the relationship between network factors and self-perceived influence.

2.7.1 Social Capital

Social capital is at the crux of the relationship between social network structure and self-perceived influence. More specifically, certain network formations impact the accessibility and flow of social capital (Adler & Kwon, 2000; Burt, 2000, 1997; Poldony & Baron, 1997). It is important to understand what social capital is prior to explaining how variations in social network structure contribute differently to the development of resource dependence, self-efficacy and reputation, thereby shaping self-perceived influence. Social capital is generally defined as the returns gained from the investments in relationships (Lin, 1999; Burt, 2000, 1997). One of the several and commonly used formal definitions of social capital is offered by Bordieu (1986) and states it is "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition" p. 248). In other words, social capital are resources gained through exchanges between connected individuals (Mouw, 2006; Kadushin 2012). Thus, social capital can be conceptualized as social network resources. Just as with other types of capital, social capital is used as a means to attain a particular desired outcome such as positions of influence (Coleman, 1989; Brass, 2001). In fact, social capital can be translated to human and economic capital that can be realized into personal gains necessary for advancement and solidifying positions of power within organizations (Portes, 2000; Coleman, 1989; Adler & Kwon, 2002). For example, relationships among colleagues can result in them attaining financial resource and expert input that would be helpful for productivity.

Social capital include opportunities, invitations, recognition of performance, financial resources, socio-emotional support, information and feedback and reputational benefits that come with being associated with other influential individuals--all of which have the potential to enhance the status and abilities of both parties (Coleman, 1989; Burt, 2000). Connections with peers can provide the following types of specific social capital that are especially pertinent to STEM faculty: knowledge of the grant funding process as well as chances to collaborate on grant applications; access to tangible resources such as funding, equipment, facilities, and human resources; opportunities to increase the capacity of labs, which increases knowledge production and dissemination; important information about organizational culture, processes and the political landscape, all of which can facilitate and individual's navigation in the organization; technical knowledge and performance feedback resulting from research, teaching, and service collaborations with fellow academics; and chances to promote individual reputations (Bozeman & Corely, 2004; Dietz & Bozeman, 2005; Johnson & Harvey, 2002). It is key to emphasize that at the cornerstone of social capital is its socio-emotional dimension of trust or goodwill among network members. Mayer et al. (1995) offer a useful definition of trust, which is "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (p. 712). Without trust, the exchange of key social capital is not likely to occur with significant frequency or fluidity (Adler, 2001; Portes, 2000; Granovetter, 1973). In short, without trust among connected organizational members, there will be a decreased likelihood that resource dependency, self-efficacy and reputations will be meaningfully cultivated into self-perceived influence.

Certain network resources can be more pertinent in empowering organizational actors (Siebert et al, 2001; Ibarra, 1993; Lin, 1999; Podolny & Baron, 1997), thereby having a greater impact on self-perceived influence. Thus, conceptualizing social capital into different types of network resources can provide more substantive insight into their function as drivers of self-perceived influence in organizational decision-making. For this research, social capital will be categorized into two types of network resources: career development and mentoring.

2.7.2 Career Development Network Resources

Career development network resources are characterized by their significance in contributing towards building an individual's reputation and visibility both inside and outside of the organization (Wagner & Leydesdorff, 2005; Siebert et al, 2001). It is the institution's cultural norms, values and policies that define the criteria for reputational development and visibility enhancement (Tierny & Rhoades, 1996; Sporn, 1996; O'Reilly et al., 1991; Mowday & Sutton, 1993). Resources that faculty receive from network members directly impacting production activities are deemed as reputational network resources. Examples of career development network resources include opportunities to collaborate on research projects or grants, funding to build labs that will help with knowledge production and invitations to serve on committees in the university or in professional associations.

2.7.3 Mentoring Network Resources

Mentoring network resources are more salient to the individual's particular operation and function within their specific organization (Tung, 1979; Burke, 1984; Kram, 1988). In other words, these types of resources provided by faculty member's connections assist an organizational actor to perform specific tasks relevant to their position within the organization and persist in their particular environment, thereby making him or her feel more relevant within the particular organization (Gist & Mitchell, 1992; Kogler et al., 1989). Examples of mentoring network resources include advice about how to interact with other faculty members, insight into the political landscape of the institution, and information about organizational policies and processes. It is important to note that these two types of resources are not mutually exclusive. Resources that provide reputational and visibility benefits can certainly contribute to individual performance and vice-versa. In terms of social network structure, the generation of and access to social capital driving self-perceived influence can stem from the presence of the following characteristics of a social network: structural holes, proportion of strong or weak ties and the ratio of external and internal ties (Burt, 1992; Adler & Kwon, 2002; Lin, 1999; Lin et al., 1981). The next section details how these particular structural characteristics, determine access or barriers to social capital.

2.8 Social Network Structure

It is important to note that what is common amongst all of the aforementioned sources of self-perceived influence and paramount to understanding how social network structure develops these sources is that they involve interpersonal connections. More specifically, the presented dissertation posits that these sources of self-perceived influence are built as a result of the social capital derived from such connections. This dissertation asserts that it is the structure (i.e. pattern and composition of interpersonal connections) within their networks that allow them to gain network resources (i.e. social capital) needed to build self-perceived influence. The following section discusses the particular functions of the following network structure characteristics in developing self-perceived influence: network constraint, network tie strength and external-internal tie orientation. Prior to explaining these structural elements, it is important to provide important terminology used to describe elements of egocentric networks (i.e. social networks belonging to an individual). The "ego" is the individual that is the primary object of analysis in an egocentric network. For this dissertation the analysis focuses on the individual faculty member's network, meaning that the ego is the faculty member. The "alter(s)" in an egocentric network are the people within the ego's network. Essentially, they are the network connections or individuals in the faculty member's network.

2.8.1 Network Constraint

For the proposed research, the relevance of structural holes will be analyzed in the context of network constraint, which is the extent to which an ego is limited (i.e. constrained) in accessing and generating social capital through the presence of structural holes within his or her network (Burt, 1997). In general, structural holes are "gaps between non-redundant contacts [in a network]" (Burt 1997, pg. 341). Furthermore, "A structural hole indicates that the people on either side of the hole circulate in different flows of information" (ibid). Fewer connections among alters (i.e. other people within the ego's network) creates structural holes within and across networks meaning that there are clusters of connections among disconnected sub-groups of , resulting in holes or gaps (Burt, 2000, 1992). This fundamentally means that alters are connected primarily through the ego, rather than directly to each other. Such gaps provide the benefit of access to and control of varied information and resources such as learning and performance opportunities, advice, and etc.(Burt 1992, 1997). Thus, egos with more structural holes have a greater chance of realizing this benefit. The next chapter provides a more detailed explanation of how network constraint impacts the development of self-perceived influence, by discussing how each factor related to network constraint—network size, hierarchy and density—shapes access to network resources.

2.8.2 Network Tie Strength and External vs Internally Located Network Ties

In addition to network constraint, the strength of the connections between an ego and his or her alters impacts the ego's level of self-perceived influence in organizational decision-making. This is because tie strength reflects the extent of closeness between network members and is indicative of the amount of trust present in the network, which as mentioned previously, facilitates the provision of key social capital necessary to build self-perceived influence (Granovetter, 1973; Kadushin, 2012; Bandura et al., 1980). In other words, stronger connections increase the likelihood that egos will receive more social capital from alters in their network., thereby increasing the extent to which they feel influential in organizational decision-making.

Network resources can have an external-internal orientation (Adler and Kwon, 2002). This accounts for the extent to which an ego's ties—and thus network resources--come from outside or inside of their organization. Thus, it is important to recognize the extent to which egos have strong ties among externally and internally situated networks. More internally situated ties can provide pertinent social capital that can help an ego gain insights into their organization, therefore gaining confidence in their ability to contribute to organizational decision making. Additionally, strong internal ties can provide more opportunities for collaboration, which can enhance their self-efficacy. However, externally situated networks can not only build sources of self-perceived influence in a general sense where the ego is better able to meet the common demands of their occupation and field (irrespective of their institution) through activities such as academic collaboration for the purpose of knowledge development, but also provide opportunities for the ego to broadly enhance his or her reputation and visibility in more circles. The next chapter will provide a more detailed explanation of how tie strength and external versus internal orientation function to effect an individual's self-perceived influence. With a brief explanation of how social capital and certain network characteristics matter for self-perceived influence, there can now be a discussion of how race results in the unique structure of minority networks.

2.9 Minority Social Networks

In addition to exploring the experiences of minorities in academic settings it is necessary to also understand the nature of their networks, with a particular emphasis on unique features of minority's social networks. This will inform an understanding of how minorities may develop and utilize relational based resources differently from their non-minority counterparts, which can consequently have varying impacts on minority faculty members' self-perceived influence is shaped. Important relationships contribute to extent to which minorities persist in STEM careers. In particular, researchers such as Kosoko-Lasaki et al. (2006), Adams (1992) and Hill et al. (1999) evaluating the experiences of minorities assert that both future and current minority faculty benefit from having relationships with professors who can provide them with collaborative research opportunities as a means to enhance their expertise and technical skill set as well as advice about how to succeed in the academic environment. Such provisions in these relationships are essentially social capital, which as previously mentioned, includes resources derived from relationships that individuals use and develop for personal advancement and status attainment, especially in organizations. Such resources can be tangible (e.g. information, partnerships, opportunities and etc.) or intangible (e.g. emotional support) (Lin, 1999; Portes, 2000; Burt, 1997). Research has largely affirmed the importance of relationships for minorities by examining how their social networks play a role in elevating their status in organizations. For example, while individual ability and knowledge is an important criteria to consider for career success and advancement, the access to vital social capital in the form of key organizational information, opportunities about positions, socio-emotional support and legitimacy that comes with associating with reputable organizational actors has been found to be a critical factor in positive outcomes minorities in the workplace—especially in high-status fields that have been historically dominated by non-minorities (Ibarra, 1995; Combs, 2003; Friedman et al., 1998; Friedman, 1996; Thomas, 2001). The following discussion reviews unique structural and content characteristics of minority networks that facilitate the types of network resources (i.e. social capital) minorities generate and utilize to progress and increase their status in organizations.

2.9.1 Structural Characteristics of Minority Networks

While the inherent value networks has been established as an important factor in shaping the status of minorities in organizations, there still much to learn as to how the access to and structure of networks may vary for minorities, thereby resulting in different outcomes than non-minorities in the workplace. The scant research on the structure and development of minority networks reveals that network patterns vary for minorities due to factors that either enhance or diminish their ability to access and be heavily embedded in existing valuable networks that allow for meaningful interactions with others or facilitate the creation of their own networks, thereby impacting their success (Mehra et al., 1998; D'Augelli & Hersherber, 1993; DiTomoso et al., 1988; Menzies et al., 2003). In particular, literature illustrates the network patterns of minorities and subsequent outcomes resulting from those patterns tend to vary on the interconnectedness of their networks (i.e. the extent to which their network members are connected to each other); the extent to which their networks are comprised of like others (i.e. minorities); and the strength of their connections (i.e. frequency of communication, socio-emotional bonds and etc.). Individual career advancement has been typically attributed to networks that are not highly interconnected, contain fewer with like others (especially if those others are located in the upper ranks of the organizational hierarchy), and less strong connections (Poldony & Baron, 1997; Burt, 1992). All of these characteristics allow for organizational actors to access more and varied social capital that is facilitates advancement and status attainment in the work place (Mehra et al., 1988; Kanter 1977; Salancik & Pfeffer, 1978; Ibarra, 1995; Tharenou, 1997).

Hermania Ibarra was among the early researchers to pointedly examine how network structures commonly assumed to be generally beneficial may have a different impact on minorities in organizations. In particular, she asserted that organizational context influenced how minorities developed their networks. "Organizational context is one in which informal interaction is embedded and produces unique constraints on women and racial minorities, causing their networks to differ from those of their white male counterparts on a variety of characteristics" (Ibarra, 1993, p. 57). There are several aspects of the organizational context that Ibarra and others have highlighted that constrain the development of networks for minorities—especially those in majority settings. Essentially, these constraints result in minorities having network patterns that differ from those of non-minorities. Furthermore, these varying network patterns emerge due to minorities making intentional choices about who to align themselves with and not having access to key social capital in their organization (Ibarra, 1993, 1995).

The several aspects of the organizational context in majority settings as identified by Ibarra (1993) and others that constrain the development of minority networks include the overall lower representation of minorities; the uneven distribution of minorities in various ranks and departments (i.e. lower representation in the upper ranks of the hierarchy and higher representation in lower status departments and positions); the higher turnover rates and lower mobility rates of minorities; and negative expectations of minorities by work group members and superiors to perform poorly (Morrison & Glinnow, 1990; Ilgen & Youtz, 1984) . Overall, these factors cause minorities to have networks that are more externally located outside of their departments (or even their organization) and are comprised of a higher proportion of strong ties to other minorities in order to gain more socio-emotional support from like others (Ibarra, 1993; Combs, 2003;). For example, minorities may tend to have more connections in external professional minority associations in order to attain social capital (Thomas and Alderfer, 1989). Additionally, the imperative to perform and ascend in the organizational hierarchy promotes the tendency for organizational actors to align themselves with individuals who are perceived to have resources and status that can facilitate performance and advancement (Podolny & Baron, 1997; Tharenou, 1997). In majority settings this motivates non-minorities to also form networks with like others (i.e. other non-minorities) who are viewed as having those resources (Pfeffer et al., 1995; Ibarra, 1993). Additionally, being excluded from important organizational networks also signals to other organizational actors that minorities are not important enough to connect with, thereby fueling negative stereotypes about the value and worth of minorities and their lower status in the organization (Combs, 2003). Unfortunately, this results in minorities having a harder time becoming part of those majority networks if not being all-together excluded from them. Overall, barriers to majority networks makes it harder for minorities to develop more internal cross-race (i.e. less race homophilous) connections with key organizational actors (especially those in leadership) who can provide a variety of important social capital (Ibarra, 1993; Igbaria & Wormley, 1992; Fernandez, 1991; Lincoln & Miller 1979; Combs, 2003; Braddock & McPartland, 1987;

McPhereson & Smith-Lovin, 2001). However, research suggests that unlike non-minorities, minorities realize greater career advancement and success by having more cross-race connections in majority settings (Friedman et al., 1998; Ibarra, 1993). In fact, successful minorities were found to have strong links to non-minorities in upper leadership (Ibarra, 1995; Parks-Yancy, 2006). Overall, the lack of availability of minority ties and difficulties in developing connections with instrumental non-minorities typically results in minorities having networks within their organizations that are more interconnected (Ibarra, 1993).

To summarize, within organizations, minorities tend to benefit from social networks that are comprised of more strong internal cross-race relationships for instrumental support, more strong same-race relationships for socio-emotional support and overall more interconnectedness. However, it is important to note that it is necessary to consider the dynamics of specific outcomes for organizational actors when assessing how race may impact various network characteristics, which is a specific goal of the present dissertation. The composition of networks is also important to consider. The next section discusses a compositional feature that tends to be unique for minorities: mentoring.

2.9.2 Mentoring Composition of Minority Networks

Aside from the variations in the structure of minority networks, there is an additional important difference in minority networks worth highlighting. While mentoring network resources have been proven beneficial for minorities and non-minorities alike, extensive mentoring networks have been particularly instrumental for minorities in attaining social capital in the workplace (especially in academia), because they offer minorities access to opportunities and insights into organizational life that facilitate minorities becoming more productive and integrated into organizational life, which can subsequently enhance their personal perceptions of how they can contribute to organizational life (Friedman et al., 1998; Sorcinelli & Yun, 2007; Leon, 1993). Thus, because of the value of mentoring relationships, organizations have increasingly sought to provide minority workers with mentors via formal mentoring programs that either match mentors and mentees or encourage the development of such connections, which as mentioned previously is a common practice for socializing minority faculty members in academia (Ensher & Murphy, 1997; Underhill, 2006; Zellers et al., 2008; Tillman, 2001). Nonetheless, the value of mentoring relationships seems to be instrumental for minorities in realizing positive career outcomes (Thomas, 2001; Kosoko-Lasaki, 2006).

Before discussing the importance of mentoring network resources, it is important to first briefly define the construct of mentoring. There are various conceptualizations of mentoring. However, in the organizational and career development context, literature commonly identifies mentoring as a relationship between a junior (or less experienced) and senior (or more experienced) organizational member whereby the senior individual provides the junior individual with a range of social capital that includes (but is not limited to) socio-emotional support, useful insights into the organization, opportunities for advancement and development, guidance related to how to navigate through the organization, and etc. for the expressed purpose of advancing the interests of the junior member (Mullen, 1994; Kram & Isabella, 1985). While other network members can provide such resources, Eby et al. (2007) identifies several unique aspects of the mentor-mentee relationship. First, there is not necessarily an equal exchange of social capital or benefits where the junior member provides as many resources and advantages to the senior member. Thus, there is a significant investment on behalf of the mentor, meaning that mentoring relationships can have inherently stronger bonds than non-mentoring network ties in that mentoring relationships can provide benefits such as sponsorship, coaching, protection, fostering visibility—all of which require more substantial investment in time, trust, intimacy and provision of resources than non-mentoring relationships. Second, mentoring relationships have the primary purpose of providing the mentee with a mechanism to gain significant knowledge (especially of institutional norms) and emotional support. Lastly, mentoring relationships involve a time dimension whereby the benefits of the relationship and the dynamics that facilitate those benefits evolve over time.

Why are mentoring network resources crucial for minorities? Because minorities are typically excluded from important networks, an abundance of advice, information and opportunities from more seasoned individuals who have been embedded in the organization (or field) can provide minorities with information that other network members or organizational members may not be as willing to provide (Sorcinelli & Yun, 2007; Thomas, 1990). This is especially true if the mentor-mentee relationship is one where the mentor is grooming the mentee to be his or her protégée, which inherently denotes a stronger bond and thereby results in more knowledge passed on by the mentor (Eby et al., 2007). However, in majority settings, there are few cross-race protégée-mentor relationships, where both the potential protégée and mentor seek to establish relationships with individuals of their same race due to barriers including lack negative stereotype attribution by the mentor about the value and ability of a minority mentee; perceptions of tokenism by other organizational members; lack of understanding by the mentor about unique cultural differences with the mentee; the avoidance of both mentor and mentees to address sensitive issues dealing with race; and socialization processes that are incompatible with unique needs and cultural norms of minority groups (Ilgen & Youtz, 1986; Kanter, 1979; Thomas, 2001; Tillman, 2001). Thus, the enhanced benefits received from the protégée mentoring relationship are more likely to occur between same-race mentors and mentees (Collins et al., 1997; Solomon, 1991; Thomas, 1990; Tillman, 2001). Additionally, the socio-emotional and instrumental (i.e. advice about career advancement) support provided by seasoned minority mentors--even ones who are outside of the organization, but have been successful in a particular discipline--can inspire and enable less experienced minority mentees to persist in their environments leading to important outcomes such as lower turnover rates and greater job satisfaction (O'Neill, 2002; Malloy, 2005; Thomas, 1990; Gardiner et al., 2000). Outcomes such as lower turnover rates and greater job satisfaction among organizational actors are essentially a reflection of organizational actors being more empowered to substantively participate in and shape their organizations, which reflects enhanced perceptions of influence (Harris et al., 2009; Tsai, 2012; Daly & Dee, 2006).

While cross-race relationships are harder for minorities to develop, these cross-race ties do exist. In fact, Ibarra (1995) suggest that because there are fewer minorities available to create same-race connections with, minorities are constrained to develop more internal ties with non-minorities. Moreover, some research shows that minorities who develop cross-race mentoring relationships reap better career outcomes than those who do not (Dreher & Cox, 1996; Thomas, 2001). There are benefits of cross-race mentoring relationships realized by minorities, even if they are not characterized by protégée development. For instance, because positive and enduring mentoring relationships are characterized by consistent contact and a substantive connection with successful and more seasoned organizational members, minorities with non-minority mentors within a majority organization can enjoy the reputational benefits from aligning themselves with such mentors (Murrell and Tangri, 1999). In particular, the relationship signals to other organizational members that the minority mentor is valuable and thus deserving and worthy of advancement and reward (Thomas, 2001). Thus, the mentoring relationship with a reputable non-minority mentor can open the doors for a minority organizational member to be part of beneficial networks that they would more than likely be otherwise excluded from as well as enjoy a higher status (Ragins, 1997). However, there has been some research suggesting that because organizational members may perceive the value and worth of minorities to be inherently tied to successful mentors, there is a limit on the extent to which minorities are attributed as being successful and useful based on their merit (Thomas, 2001). Thus there is a risk that minorities may still not be as heavily embedded in significant networks in majority settings because they still may not be viewed as having an abundance of social capital, outside of their connections to successful mentors. Nonetheless, despite the difficulties in forming and maintaining cross-race ties, such ties are instrumental in facilitating career advancement for minorities. To end the aforementioned review of the role of mentoring in minority networks, it is important to identify that at the core of such relationships is the strength of the connection that minorities have with their connections.

Because of the importance of social capital in the career outcomes and success of minorities within their organizations, the connection between minorities and mentors requires a link that offers steady and consistent provision of social capital that is fortified in a strong bond. Thus, for the proposed dissertation, it is the strength of connections within minority networks that is the focus.

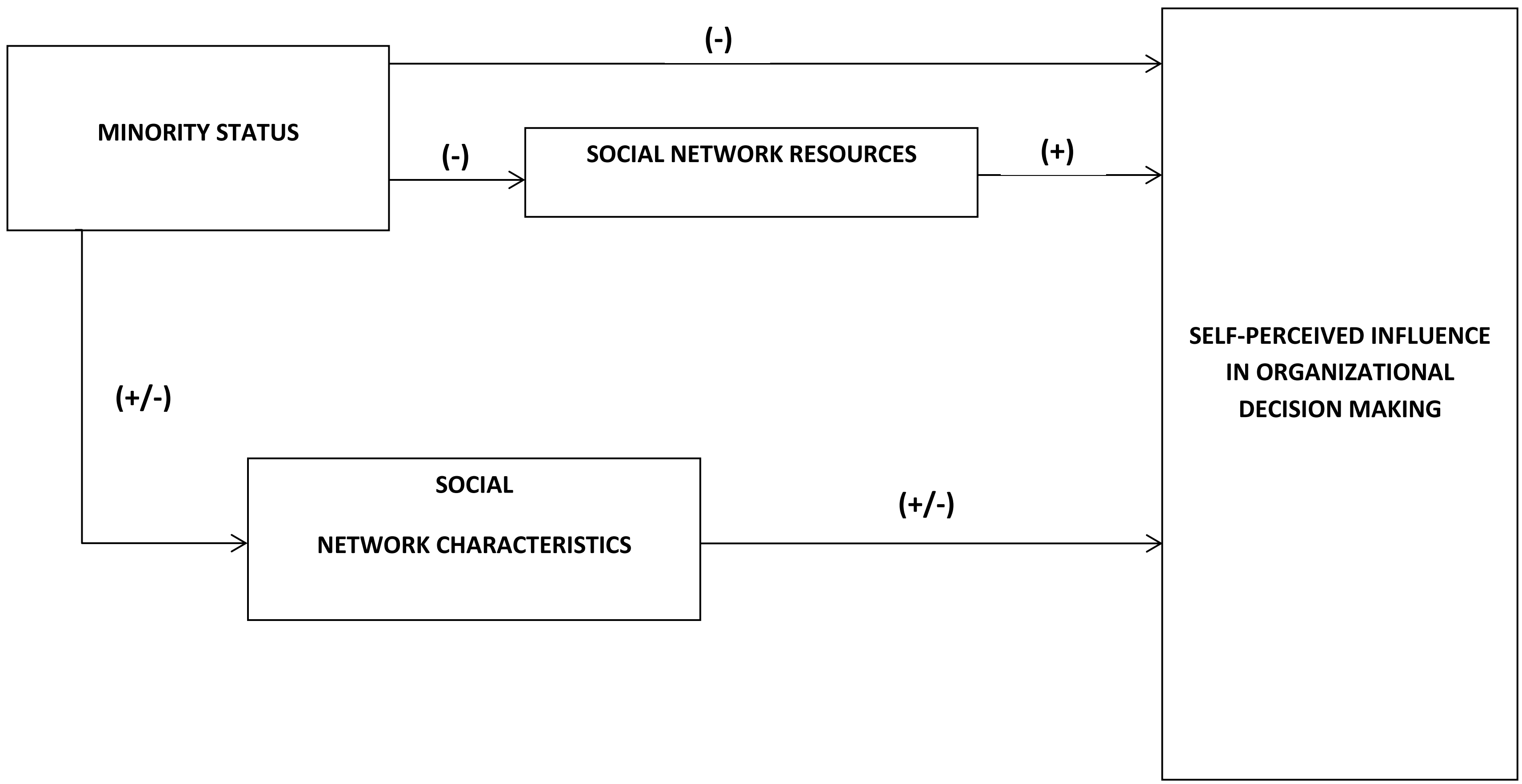
To summarize, minority networks (particularly those based in settings with predominately non-minority organizational actors) are generally characterized by having many same race connections that are externally located and fewer cross race connections that are internally located due to several organizational barriers including low, unequal representation of minorities within the organization and generally being excluded from majority networks. Moreover, these internally situated networks are highly interconnected and external networks that are not as interconnected. Furthermore, minorities appear to attain different types of support from same race and cross race connections. While same race connections can offer more socio-emotional support, cross race connections offer more functional support that directly impacts career outcomes of minorities. Strong connections to mentors play a particularly important role in providing minorities with such support, especially cross race mentoring relationships which can allow minorities to infiltrate networks they are typically excluded from.

The preceding literature provides a basis for the dissertation's core perspective regarding the role of race and social networks in determining self-perceived influence. First, a faculty member's minority status has a direct effect on their self-perceived influence, where minority faculty members feel less influential due to being marginalized, isolated and less valued than their non-minority peers. Additionally, minority racial status has an indirect impact on self-perceived influence, due to the unique attributes of minority social networks, which facilitate or hinder access to social capital that can impact levels of self-perceived influence. In particular, in majority settings (i.e. PWI's), minorities are often marginalized and excluded from networks with instrumental resources that have been found to facilitate organizational status, meaning minorities have less access to important social network resources. Second, minorities seek out strong race homophilous relationships to provided more psycho-emotional and socio-emotional support as well as mentoring ties, which consequently shape the structural elements of their networks and subsequent access to (or lack thereof) to social network resources that impact their levels of self-perceived influence. Overall, this chapter provides a basis for the next chapter which will integrates the previous discussion into hypotheses specifically illustrating how self-perceived influence is impacted by the racial minority status of faculty members and aspects of their social networks. However, prior to presenting the hypotheses, this chapter will end with a conceptual model that summarizes the previously presented theoretical foundation explaining the individual and integrated relationships between minority status, social network characteristics, network resources and self-perceived influence.

2.10 Conceptual Model

Based on the components from the theoretical foundation, Figure 1 below summarizes the conceptual model illustrating the relationships among these components. Overall, this model indicates direct and indirect impacts of racial minority status, social network characteristics and network resources on self-perceived influence. Minority racial status has a direct impact on self-perceived influence where minority faculty will have lower levels of self-perceived influence than non-minority faculty due to racial bias that leads to an exclusion from organizational life and disempowerment. Social network resources (i.e. social capital) contribute to self-efficacy, resource dependency and reputation development, which translates into greater feelings of self-perceived influence. Additionally, because of racial bias that marginalizes and isolates minorities from extensive connections, minority faculty will have fewer network resources (i.e. social capital), which also results in them having less self-perceived influence. The enhanced or diminished configuration of certain social network characteristics result in access to network resources resulting in higher degrees of self-perceived influence. Lastly, due to racial bias, minority faculty will have enhanced or diminished aspects of certain network characteristics.

Figure 1. Conceptual Model Illustrating Relationships among Minority Status, Network Characteristics, Network Resources and Self-Perceived Influence in Organizational Decision Making among STEM faculty



3.0 CONCEPTUAL FRAMEWORK AND HYPOTHESES

3.1 Introduction

The preceding chapter established the context for understanding the role of race and social networks (i.e., network resources and network characteristics) in determining self-perceived influence in organizational decision making among academic STEM scientists. First, there was a brief review of racial disparities in STEM to establish a justification for the presented research. Second, the context for understanding influence and decision-making in the academic STEM environment and how racial bias results in minorities being marginalized in organizational life—leading them to believe they are less influential—were discussed. Towards that end, cultural norms and values—that shape influence in the academic STEM environment functions of academic faculty in academic governance—were reviewed. Third, self-perceived influence was conceptualized using theories about power, self-efficacy, resource dependency and reputation. Lastly, there was a review of social network theory and how key elements of social networks contribute to the self-efficacy, resource dependency and reputation development necessary for self-efficacy.

These individual building blocks will now be used in this chapter to develop specific integrated hypotheses illustrating the specific literature-based relationships between self-perceived organizational influence, minority status and social network characteristics. Essentially, this chapter further details the mechanics of the previously presented literature. The first hypothesis proposes that network resources in individual faculty members' social networks will positively impact their level of self-perceived influence. The second hypothesis asserts that as individual faculty members have less constrained networks, their levels of self-perceived influence will be higher. A third hypothesis states that faculty with stronger ties in their networks will have higher levels of self-perceived influence. A fourth hypothesis states that when faculty members have higher ratio of internal to external network ties, they will have higher levels of self-perceived influence.

The next set of hypotheses proposes the impacts of race on self-perceived influence and social network characteristics. It is important to note that although the previous chapter presented multiple ways in which minority status impacts the development of social networks, this dissertation will conduct analysis and interpret findings on the impact of minority racial status on a select number of network attributes. The fifth hypothesis indicates that overall, minority faculty members are expected to report lower levels of self-perceived influence than non-minority faculty. The sixth hypothesis predicts that minority faculty will have significantly fewer network resources than their non-minority counterparts. The seventh hypothesis states that minority faculty networks will be significantly more constrained than the networks of non-minority faculty. The eighth hypothesis proposes that minority faculty will have a higher ratio of external ties to internal ties in their networks than non-minority faculty. The ninth and final hypothesis predicts that minority faculty will have significantly more strong ties in their networks than non-minority faculty. Lastly, a proposition is presented asserting that the direct effect of minority status alone has a greater impact on self-perceived influence than the indirect effect of minority status that is mediated by network structure and network resources.

3.2 Hypotheses Effects of Social Networks on Self-Perceived Influence

3.2.1 Hypothesizing Network Resources and Self-Perceived Influence

Thus far, network resources have been discussed in the context of career development and mentoring network resources. To reiterate, career development network resources, such as invitations or opportunities to collaborate on research and grant projects, build a faculty member's performance attainments through the development of skills related to knowledge production and dissemination. Consequently, a faculty member may feel more empowered to shape decisions impacting the organization's reputation (e.g., determination of research agendas, funding for projects, and admission of new faculty). Mentoring network resources—such as insights into particular faculty members, the political landscape of the department and departmental expectations of research, teaching and service activities—can also contribute to the development of performance attainments by helping a faculty member make more informed organizational decisions that can shape the environment and their experiences in it (e.g., promotion of faculty and personal teaching loads).

There are key connections between network resources and several of the previously discussed sources of self-perceived influence. In particular, these sources of self-perceived influence are developed and reinforced through social capital in the form of collaboration opportunities, recognition and rewards that come from within one's social network (Wood & Bandura, 1989; Wood 2000; Judge et al., 2007). Self-efficacy through social or professional connections is developed as faculty members are able to successfully leverage collaboration opportunities including grant writing, research activities, patent development and more. In particular, self-efficacy is realized through the augmentation of technical skills and knowledge, insight into key institutional processes—those that can facilitate the creation of scientific knowledge and organizational performance (e.g., working with technology transfer offices, going through the publication process, preparing promotion and tenure packages requiring evidence of research and teaching activities, and navigating the grant writing processes at various institutions)—and attainment of feedback. Collaboration opportunities also allow faculty to have vicarious experiences as they work with productive peers. As faculty members successfully collaborate with productive, recognized colleagues with whom they may identify socially, intellectually, etc., they may develop notions of their own ability to be equally successful. Additionally, verbal persuasions can be attained through collaborations when faculty members receive positive feedback and encouragement regarding their performance during the collaborative process. Rewards and recognition are also forms of positive feedback that signals to faculty members that their work and performance are valuable and important in the development of their field. The role of social capital in developing self-efficacy is further substantiated by Burt et al., (2013) who state social capital provides benefits for individuals "that manifest in higher odds of proposing good ideas, more positive evaluations and recognition, higher compensation and faster promotions" (p. 3). In other words, social capital enables individual productivity and advancement that allows for organizational members to successfully develop and evaluate their performance (Brass & Krackhardt, 1999; Burke et al., 2007; Hansen et al., 2001; Nahapiet & Ghoshal,1998).

Reputational benefits also accrue to faculty members when they engage in collaborative opportunities and receive recognition and rewards. Research outputs such as grants, patents and publications as well as teaching and service activities are highly esteemed in the academic environment as key indicators of value and success. Because of the significant value ascribed to key research, teaching and service activities, faculty will continue to seek to engage in such activities with other colleagues so as to manage and further their reputations. Thus, faculty—who are able to engage in collaborations resulting in successful production of these outputs—develop images and identities as skilled individuals who not only can substantially contribute to the development of the scientific knowledge, but also to the reputation and development of their respective organizations. While faculty may be able to develop their images and identities through individual effort, collaboration offers a chance for reputations to be developed and endorsed more prominently for two key reasons. First, collaborators communicate experiences about working with colleagues to others. As knowledge of this image or identity is communicated both inside and outside of the organization, the faculty member's reputation emerges and spreads. The proliferation and confirmation of their reputation is facilitated by rewards and recognition for noteworthy work conferred by colleagues, which essentially serve as signals throughout the organization and general academic community that faculty members are in fact productive in meaningful ways. Examples of reward and recognition include significant amount of citations, promotion and tenure, invitations to conferences, and special institutional or organizational recompense such as chaired professorships. Secondly, when faculty collaborate with recognized successful colleagues, their reputation develops as a result of the quality of their associations (i.e., the halo effect). In other words, as a faculty member works with recognized productive and influential peers, other organizational actors—particularly those outside of a faculty member's current network who are connected to other collaborators—may begin to attribute to that faculty member significant potential for success based on the successful faculty member's accomplishments and power.

Resource dependency is cultivated through social capital in several ways. First, social capital can translate into key tangible economic or material capital necessary for advancement. For example, it is possible that some key resources such as lab space, materials, equipment or funding needed for productivity can be obtained through a connection to a colleague who has access to such resources. Because access to those resources is bounded through a social connection, gatekeepers for those resources who determine or manage the availability of those resources create dependence by potential consumers. Second, reputations themselves are an additional (but intangible) resource that faculty members can use for their own advancement and development towards becoming influential organizational members. For example, recommendations for participation in organizational activities (i.e., service committees or research projects) from reputable colleagues can be a coveted means of placing faculty members in positions to shape organizational life. Reputable organizational members and those seeking to take advantage of those reputations are aware of how their powerful image and identity can be used to influence the progression of organizational actors, thereby creating a dependence upon reputable colleagues to provide support in their career progression. Additionally, given that personal reputations contribute to the development of institutional reputations, organizational actors who are able to positively shape organizational identity and images as well as enable their institutions to build additional resources are in significant positions to influence organizational decision-making. For example, the strength of an academic department is significantly correlated to faculty who are well known for their research, practical contributions and ability to produce well-prepared students. Departments with reputations for productivity are likely to garner additional resources such as funding and strong students, both of which substantially contribute to overall organizational well-being. Thus, faculty reputations can influence decisions that impact organizational growth and stability.

The previous discussion of self-efficacy, reputation advancement and resource dependency in the context of social capital highlights key dynamics of how social capital contributes to the development of self-perceived influence. More specifically, social capital provides opportunities for knowledge and skill development and chances to control access to and generate key resources, develops images and identities, and takes advantage of connections to influential colleagues. These benefits resulting from connections with colleagues allow faculty members to build confidence and cultivate positive evaluations of their ability to perform in meaningful ways that shape their organizations, which likely leads to higher levels of self-perceived influence. Considering this discussion on social capital as network resources, hypothesis one (H1) provided below illustrates the impact of social capital on the development of self-perceived influence. Overall, having higher amounts of network resources will result in higher levels of self-perceived influence. H1 states the proposed relationship between network resources and self-perceived influence.

H1: STEM faculty with more network resources will report higher levels of self-perceived influence.

3.2.2 Hypothesizing Network Constraint and Self-Perceived Influence

As mentioned in Chapter 2, network constraint is discussed in the context of structural holes. To elaborate from the previous chapter, there will be a more detailed discussion of how structural holes provide several advantages in developing self-perceived influence in organizational decision-making.

First, less connectivity means that there is more varied, non-redundant information available to the ego (Kadushin, 2012). The varied information and resources allow the ego to expand the breadth of his or her knowledge and skill sets relevant to overall organizational functions as opposed to having an in-depth understanding of one or a few organizational functions afforded by denser networks (Burt, 1992, 2001). Access to varied information and resources will expand one's awareness and knowledge of how the organization operates more broadly, which is also an asset in organizational decision-making because decisions have far reaching impacts throughout the organization (O'Reilly, 1983). Also, there are more varied opportunities to build skills, expose oneself to diverse comparable colleagues and receive varying types of feedback, all of which can provide insights into broader organizational functions. Exposure to broader organizational functions allows an ego to know how the possible inputs and outputs of decisions in various areas are interconnected (Rodan, 2010). Armed with more information, the ego develops confidence making informed decisions about organizational life. This will increase an ego's perceived ability and value in shaping overall organizational development, subsequently increasing their self-perceived influence.

The second advantage of structural holes is that egos can better control the flow of information and resources. Because alters are not heavily connected to each other in less dense networks, egos can significantly influence how information is distributed (Burt, 1992, 2001, 1997). Since unconnected alters are not sharing information with each other, an ego acting as a boundary spanner can create a dependency among alters whereby alters rely upon egos for pertinent information they would not otherwise receive (Brass, 2001; Burt, 2001). As the boundary spanning ego navigates among disconnected alters who are likely located in different parts of the organization, he or she becomes more recognized and identifiable in various circles in the organization, thereby increasing the dependency others have upon the ego (Fleming & Waguespack, 2005, 2007; Kilduff & Krackhardt, 1994; Tsui, 1984). Additionally, the wide variety of information and resources that expands the egos' knowledge and skill sets can lead to dependency as well—increasing their perceptions of being able to perform and contribute to the overall development of the organization (Brass, 1984; Brass & Burkhardt,1993; Gist & Mitchell, 1992; Spreitzer, 1995). This dependency serves as a source of power for the boundary spanning ego (Hambrick, 1981; Jemison, 1984; Spekman, 1979; Russ et al., 1998). In short, the varied information and resources coupled with the dependency of others build self-perceived influence in organizational decision-making.

A third advantage to structural holes is that the ability to control information between structural holes allows a boundary spanning ego to also control how his or her reputation is shaped. More specifically, moving among structural holes allows egos to determine the extent to which alters are aware of their shortcomings or strengths, which cannot necessarily be confirmed or disconfirmed among disconnected alters (Flynn et al., 2006; Mehra et al., 2001). Therefore, the feedback that egos subsequently receive from alters will be based on the messages they initially receive from the egos about their abilities. In other words, if egos are adept at conveying themselves as competent and resourceful among disconnected alters, they are more likely to receive positive feedback from alters who will not likely receive any contrary information from other alters in the ego's network. Such positive feedback builds an ego's self-perceived influence in impacting organizational decisions.

Considering these benefits of structural holes, the functionality of network constraint can be summarized as follows: highly constrained networks have fewer structural holes, resulting in access to and ability to generate less social capital; whereby less constrained networks have more structural holes, allowing access to and ability to develop more social capital (Burt 1997). Furthermore, network constraint is a single construct that varies by network size, density and hierarchy (Burt 1997, 2001). The following discussion focuses on how each these factors shape network constraint.

Network size refers to the total number of people in the network (Wasserman and Faust, 1994). Larger networks provide egos access to more social capital necessary for building the sources of self-perceived influence. Conversely, smaller networks limit the amount of social capital that egos may receive—constricting the development of self-perceived influence (Granovetter, 1973; Podolny & Baron, 1997; Cross & Sproull, 2004). Thus, egos with larger networks have less constraint in accessing social capital necessary for building self-perceived influence.

Network density is the degree to which alters within an ego's network are connected to each other relative to all possible connections (Burt 1992, 2002). Network density can be viewed as a landscape of social capital flow and depth. "Other things being equal, the greater the density, the more likely is a network to be considered a cohesive community, a source of social support and an effective transmitter" (Kadushin, 2012, p.29). Highly dense networks (i.e., many connections among alters) reflect a tightly knit cluster of relationships where there is consistently fortified social capital (i.e., redundant information) that is highly accessible through a consistent flow between network actors (ibid). However, less dense networks (i.e., fewer connections among alters) result in more structural holes that offer varied social capital. Thus, less dense networks mean fewer structural holes, thereby lower constraint, which can increase self-perceived influence.

However, the development of self-perceived influence can benefit from a denser or more constrained network. More dense networks provide more redundant information and resources to an ego, subsequently increasing his or her robustness of knowledge (Balkundi & Kilduff, 2006; Brass & Krackhardt, 1999). Such social capital allows for an ego to enhance his or her human capital (i.e., depth of knowledge and skill set). Thus, rather than being a 'jack-of-all-trades' with knowledge and skills in many varied areas, an individual can create an expert level of proficiency based on the in-depth information and resources shared by highly connected alters (Brass, 1984; Ibarra, 1993). This expert proficiency increases the ego's self-perceived influence, especially as it relates to making key organizational decisions that benefit from expert knowledge. Such expertise is a source of power, which can also build an ego's perception of their influence (French & Raven, 1959; Spekman, 1979). As an ego's self-perceived influence evolves and they improve their performance, more dense networks allow for an ego's reputation as a proficient performer and highly skilled to be further reinforced among other network members (Mehra et al., 2006; Coleman, 1989; Raub & Weesie, 1990). The closeness of a denser network essentially reflects a small feedback loop where there is more frequent, consistent and concentrated feedback (i.e., verbal persuasion) that can contribute to increased self-perceived influence. Thus, changes in density resulting in more or less constrained networks can have positive impacts on self-perceived influence.

Network hierarchy refers to the extent to which connections in a network are exclusively or directly tied to and dependent upon single dominant contact (Burt, 2000; Hanneman & Riddle, 2005). In other words, a network with a higher degree of hierarchy has more individuals directly connected to one contact, as opposed to individuals being connected to each other. In essence, this means a higher degree of dependency upon one individual to provide social capital because the single primary contact has the key advantage of being a primary source of information and resources for network alters. Thus, hierarchical networks tend to be more constrained because there is less opportunity to get non-redundant information and resources from a variety of individuals (Burt, 1997). If an ego is not the primary contact in a highly hierarchical network, this can negatively impact their self-perceived influence. However, similar to an ego acting as a boundary spanner, an ego who is the primary contact in a highly hierarchical network can create a sense of dependence that can increase their confidence, thereby increasing their self-perceived influence. Thus, as with network density, network hierarchy may have a dual impact on self-perceived influence where more or less constraint can positively shape it. Based on the previous discussion, the following hypothesis two (H2) states the proposed relationships between network constraint and self-perceived influence.

H2: STEM faculty with lower network constraint will report significantly higher levels of self-perceived influence.

3.2.3 Hypothesizing Network Tie Strength, External-Internal Network Tie Orientation and Self-Perceived Influence

As mentioned in Chapter 2, strong ties between ego and alters reflect a high level of trust, which is imperative for the provision of social network resources needed to increase self-perceived influence. In particular, given the higher levels of trust present in strong ties, alters may have more confidence that their interests will be promoted by the ego. Furthermore, because strongly tied alters may have given a significant amount of resources to egos, they may have greater expectations of egos to reciprocate by making organizational decisions that favor the alters. Confidence and trust can be manifested as an alter's support for an ego's decisions, especially ones favored by the alter (Johansson et al., 2005; Hoppe & Reinelt, 2010; Podolny & Baron, 1997). Confidence from alters can build the value egos place on their ability, thus leading to higher self-perceived influence. In short, alters may perceive that egos with high levels of resources, confidence and trust can be relied upon to make certain decisions, thus increasing an ego's perception of the power he or she wields (Bandura et al., 1980; Astley & Sachdeva, 1984).

However, it is important to acknowledge the benefits of weaker ties as well. Weaker ties have proven to advance the position of organizational actors due to the varied social capital gained from across structural holes resulting from the presence of weak ties; and it is the varied social capital that likely increases the breadth of an individual's skills and knowledge that improves performance and subsequent performance attainments (Granovetter, 1973; Bandura et al., 1980). However, the gains from stronger ties may be more significant in building self-perceived influence. Strong ties between an ego and alter mean that higher levels of emotional closeness and trust are present, thereby increasing the likelihood that information, resources, social support, learning and collaboration opportunities, constructive feedback on performance, and other forms of social capital are more willingly shared with the ego. Furthermore, trust and emotional closeness enables a greater flow of social capital (Friedkin, 1982; Podolny & Baron, 1997; Uzzi, 1997). Essentially, social capital from strong ties may offer more benefits relevant for the examined sources of self-perceived influence (i.e., performance attainments, vicarious experiences and verbal persuasions) than weaker ties, which has a more limited scope in developing self-perceived influence. Another way to consider this is that stronger ties will likely result in an ego feeling more empowered in wielding influence in organizational decisions, which has been forged as power based on expertise and resources constructed from the social capital received from well trusted and emotionally close connections (Bandura et al., 1980; Tortoriello et al., 2012).

An internally situated network with strong ties not only can provide an ego with opportunities to build performance attainments, attain vicarious experiences, and receive verbal influence that are more relevant to the unique internal environment, but also can help the ego to gain particular insights into the specific institutional landscape of his or her academic institution that are useful in organizational decision-making. Furthermore, internally situated networks with strong ties may provide egos with access to key organizational information such as how to navigate organizational politics and how to interact with organizational actors (Kilduff & Krackhardt, 1994; Brass & Krackhardt, 1999), thereby providing egos with an increased sense of confidence. Opportunities to build sources of self-perceived influence, coupled with the advantage of internal organizational insights as well as opportunities for powerful alliances, can contribute to higher levels of self-perceived influence.

The reputation and visibility of the individual also results in reputational and visibility benefits for the academic institution as well (Rindova et al., 2005; Golden & Carstensen, 1992; Tien & Blackburn, 1996), which can afford the ego a more powerful or influential position within his or her organization due to the intense value that academic institutions place on individual productivity (Toutkoushian et al., 2003).

A powerful and influential position can enable an ego to have more impact on decisions that can eventually contribute to the further development of the organizational reputation such as leadership, funding for research, etc. The third hypothesis (H3) below summarizes the relationship between self-perceived influence and tie strength. The fourth hypothesis (H4) states the relationship between self-perceived influence and external ties.

H3: STEM faculty with more strong ties will report higher levels of self-perceived influence.

H4: STEM faculty with a higher ratio of internally ties to external ties will report higher levels of self-perceived influence.

3.3 Hypothesizing Effects of Minority Status on Self-Perceived Influence

This section establishes the foundation for several hypotheses illustrating the interconnected relationship between minority status, social capital, social network structure and resultant variations in self-perceived influence among minority faculty. Much research has examined outcomes and experiences of minority experiences in the context of all groups of minorities. However, in the presented research, minority status will be confined to faculty members who are identified as African-Americans/Blacks. While, the presented dissertation focuses on how minority status affects faculty in predominately white institutions where racial bias is more prevalent, it is nonetheless important to acknowledge that self-perceived influence among minority faculty may differ based upon their institution given the differences in culture that may contribute to their experiences and perceptions of value (Johnsrud & Sadao, 1998; Butner et al., 2000). In particular, while it may be reasonable to assume that minority faculty at minority serving institutions (MSI's) may generally have high levels of self-perceived influence because those institutions tend to be more inclusive and supportive of minority faculty, little is known about faculty involvement in academic governance at some MSI's (Guy-Sheftall, 2006). Consequently, there is a less thorough understanding of how an important subset of minority academics assess their self-perceived influence in organizational decision-making. However, some research indicates that particularly at historically black colleges and universities (HBCU's), faculty involvement in governance is minimal due to a paternalistic culture that defers the majority of decision-making to college presidents (Guy-Sheftall, 2006; Minor, 2005). Consequently, counter to reasonable assumptions, minority faculty at minority serving institutions may in fact have lower evaluations of their self-perceived influence. However, the lack of substantive research on minority faculty at MSIs does not clearly indicate if this is solely due to organizational structure characteristics or if social capital may play a role as well.

The more substantial literature on minority faculty experiences at majority white institutions yields significant insights on minority faculty's involvement in organizational decision-making and their subsequent beliefs of self-perceived influence, which can be traced to challenges in them obtaining social capital that builds self-efficacy, develop reputations and contribute towards resource dependency. Overall, underrepresented minority faculty in majority institutions tend to report believing that their opinions and influence are generally less relevant in organizational decisions than their non-minority counterparts (Aguirre et al., 1993; Aguirre, 2000; Williams et al., 1987; Wyche & Graves, 1998; Turner, 2003). There are several commonly cited barriers experienced by minority faculty in majority institutions that limit their access to and creation of social capital, resulting in an overall lower assessment of their self-perceived influence. Essentially, minority faculty's lack of access to social capital (or network resources) is a result of marginalization in the academic environment. In particular, marginalization experienced by minority faculty comes as a result of the barriers, such as an unwelcoming environment rife with racism, presumed incompetence by colleagues fueled by negative racial stereotypes, and intense pressure to engage in service activities that take time away from important research responsibilities (Aguirre et al., 1994). The latter barrier is especially relevant in light of the fact that minorities in overall organizational decision-making are commonly relegated to service activities that are narrowly focused (i.e., diversity initiatives), thereby limiting the scope of minority faculty's influence in overall decision-making (Blackwell, 1989; Menges & Exum, 1983; Turner & Meyer, 2000; Banks, 1984).

First, it is commonly reported by minority faculty at majority institutions that the academic environment is unwelcoming and hostile (Aguirre, 2000; Bower, 2002; Villalpando & Bernal, 2002). While early career faculty may be inundated during the recruitment process with the rhetoric of the redeeming and positive values of diversity and efforts by the institution to practice inclusion, the attractiveness of that message erodes once they actually enter academia. Upon entry, they often report experiencing racism from colleagues and leaders as well as promotion of negative stereotypes, which results in them having a lower status and preventing them from advancing in their departments (Chinn, 1999; Malone & Barabino, 2009). The result is isolation from peers, leading to lack of key social capital such as information and opportunities that can be gained through strategic relationships within the department (Aguirre et al., 1993; Butner et al., 2000).

Isolation is compounded by the fact that often times, minority faculty are very few in number (especially in STEM departments) at majority institutions, which translates to less support from similar peers who have successfully overcome a racially hostile environment (National Science Foundation, 2011; Blackwell et al., 2009). Thus, isolation—coupled with less availability of connections within their departments with other minority faculty—may drive minority faculty to be more aggressive in seeking strong connections (especially in the form of mentors) outside of their immediate department, which can allow them to have different access to other types of social capital such as socio-emotional support (Fries-Britt, 2000; DeCuir-Gunby et al., 2009). However, while more externally located socio-emotional support may marginally contribute to developing minority faculty's self-efficacy by building their confidence in their ability and persistence in performing, it may do little to help them develop their reputations within their departments and make them a prime vessel of resources that other organizational members must rely upon.

Secondly, as a result of presumed incompetence and personal research agendas sometimes being incongruous with that of other colleagues or overall institutional priorities, there is commonly a lack of value placed on scholarly work produced by minority faculty in majority institutions. Often, minority faculty report that their work is neither held in high regard nor considered rigorous or relevant—in other words lack of overall support from peers in knowledge production (Bernal & Villalpando, 2002; Turner & Myers, Jr., 2000; Antonio, 2002). A negative evaluation or less prioritization of production outputs can result in several counterproductive outcomes for minority faculty that inhibits access to social capital necessary for developing self-perceived influence. First, minority faculty members are less likely to advance in the academic ranks possessing images of being highly reputable contributors to the scientific institution that are worth being sought after for collaboration opportunities and source of valuable resources (Bernal & Villalpando, 2002; Berget et al., 2010; Thomspson, 2008). In other words, minority faculty in majority institutions have greater challenges in developing positive reputations that are reinforced through connections with colleagues and institutional acknowledgement of their work. Secondly, a lack of affirmative peer and institutional acknowledgement means minority faculty are less likely to have opportunities to develop their self-efficacy through collaborative opportunities that also contribute to sustained confidence in their ability to produce according to institutional expectations.

Third, there is intense priority placed on minority faculty being involved in service activities that reduce the amount of time they can commit to research and teaching activities (Turner, 2002; Stanley, 2006). Academic institutions typically have excessive expectations of minority faculty to engage in service activities (Baez, 2000; Laden & Hagedorn, 2000; Aguirre, 2000). Unfortunately, often minority representation in service activities is sometimes superficial in order to project equality and inclusion, which can prevent minority faculty from fully reaping the benefits of service activities that can offer opportunities to increase self-efficacy, build solid reputations, and place them in positions of authority and gatekeepers to key resources needed by other organizational actors (Padilla, 1994; Aguirre, 2000). In other words, service activities provide a narrow scope of social capital that can only marginally contribute to the development of self-perceived influence. Consequently, as minority faculty are not able to fully reap the benefits of a broader array of social capital from other important types of collaborative relationships that are important for developing performance attainments and self-efficacy (i.e., teaching and research projects). Additionally, minority faculty are often not adequately rewarded or recognized for a significant portion of their overall service activities because researching and teaching activities tend to carry more weight in promotion and tenure criteria (Johnsrud & Sadao, 1998; Blackwell 1988; Menges & Exum, 1983; Turner et al., 1997; Turner, 2002). Furthermore, minority faculty sometimes report not having an active and significant role in overall academic governance (Trower & Chait, 2002). The lack of substantive organizational representation and limited recognition for participation in organizational development can reduce the chances that minority faculty have to improve assessments of their performance—opportunities that can also help comprehensively build their reputations among peers within their institution as accomplished well-rounded academics with substantive teaching, research and service capabilities.

Despite the limitations in attaining social capital that minority faculty face as a result of narrowly focused participation in service activities, they still have a strong desire to take advantage of opportunities to participate in organizational decision-making to ensure their environment reflects authentic equality, facilitates the fulfillment of their interests and reflects social justice (Brown & Miller, 1998; Stanley, 2006). The irony is that minority faculty typically satisfy such desires through participation in service activities that are directly related to organizational development such as advising on diversity initiatives or serving on recruitment and retention committees (Baez, 2000). Thus, there is a tension between the desires of minority faculty to shape their organizational environment through service activities and the excessive expectations placed upon minority faculty to engage in such activities which typically result in less time to devote to other activities that can place them in a position to markedly contribute to overall organizational development.

To summarize, minority faculty generally tend to perceive themselves as having lower organizational standing due to marginalization, negative bias and less substantive, authentic inclusion—especially as it relates to service activities. Thus, minority faculty have limited access to internal network resources that are likely to provide them with more varied social capital, enabling them to develop a variety of skill sets and knowledge, thereby improving their confidence and personal value, as well as reputation and visibility—all of which contribute to enhanced self-perceived influence in organizational decision-making. Consequently, minority faculty are likely to have networks characterized by fewer structural holes meaning higher constraint. However, adverse factors may prompt minority faculty to seek outside support, resulting in more externally situated networks with stronger ties. The fifth hypothesis (H5) below illustrates the expected relationship between minority status and self-perceived influence. Hypotheses six (H6) through seven (H9) express the relationship between minority status and various network structure characteristics—all of which further substantiate the fifth hypothesis.

H5: Overall, African-American/Black STEM faculty will report lower levels of self-perceived influence than non-minority STEM faculty.

H6: African-American/Black faculty will report having overall less network resources than non-minority STEM faculty.

H7: African-American/Black STEM faculty will report having more constrained networks than non-minority STEM faculty.

H8: African-American/Black STEM faculty will report having a higher portion of external to internal ties than non-minority STEM faculty.

H9: African-American/Black STEM faculty will report having more strong ties than non-minority STEM faculty.

The following proposition summarizes the expected impact of the direct and indirect effects of minority status, social network structure and network resources on self-perceived influence.

Proposition 1 (P1): The direct effect of STEM faculty's minority status has a stronger impact on levels of self-perceived influence than the combined indirect effect of STEM faculty's minority status, network structure and network resources.

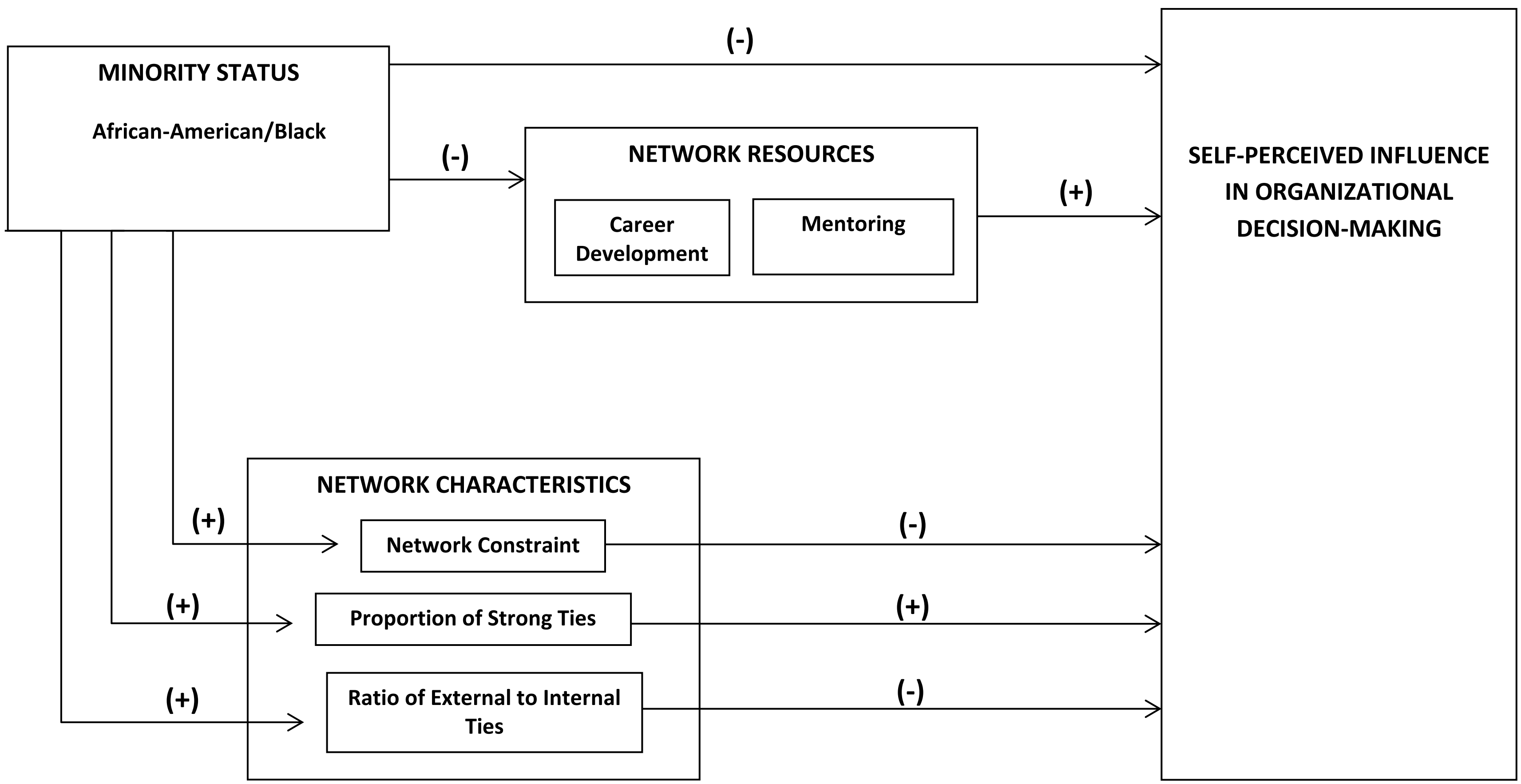
3.4 Empirical Model

Based on the previous discussion, this section details the proposed empirical model that describes the relationships among specific independent and dependent variables. At the core of this model is that influence is facilitated by social networks (Kempe et al., 2003). To review, self-perceived influence is shaped by access to social capital that can bolster performance attainments, provide constructive verbal persuasions and offer positive vicarious experiences. More specifically, it is the social capital from relationships in the forms of opportunities for learning, collaborative work, feedback, access to resources and information and alignment with other high performing colleagues that matters. Network characteristics such as network constraint, strong ties and the proportion of external to internal ties facilitate access to and flow of that social capital. This results in egos increasing their skill sets, performance, confidence, knowledge, reputations and ability to facilitate access to important resources—all of which increase their self-perception of wielding influence. However, minority faculty members tend to be isolated and marginalized, resulting in differences in their social network structure. Such variations can impact the amount and kinds of social capital that minority faculty member's access, thereby leading to differences in their self-perceived influence.

The empirical model in Figure 2 illustrates the key variables to be analyzed in the proposed research and relationships among them. The dependent variable is the faculty member's self-perceived influence in different types of organizational decisions. There are three independent variables. First is the individual faculty member's minority status, which is specifically indicated by the faculty member being an African-American/Black. Second are characteristics of the individual faculty member's professional and social network, including network constraint, number of strong ties and the proportion of external to internal ties. Lastly is the amount of various types of career development and mentoring network resources (i.e., social capital) that individual faculty have access to in their networks.

There are several other factors that may impact the development of self-perceived influence that will act as controls. First, certain STEM disciplines may have various cultural norms that shape the development of and access to social capital. Second, similar to minority groups, female faculty members may have different network characteristics and different access to social capital due to marginalization. Third, certain personalities may be more extroverted or forceful, meaning that faculty with these personality types may be more inclined to think of themselves as influential. Fourth as faculty members become more productive, they may also think of themselves to be more influential. Lastly, as an individual advances in the academic ranks they will have accrued additional experience and social capital. Thus, for the proposed research, the control variables will include the faculty member's STEM discipline, social potency, productivity, gender and rank. Based on the previous discussion, the following empirical model in Figure 2 is proposed. It illustrates the relationships between self-perceived influence and specific network, racial status and network resources.

Figure 2. Empirical Model Illustrating Relationships Among minority Status, Network Characteristics, Network Resources and Self-Perceived Influence in Organizational Decision-Making among STEM Faculty



4.0 DATA AND METHODS

4.1 Introduction

The last chapter provided a comprehensive overview of how the elements of social network structure, network resources and minority status are proposed to impact the development of self-perceived influence in organizational decision making. To reiterate, self-perceived influence is essentially the extent to which organizational actors feel valued and empowered to help shape their organizations as well as their experiences in it. This dissertation argues that extent of certain social network characteristics--particularly, strong ties, network constraint, and the external to internal tie ratio—contribute to the development of self-perceived influence by shaping its various sources including self-efficacy, reputation development and resource dependency. This dissertation asserts that minority faculty have lower levels of self-perceived influence due to marginalization within their environment due to their network structures not facilitating the acquisition of network resources. Moreover, this research also posits that differences in levels of self-perceived influence between minority and non-minority faculty can be attributed to differences in each group's social network characteristics. In particular, the dissertation asserts that the marginalization of minority faculty results in different manifestations of network characteristics where minority faculty tend to have networks that are less resource-rich, more constrained, more internally situated, and have fewer stronger ties.

This chapter provides descriptions of how variables for the presented research are measured and how they will be analyzed, as well as data illustrating the distribution of data and relevance of relationships among variables. First, there is an explanation of the survey data to be used, including how the sample frame and final sample for the data analysis was created. Second, there is a description of how the predictor variables (i.e. minority status, network characteristics, and social capital), dependent variable (i.e. self-perceived influence) and control variables (i.e. scientific discipline, productivity, and rank) are measured and operationalized. Third, there is an explanation for how missing data will be handled. Lastly, there is an overview of the various data analysis methods to be used including descriptive statistics used to provide a basic description of the sample data and path analysis to illustrate the indirect, direct and total effects of the predictor variables (i.e. minority status and network characteristics) on self-perceived influence.

4.2 Sample Development and Data Collection Process

Data for this research comes from a National Science Foundation (NSF) funded national survey of academic STEM faculty conducted in 2011 at higher education institutions in the United States[1]. In developing the sample for the research, the goals were to have a widely representative sample that would allow for significant comparisons among and within key categories including institution types, genders and racial/ethnic groups. Thus, the overall sampling strategy entailed creating a sample that contained faculty in (a) Carnegie designated

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[1] Data comes from the following project funded from the following NSF Grant: "Breaking through the Reputational Ceiling: Professional Networks as a Determinant of Advancement, Mobility, and Career Outcomes for Women and Minorities in STEM" (NSF Grant # DRL-0910191).

institutions including research extensive, research intensive, master's, women's colleges, liberal arts colleges, Hispanic serving institutions and historically black colleges and universities; and (b) scientific fields designated by the NSF as having high, low and medium female representation including biology, biochemistry, civil engineering and mathematics.

The initial sample frame was constructed by manually retrieving faculty information from online university science and engineering department directories and faculty webpages of 487 institutions. This information was subsequently placed into a population database. This database contained the faculty member's minority status[2], gender, academic position, institution type and departmental contact information. The final stratified sample frame contained 25,928 faculty members representing various combinations of the stratified categories which included gender, minority status, discipline and institution type. An additional snowball sample of 1,262 faculty was created from the names of minority alters that were named in the survey by the initial respondents. In particular, these alters were named as mentees of the faculty respondents. Upon verifying the information and characteristics of the named mentees, which included faculty rank, discipline, gender and minority status, the same survey was subsequently sent to those individuals.

The survey was administered online using Sawtooth Software™, which allowed for the complexity of the name-generator and name-interpreter questions. This software

[2] For the population build, race was categorized as either 'White' or 'Non-White'. The survey respondents were asked to verify their race in the survey based on the specific categories of White, Asian/Pacific Islander, African-American, Hispanic, Native American/Alaskan, and Other (which provided an open-ended text option).

accommodated the requirement of having no-duplicate names from the name-generator questions identifying the alters in the ego networks to be piped into to the name-interpreter questions describing the alters. Faculty members were invited to participate in the survey via a personalized email letter, which contained a personal password (which was associated with a uniquely generated password for each faculty member) and link to the online survey. Two personalized follow-up emails were also sent in order to boost the final response rate. The survey took between 30 and 45 minutes for respondents to complete.

The survey instrument contained questions regarding the academic faculty's professional background, first faculty job experience and placement process, service activities, teaching activities, research activities, productivity, workplace satisfaction, perspectives on their work and institutional environment, demographic information and psychometric measures. Significant network data were gathered as well. It is important to note that the network data from this survey is ego-centric, meaning that the data focuses on the select relationships of the respondent (i.e. ego), rather than the global network that the ego belongs to (Wasserman and Faust 1994). Network data was gathered by asking the respondents name-generator questions, which allowed them to name up to five people (i.e. network alters) for each of the following activities: talking about departmental issues with, getting advice from, and collaborating with for teaching and research purposes. Understanding the value of mentoring relationships was also very important for this research project as well. Thus, faculty were also asked in the survey to identify their mentors and mentees. From the overall network data, it was possible to categorize the alters who are in the faculty member's teaching, research, and advice networks.

Furthermore, we ask if the alters are inside or outside of the respondent's university. Thus, it is known the extent to which the respondent's collaboration networks are more externally or internally located. The survey then went a further step to create a comprehensive picture of the faculty's network by asking respondents several name-interpreter questions. This was done by piping in the unique alter's names from the name-generator questions into the name-interpreter questions. In other words, after naming up to five individuals with whom the respondent collaborated on research projects, teaching activities, and received advice from, those unique names were listed in the name-interpreter questions asking for information about those alters. In particular, respondents were asked detailed questions about the nature of their relationships with their alters, how and where they met, where they work, the kinds of resources received from them, whether or not the alters in their various networks know each other, and their demographic characteristics . This is a commonly used approach in social network analysis (Burt & Minor 1983; Straits, 2000; Marin & Wellman, 2011). Alter-level data from the survey (was aggregated and uniquely tied to each individual respondent. This provides for a rather unique survey in that both dimensions of individual-level and network-level data offers robust insight into the relationships between network factors (i.e. network type, network activity, network content, and network structure) and individual career outcomes as well as personal perceptions.

A total of 4,196 valid responses came from a random sample of 9,925 academic members stratified by sex, minority status, rank, institution type[3] and discipline. Of the 4,313 completed and partially completed surveys, 117 were removed because of ineligible rank or discipline resulting in a final total of 4,196 valid responses. Of the completed and partial responses, 3,891 were from the original sample and 196 came from the snowball sample. The completed responses yielded a total of 38,294 unique alters named. The overall response rate of the survey, which was calculated using the RR2 method of the American Association for Public Opinion Research (AAPOR), yielded a result of 42.9%. Weights were also assigned to each respondent in order to reduce bias in estimation results by assigning each respondent a probability of representing a difference part of the population (Brick and Kalton, 1996). Weights were calculated using 1/pi, where pi is the probability of the respondent being included in the sample. The probability of selection was based on how faculty members in the sample frame were stratified by institution type, field, sex, and minority status. Table I below lists the description of the overall responses.

TABLE I. OVERALL RESPONSES OF THE SURVEY DATA

Number of complete responses	3560
Number of partial or break-off with partial info	636
Number of explicit refusal	339
Number of nothing was ever returned	5551
Number of unreachable respondents	295
Number of Selected respondent screened out of sample	116
Number of ineligible for sample	117

[3] Institution type was based on the Carnegie classification system.

Table II provides the overall distribution of total number of respondents across several sample stratification categories: discipline, gender, race and institution type. The distribution of the total number of responding faculty by rank is as follows: assistant professors (27%), associate professors (33%) and full professors (39%). The distribution of scientific disciplines among the respondents is as follows: biology (34%), biochemistry (17%), civil engineering (16%), math (13%), and other fields (2%). Women comprised approximately 43% of the respondents and men made up close to 57% of the respondents. Distribution of the respondents by racial category is as follows: White (74.6%), Asian/Pacific Islander (14.2%), African-American (3.3%), Hispanic (4.0%), Native American/Alaskan Native (.5%), and other or unknown (3.5%). Distribution of the respondents by institution type is as follows: research extensive universities (51.5%), research intensive universities (15.9%), liberal arts colleges (5.9%), women's colleges (1.9%), Hispanic serving institutions (6.0%), historically black colleges and universities (3.8%), and master's institutions (15.1%). The next chapter will provide the descriptive statistics for the specific study sample used for the dissertation.

TABLE II. OVERALL DISTRIBUTION OF TOTAL NUMBER OF SURVEY RESPONDENTS

Assistant Professor	27%
Associate Professor	33%
Full Professor	39%
Biology	34%
Biochemistry	17%
Civil Engineering	16%
Mathematics	13%
Other fields	2%
Women	43%
Men	57%
White	74.60%
Asian/Pacific Islander	14.20%
African-American/Black	3.30%
Hispanic	4.00%
Native American/Alaskan Native	0.50%
Other/Unknown	3.50%
Research Extensive	51.50%
Research Intensive	15.90%
Liberal Arts Colleges	5.90%
Women's Colleges	1.90%
Hispanic Serving Institutions	6.00%
Historically Black Colleges and Universities	3.80%
Master's Institutions	15.10%

The final sample to be used for the dissertation will be based on several criteria. The first criteria requires that included faculty respondents are ones who work at research intensive or research extensive universities. The reason for including only research intensive and extensive universities is that environments at non research intensive or extensive institutions may have organizational cultures and practices, missions, institutional norms and reward or incentive criteria that can lead to variations in how minorities and non-minorities perceive their influence in decision-making. For example, the organizational environment at minority serving institutions (i.e. Hispanic serving institutions or historically black colleges and universities) may be more amenable to making minority faculty feeling more valued and inclusive in organizational decision-making. Thus, including such schools in the analysis may not allow for a demonstration of differences in the experiences and status of minority and non-minority faculty. Many research intensive and extensive universities are predominately white institutions where the representation of minority STEM faculty is rather low and where minority faculty tend to report having negative experiences and less engagement with the organization. Secondly, the final sample will include respondents who were categorized in the distinctive racial categories of African-American/Black or White, rather than those who were identified as “other” or “unknown”. This is because the construction of race is a rather complex process that historically in the United States has depended upon socio-cultural norms, legal traditions, science and personal preferences--especially for individuals of mixed-race heritage (Lopez, 1994; Smedley & Smedley, 2005). It is not uncommon for individuals identifying as belonging to at least one racial group to be considered belonging to only one racial group. For example, in the United States, the historical ‘one-drop’ rule dictated that if an individual was mixed with both black and non-black would be considered fully black and subjected to the same treatment as all African-Americans (Hickman, 1996; Davis, 2001). Lastly, all of the faculty member’s network types (collaboration, teaching, talk and advice networks) will be included in order to gain an overall picture of network dynamics, rather than focus on specific network types which would limit the ability to make generalizations about network dynamics. Based on these criteria, the sample size for the analysis will be 1,324 respondents. It is necessary to acknowledge that final sample size for analysis may be less than 1,324 due to the presence of missing data for the predictor and dependent variables. However, missing data values can be compensated for through data imputation where statistical software provides estimates of missing values resulting in what would be a complete data set of 1,324 faculty respondents. The distribution and handling of missing data will be discussed later.

4.3 Description of Measures for Dependent and Predictor Variables

4.3.1 Dependent Variables: Self-Perceived Influence in Organizational Decision-Making

As the empirical model indicates from chapter three, the dependent variable is the individual faculty member's level of self-perceived influence in organizational decision-making. This is measured by the following question on the survey: "Compared to your colleagues in your department or unit, how much influence do you have over the following decisions: ***selection of new faculty, selection of unit head, selection of reviewers for your own tenure/promotion, who receives tenure or promotion, admission of new graduate students, allocation of budget/departmental research funding, allocation of your service/committee assignments, the courses that you teach, and selection of your teaching/research assistants."*** The respondents were asked to rate their level of self-perceived influence in each decision area using the following Likert scale: ***(1) much less influence, (2) somewhat less influence, (3) about the same influence, (4) somewhat more influence and (5) much more influence.***

Because of the many decision areas, a factor analysis that included a varimax rotation was conducted on the nine decision areas to assess whether there were commonalities among them, thus allowing for broader categorizations of types of self-perceived influence. The summary of the factor analysis using principle component extraction with the rotated component matrix is in Table III below. The factor analysis yielded two factors: macro and micro level decision areas. Macro-level decisions are in the faculty member's external locus of control and essentially reflect the decisions related to broader decisions that shape the organization's environment and have implications for its overall leadership, policies, culture and values. The micro-level decisions are in the faculty member's internal locus of control and generally reflect the decisions related to factors more directly related to their personal experience and performance within the organization, but are still impacted by broader decisions made at the macro-level. The first factor (macro level decision areas) loaded the following decision areas: selection of new faculty, selection of a unit head, selection of reviewers for your own tenure and promotion, who receives tenure and promotion, and allocation of budget and departmental research funding. A reliability analysis of this first factor yielded a cronbach's alpha of .840. The second factor (micro level decision areas) loaded the remaining following decision areas: admission of new graduate students, allocation of your service/committee assignments, the courses you teach and selection of your teaching and research assistants. A reliability analysis of this second factor yielded a cronbach's alpha of .691. While the hypotheses did not specifically account for the independent variable's impact on macro or micro level decisions, the data analysis will examine potential variations between the two types of decisions. This will verify if the hypotheses are wholly or only partially supported. Table IV below summarizes the description of the dependent variable.

TABLE III. EXPLORATORY FACTOR ANALYSIS FOR WORKINFLLUENCE VARIABLES, ROTATED COMPONENT MATRIX

	Component	
	1	2
WorkInfluence-Selection of new faculty.	.767	.239
WorkInfluence-Selection of unit head.	.822	.208
WorkInfluence-Selection of reviewers for your own tenure/promotion.	.637	.098
WorkInfluence-Who receives tenure or promotion.	.795	.153
WorkInfluence-Admission of new graduate students.	.294	.516
WorkInfluence-Allocation of budget/departmental research funding.	.669	.421
WorkInfluence-Allocation of your service/committee assignments.	.484	.578
WorkInfluence-The courses that you teach.	.158	.763
WorkInfluence-Selection of your teaching/research assistants.	.055	.782

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

TABLE IV. SUMMARY OF DEPENDENT VARIABLE: SELF-PERCEIVED INFLUENCE IN ORGANIZATIONAL DECISION-MAKING

VARIABLE MEASUREMENT	**MACRO LEVEL INFLUENCE** *cronbach's alpha = .840*	**MICRO LEVEL INFLUENCE** *cronbach's alpha = .691*
Survey question: compared to your colleagues in your department or unit, how much influence do you have over the following decisions? *1 Much less influence* *2 Somewhat less influence* *3 About the same influence* *4 Somewhat more influence* *5 Much more influence*	WINF_1: Selection of new faculty	WINF_5:Admission of new graduate students
	WINF_2: Selection of unit head	WINF_7: Allocation of your service/committee assignments
	WINF_3: Selection of reviewers for your own tenure/promotion	WINF_8: The courses you teach
	WINF_4: Who receives tenure/promotion	WINF_9: Selection of your teaching/research assistants
	WINF_6: Allocation of budget/departmental research funding	

4.3.2 Predictor Variables: URM Status, Network Structure Components and Network Resources

As indicated in the empirical model chapter 3, there are three primary predictor variables. One indicates the faculty member's URM status, a second set reflects components of faculty member's network structure and a third set are associated with social capital (or network resource types) in the faculty member's network. The URM Status variable is a dichotomous variable measured as "1" (African-American/Black) or "0" (not being an African-American/Black). According to the NSF, URMs are members of racial minority groups who do not have statistical representation in the STEM fields that is comparable of the general population of minorities. As such, the NSF classifies members of the following racial minority groups as being underrepresented in the context of STEM fields: African American/Black, Hispanic/Latino, and Native American. For the proposed research, the faculty member's URM status was determined using two survey questions. For one question, "What is your race/ethnicity?", respondents could choose multiple or single selections from the following options: White, Black/African American, American Indian or Alaskan Native, Pacific Islander/Asian, or Other. A text box associated with the "Other" response option allowed faculty to provide their own answers if they did not feel the provided categories accurately or fully described their racial and ethnic background. This question generated a categorical variable labeled as Race. The following second question on the survey used to determine if the faculty respondent was of various Hispanic origins: "Do you consider yourself to be of Hispanic, Latino, or Spanish origin?", from which the faculty could respond "yes" or "no". This question generated a dichotomous variable labeled Hispanic, where "1" indicated the respondent as being Hispanic and “0” indicated the respondent being non-Hispanic. Based on these two questions, a categorical variable labeled RaceRecode was generated to capture all of the racial categories: White, Black/African American, American Indian or Alaskan Native, Pacific Islander/Asian, Hispanic, or Other. If a respondent answered “yes” to the question about having a Hispanic, Spanish, or Latino origin, they were categorized as Hispanic in the RaceRecode variable. In some instances for the first question, respondents wrote in responses for the “Other” category that were associated with the previous options. In other words, a faculty member may have indicated being from a specific ethnic group or nationality that is widely accepted as falling under a broader racial category. For example, a respondent may have specifically indicated being Nigerian, which could be broadly categorized as African-American/Black. In those instances, the RaceRecode variable was coded to reflect the broader racial category, rather than the specific ethnic group or nationality. Based on the RaceRecode variable, a final dummy variable (NotWhiteAfamBlack) was created to reflect if the respondent was categorized solely as White (coded as “0”) or African-American/Black (coded as “1”).

The predictor variables measuring structural factors in the individual faculty member’s network are based on the individuals named in their collaboration, teaching, advice and talk network. The sum of individuals named in these networks represents the total size of the faculty’s collaboration network. The total network size will be used to help calculate the specific independent network variables of interest including network constraint, strong ties and the ratio of external ties to internal ties.

As mentioned previously in chapter three, network constraint is a measure of the structural holes present in an ego's network (i.e. faculty network), which represents unconnected gaps among clusters of individuals within a network, thereby providing egos opportunities to develop social capital. Overall, network constraint reflects the distribution of time and energy invested among connections in a network and varies by network size, density and hierarchy. More constraint is present when the investment of time and energy is limited within a concentrated portion of the network. Less constraint is present when time and energy is spread out In other words, networks with more structural holes are less constrained. Based on the survey, network constraint is operationalized by the total number of unique alters named by the faculty member as belonging in their network and a survey question asking how many of those alters know each other on a personal basis. In the survey, respondents were provided a matrix of all names that they had entered in the survey through previous name generator questions and were then asked to indicate if each pair of alters knew each other on a personal basis. Thus, an overall picture is developed illustrating relationships where there are direct investments of time and energy between the ego and alter, as well as the magnitude of indirect investments of time and energy that come by way of investments among alters who subsequently transfer the outcomes of those investments to the ego. Given that network constraint is a function of network size, density and hierarchy, it is also necessary to explicate how each of these factors is calculated. As mentioned previously, network size refers to the total number of unique individuals named by the respondent's in their teaching, collaboration, advice and talk networks. Network density indicates how connected alters in the respondent's network are connected to each other and is measured by dividing the total number of ties in the collaboration network by the total number of possible ties, as follows:

Network Density = (2 * Number of Ties)/((Network Size) * Network Size−1)).

Network hierarchy measures the extent to which connections in a network are exclusively or directly tied to and dependent upon single dominant contact. Analytictech's E-Net Software™ will be used to calculate the constraint of the faculty network using the following formula:

$$C_{ij} = (P_{ij} + \sum_{q} P_{iq} P_{qj})^{2}$$

This formula comes from Burt's (1992) work on structural holes. Essentially, this equation captures the fact that ego *i* is constrained by network alter *j* to the extent that *i* provides resources to alter *q* who in turn provides resources to alter *j*. In the portion of the equation *pij = Zij / Σq Ziq*, *pij* represents the ratio of the ego's investment of resources in *j* to the subsequent investment of those resources to *q* through *j* (i.e. hierarchy). In particular, the investment of resources from *i* to *j* is represented by *Zij*. The subsequent investment of *i's* resources to *q* through *j* is captured by *Σq Piq Pqj*, which specifically represents the sum of *i*'s relation invested in *q* that is then invested in *j*. Based on the constraint equation, the function of size, density and hierarchy become more evident. Networks larger in size (i.e. containing more alters) are less constraining. Networks with greater density (i.e. more connections between alters) are more constraining. Networks with higher levels of hierarchy (i.e. more investments of time and energy stemming from a single dominant contact) are more constraining.

To reiterate from chapter three, tie strength is indicated by an emotional connection within a relationship as well as the time and energy invested in relationships. Traditionally, tie strength is measured by closeness, frequency of communication and length of time a relationship has existed. For the presented dissertation, strong ties utilize these measures by using three name interpreter survey questions about the alters named by faculty. These questions include naming alters that faculty members consider to be close friends, which is measured by a “1” (yes) or “0” (no); the frequency with which they communicated with named alters in the past academic year, which is measured by “1” (at least daily), “2” (about weekly), “3” (about monthly); “4” (less often); and how long they have known the named alters, which is measured by “1” (less than two years), “2” (between two and five years) and “3” (more than five years). To indicate strong ties based on frequency of communication and length of time known, two dummy variables were created. A frequency dummy variable was created with “1” indicating strong ties , which reflected alters with whom communication happened weekly or daily; and “0” indicating weak ties, which reflected alters with whom communication happened monthly or less often . A length dummy variable was also created with “1” indicating strong ties, which reflected alters that faculty had known at least two years; and “0” indicating weak ties, which reflected alters that faculty had known less than two years. Then, each of these dummy variables were summed to individually indicate the total amount of close friends, strong ties by frequency of communication and strong ties by length time known.

The external-internal tie index variable is the ratio of faculty’s ties outside of their institution (external) to the ties inside of their institution (internal). In other words, this variable represents the relative balance between faculty's connections to alters located in their organization and connections to alters located inside of their organization. Furthermore, this is a continuous variable ranging from "-1" (i.e. networks being completely internally situated) to "+1" (i.e. networks being completely externally situated). A measure of "0" means the faculty member has a perfect balance of external and internal connections. The following formula will be used to calculate the ratio of internal to external ties:

$$E - I \text{ index} = (ECL - ICL)/ECL + ICL).$$

ECL is the total number of external ties and ICL is the total number of internal ties.

As mentioned earlier in Chapter 3, resources that faculty attain from their network members can contribute in different ways to the development of self-perceived influence, giving rise to the notion that while not mutually exclusive, network resources can be conceptualized based on qualitative differences in what they offer. Faculty's self-perceived influence can be developed by resources that (1) provide career development opportunities for the faculty member, enhance his or her reputation and increase his or her visibility (i.e. career development resources); and (2) provide the faculty member with information as well as insights that can aid them in successfully fulfill the functional tasks expected to be executed within their organization (i.e. mentoring network resources).

Network resources were measured based on a number of name interpreter questions on the survey. In particular, faculty were asked if a named alter provided them the following resources: collaboration opportunities for developing grants, research outputs, teaching curriculum; invitations to grant teams; introductions to potential collaborators; nomination for awards; recommendation to be a speaker or panelist; and advice about various production outputs, departmental politics, working with colleagues and students, work-life balance, and collaborating in industry and government. All network resource questions were coded as binary variables with an indication of “1” (yes-resource provided) or “0” (no-resource was not provided). In order to determine how the resources received from the faculty respondents factor into being career development resources and mentoring resources, an exploratory factor analysis was done. Career development resources are characterized by their ability to facilitate professional development, productivity and reputation. Mentoring resources are characterized by advice given about how faculty can function in their organizational environment and successfully perform tasks related to their position as faculty. Table V below illustrates the results from the exploratory factor analysis of the network resources. It is important to note that while five network resources indicating the collaboration activities between the faculty member and the named alter were included in the factor analysis, these five variables were dropped because it is not clearly evident to what social capital was given during these collaborative activities. Thus, the factor analysis resulted in the network resources being mainly distributed into the two factors of mentoring and career development resources.

The factor analysis resulted in career development resources being comprised of the following resources: introduction to potential research collaborators, invitation to join a teaching or research grant proposal team, recommended you as an invited speaker/panel member, nomination for an award, provided you with research or other funding and advice about collaborating with industry or government. The following resources were factored into the mentoring network resources category: reviewed your papers or proposals prior to submission (on which they were not a co-author), advice on grant getting, advice on publishing, advice on teaching, advice on departmental politics, advice on student related issues, advice on interactions with colleagues and advice on Work/family balance. A subsequent scale reliability analysis revealed that career development and mentoring resources yielded cronbach's alpha measurements of .901 and .808 respectively, which further confirms that these variables factor well together.

TABLE V. EXPLORATORY FACTOR ANALYSIS OF NETWORK RESOURCES

Rotated Component Matrix[a]					
		Component			
		1	2	3	4
nicareer1_c1_sum	Reviewed your papers or proposals prior to submission (on which they were not a co-author)	.459	.443	.161	.007
nicareer1_c2_sum	Introduced you to potential research collaborators	.334	.687	.307	.048
nicareer1_c3_sum	Invited you to join a teaching or research grant proposal team	.213	.702	.363	.201
NICareer2_c1_sum	Nominated you for an award	.192	.621	.031	.049
NICareer2_c2_sum	Recommended you as an invited speaker/panel member	.285	.619	.206	.000
NICareer2_c3_sum	Provided you with research or other funding	.226	.539	.176	.180
NIAdvice1_c1_sum	Advice on Grant getting	.591	.426	.395	.060
NIAdvice1_c2_sum	Advice on Publishing	.656	.190	.491	-.002
NIAdvice1_c3_sum	Advice on Teaching	.753	.272	.007	.158
NIAdvice1_c4_sum	Advice on Collaborating with industry or government	.207	.653	.223	.010
NIAdvice2_c1_sum	Advice on Departmental politics	.790	.198	.123	.133
NIAdvice2_c2_sum	Advice on Student related issues	.810	.222	-.004	.218
NIAdvice2_c3_sum	Advice on Interactions with colleagues	.781	.316	.096	.148
NIAdvice2_c4_sum	Advice on Work/family balance	.671	.196	.132	.090
*nicollab_c1_sum	Collaboration on Research grant proposal	.097	.388	.681	.152
*nicollab_c2_sum	Collaboration on Teaching or curricular grant proposal	.175	.537	-.225	.364
*nicollab_c3_sum	Collaboration on Publishing one or more articles together	.136	.157	.773	.062
*nicollab_c4_sum	Co-developed curriculum or course	.223	.235	.036	.733
*nicollab_c5_sum	Co-taught a course together	.122	-.015	.167	.824

Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

*variables dropped because there is no way to tell about whether social capital was actual provided

Each of the network characteristics were aggregated at the ego level to demonstrate the extent of network constraint, level of external-internal tie orientation, total number of strong ties and total amount of each type of network resource for each faculty respondent. Table VI below summarizes the predictor variables, including the specific survey questions and measures used for each predictor variable.

TABLE VI. SUMMARY OF PREDICTOR VARIABLES: MINORITY RACIAL STATUS, NETWORK RESOURCES, NETWORK CONSTRAINT, STRONG TIES AND EXTERNAL-INTERNAL TIE RATIO

VARIABLE	SURVEY QUESTION	MEASURMENT
African-American/Black (NotWhite_Af-AmBlack)	What is your race/ethnicity?	1=Yes 0=No
Network Constraint (SHConstraint)	Of the people you have named, to the best of your knowledge, which people know each other on a personal basis?	Total sum of the degree to which each alter is connected to other network members, which is calculated by the following equation: *Cij = (pij +Σq piq pqj) 2*
Total Number of Strong Ties	Please indicate if this person is a close friend. (NIDemo1_c5_sum)	1=Yes 0=No
	How long have you known the individuals you named? (nilength_dummy_sum)	1=Less than two years, 2=2-5 years, 3=More than 5 years A subsequent dummy variable created: 1=strong ties (known for at least two years), 0=weak ties(known less than two years)

VARIABLE	SURVEY QUESTION	MEASURMENT
	How frequently were you in personal contact with these individuals? (nifreq_dummy_sum)	1=at least daily, 2=about weekly, 3=about monthly, 4=less often A subsequent dummy variable created: 1=strong ties (communicate with daily or weekly), 0=weak tie (communicate with monthly or less often)
Ratio of External to Internal Ties (inst_E-I_index)	Does the person named work in your institution?	E - I index = (ECL−ICL)/ECL+ICL)
Total Number of Career Network Resources Cronbach's alpha=.808	Please indicate if the people you named have: 1. nicareer1_c2_sum: Introduced you to potential research collaborators 2. nicareer1_c3_sum: Invited you to join a teaching or research grant proposal team 3. NICareer2_c1_sum: Nominated you for an award 4. NICareer2_c2_sum: Recommended you as an invited speaker/panel member 5. NICareer2_c3_sum: Provided you with research or other funding 6. NIAdvice1_c4_sum:Advice on Collaborating with industry or government	1=Yes 0=No

VARIABLE	SURVEY QUESTION	MEASURMENT
Total Number of Mentoring Network Resources Cronbach's alpha=.901	Generally, what advice do you typically seek from the following individuals? 1. nicareer1_c1_sum: Reviewed your papers or proposals prior to submission (on which they were not a co-author) 2. NIAdvice1_c1_sum: Advice on Grant getting 3. NIAdvice1_c2_sum: Advice on Publishing 4. NIAdvice1_c3_sum: Advice on Teaching 5. NIAdvice2_c1_sum: Advice on Departmental politics 6. NIAdvice2_c2_sum: Advice on Student related issues 7. NIAdvice2_c3_sum: Advice on Interactions with colleagues 8. NIAdvice2_c4_sum: Advice on Work/family balance	1=Yes 0=No

4.3.3 Control Variables

There are several other factors other than the ones examined in this research may impact the development of self-perceived influence among faculty and will thus serve as control variables so as to identify the isolated impacts of minority status and network characteristics. In particular, these factors can also contribute to the development of reputations and the creation of varying network components, resulting in access or barriers to social capital relevant in the creation of self-perceived influence. First, certain STEM disciplines may have various norms and values including how discipline members conduct research, extent to which they collaborate, pursue and receive rewards and more (Bonilla, 2002; Whitley, 2000; Becher, 1981). Second, female faculty members may have different network structure characteristics from their male counterparts resulting in various access to or denial of social capital (Van Emmerick, 2006; Rothstein & Davey, 1995; Parker & Welch, 2013). Third, as an individual advances in the academic ranks they will have accrued additional experience, productivity and social capital; whereas junior faculty may not have yet had the time to develop fruitful social networks and produce (Wanner et al, 1981). Fourth, as mentioned in chapter three, because of the norms of academic science that reward and recognize scientists based on their outputs, faculty with higher productivity rates may perceive themselves to be more influential not because of how their networks may provide them with resources, but solely because of the rate at which they produce knowledge and secure resources on their own. Lastly, faculty with socially dominant personalities may construe their influence to be quite high because of their tendency to exhibit dominant and extroverted behaviors such as taking the lead in situations and readily voicing their opinions (Harms et al., 2007). Thus, for the proposed research, the control variables will include the faculty member's STEM discipline, gender, rank, productivity (i.e. publications and grants) and social potency, which is a scaled variable measuring social dominance). Table VII below summarizes how each control variable is measured from the survey.

TABLE VII. SUMMARY OF CONTROL VARIABLES: FACULTY DISCIPLINE, GENDER, PRODUCTIVITY, SOCIAL POTENCY AND RANK

VARIABLE	SURVEY QUESTION OR ALTERNATE SOURCE	MEASURMENT
Faculty Discipline	What is your broad academic discipline? (biology/biochemistry, civil engineering, mathematics)	Four dummy variables for each discipline (1=Yes).
Gender	Are you (male, female)?	1=Female, 0=Male
Rank	What is your current academic rank (Assistant Professor, Associate Professor, Full Professor, Emeritus and Other)?	1=Assistant Professor, 2=Associate Professor, 3=Full Professor
Productivity	Over the past five academic years, on average how many peer-reviewed articles have you published per year?	Number provided by the respondent
	Over the past five academic years, on average how many teaching or curriculum proposals (external and internal) have you submitted per year?	Number provided by the respondent
	Over the past five academic years, on average how many research proposals have you submitted per year?	Number provided by the respondent
Social Potency	How much do you agree with each of the following statements about how you generally are now, not as you wish to be in the future? (1-Strongly Agree, 2-Agree, 3-Disagree, 4-Strongly Disagree) 1. Have a natural talent for influencing people. 2. Take charge. 3. See myself as a good leader.	Scale created by averaging the scores of each question, keeping in mind the reverse scoring for items with an "R" next to it. Higher scores indicate more socially dominant behavior.

VARIABLE	SURVEY QUESTION OR ALTERNATE SOURCE	MEASURMENT
	4. Can talk others into doing things. 5. Am good at making impromptu speeches. 6. Don't like to draw attention to myself (R) 7. Lack the talent for influencing people (R) 8. Keep in the background (R) 9. Find it difficult to manipulate others (R) 10. Have little to say (R)	

With a description of the measures used for the dependent, independent and control variables, the next section discusses missing data for each variable of interest and how it will be handled.

4.4 Missing Data

Missing data is defined as information that is not present for some or all of the observable variables of interest among the given respondent cases. Addressing missing data is imperative when conducting analysis because not doing so means a reduction of statistical power and an increase in the bias in the parameter estimates, therefore yielding results that are less valid and generalizeable (Allison, 2001). Additionally, many statistical procedures assume complete data. A common approach to handle missing data has been to remove missing data through common techniques such as listwise or pairwise deletion, which can be easily done with statistical software; or using a variety of imputation techniques (Scheffer, 2002). But what is considered too much missing data? Unfortunately, there is little consensus regarding the amount of missing data that is considered problematic and would therefore yield bias results from statistical analysis. Schlomer et al. (2010) report that experts provide various thresholds at which missing data is problematic, ranging from 5% to 20%. Thus, the first step in determining how to handle missing data is to examine the extent and pattern of missing data and whether or not that pattern is at random (i.e. the probability of an observation being missing does not depend upon the presence or absence of another observation). Then, based on the results from analyzing the missing data, the second step is to determine whether or not a specific deletion or imputation technique to be used. Lastly, separate SEM analysis based on the proposed model can be run using the missing and non-missing data to determine if there are any significant differences in resulting estimations, which will verify the validity of the model and detect any bias.

4.4.1 Extent and Pattern of Missing Data

Table VIII provides the extent of present and missing values among the study sample for the variables of interest, including both types of self-perceived influence, various network resources, network size, network density, network constraint, external-internal ratio and various measures for tie strength. It is important to note that because the sub-sample used for analysis purposefully selected respondents who were coded for belonging to specific racial categories, there is no missing data for to the racial categories. From table x, it evident that the extent of missing cases for the variables of interest among the study sample is between 0% and 23%. For the variables representing macro level self-perceived influence, between 16.6% and 23.6% of cases are missing. For the variables representing micro level self-perceived influence, between 17.7% and 22.1% of the data are missing. No more than 10% of the data are missing for the career development network resources and only between 10.5% and 11.5% of the data are missing for the mentoring network resources. Approximately 7% of cases have data missing for the external-to-internal ratio variable. For network constraint, close to 9% have cases with missing data. Among the variables indicating tie strength, only between 8.4% and 9.4% of the cases are missing.

TABLE VIII. PERCENTAGE OF MISSING AND OBSERVED DATA FOR KEY VARIABLES

	N	%Observed	%Missing
MACRO LEVEL SELF-PERCEIVED INFLUENCE			
WorkInfluence_r1	1104	80.1%	16.6%
WorkInfluence_r2	1091	78.6%	17.6%
WorkInfluence_r3	1012	69.2%	23.6%
WorkInfluence_r4	1082	77.6%	18.3%
WorkInfluence_r6	1080	77.4%	18.4%
MICRO LEVEL SELF-PERCEIVED INFLUENCE			
WorkInfluence_r5	1050	73.9%	20.7%
WorkInfluence_r7	1091	78.6%	17.6%
WorkInfluence_r8	1089	78.4%	17.7%
WorkInfluence_r9	1032	71.7%	22.1%
CAREER DEVELOPMENT NETWORK RESOURCES			
NIAdvice1_c4_sum	1181	87.9%	10.8%
nicareer1_c2_sum	1185	88.3%	10.5%
nicareer1_c3_sum	1185	88.3%	10.5%
NICareer2_c1_sum	1181	87.9%	10.8%
NICareer2_c2_sum	1181	87.9%	10.8%
NICareer2_c3_sum	1181	87.9%	10.8%
MENTORING NETWORK RESOURCES			
nicareer1_c1_sum	1185	88.3%	10.5%
NIAdvice1_c1_sum	1181	87.9%	10.8%
NIAdvice1_c2_sum	1181	87.9%	10.8%
NIAdvice1_c3_sum	1181	87.9%	10.8%
NIAdvice2_c1_sum	1172	87.0%	11.5%
NIAdvice2_c2_sum	1172	87.0%	11.5%
NIAdvice2_c3_sum	1172	87.0%	11.5%
NIAdvice2_c4_sum	1172	87.0%	11.5%
SHConstraint	1206	90.2%	8.9%
inst_EI_Index	1222	91.7%	7.7%
STRONG TIES			
NIDemo1_c5_sum	1210	90.6%	8.6%
nifreq_dummy_sum	1200	89.7%	9.4%
nilength_dummy_sum	1213	90.8%	8.4%
NotWhite_AfAmBlack	1324	100.0%	0.0%

As mentioned previously, there is no consensus concerning the acceptable amount of missing data for a variable, where the deletion of the variable is necessary. However, according to some researchers, 20% of missing data is an acceptable threshold at which it is not necessary to remove variables (Peng et al.,2006; Roth, 2004). The table above shows that the percentage of missing data in the dissertation study sample fulfills this criteria. However, even though among the macro and micro level self-perceived influence there are a few indicator variables that are over this 20% threshold, it is still worthwhile to keep these variables given that they factor together well. Thus, rather than removing any of the variables, it is more useful to determine how to handle the missing data with imputation.

Before employing imputation or deletion techniques, there will be an analysis of the pattern of missing data to determine if it is at random. The extent of randomness will indicate how the missing data should be treated. The randomness of missing data is generally assessed using three criteria. Treiman (2009) provides succinct definitions of each. First, there is missing-completely-at-random (MCAR), where “missing responses to a particular variable are independent of the values of any other variable” (p. 182). Then, there is missing at random (MAR), where missing data is “independent of the true value of the variable in question but not of at least some of the other variables in the explanatory model and of the true value of the variable in question” (ibid). Lastly, there is missing not at random (MNAR) or nonignorable (NI), where missing data “depends on the true value of the variable in question and possibly other variables as well” (ibid). Statistical software packages offer a missing value analysis tool that can reveal the extent of randomness in the given data set. The missing data analysis (MDA) tool in the SPSS software package will be used. This tool provides an analysis based on both categorical and quantitative variables. For the present research, the network related and self-perceived influence variables are the quantitative (i.e. scale) variables and the racial variables are the categorical variables. There are a number of options that the MDA tool uses to identify and confirm the pattern of missing data. In particular, it utilizes the separate-variance t-test, which determines whether or the pattern of missing data influences the presence or absence of data for other variables. Results from a t-test can be the initial step in determining randomness of missing data. Next, the MDA tool provides a visual display of missing data to illustrate the extent to which pairs of data points are missing, in other words if data appears to be jointly missing for multiple variables. Lastly, the MDA tool conducts estimates means, covariances and correlations for missing data based on different methods including listwise (where cases with data for all variables is used); pairwise (where cases with data for pairs of variables is used); multiple regression analysis with estimated values; and expected maximization (EM) where the expected value of missing data is first computed and then the maximum likelihood estimate is provided based on the expected value. The EM method provides results from Little's MCAR test, which ultimately confirms whether or not the missing data pattern is MCAR. In the interest of being succinct, the results from EM estimations with Little's MCAR test will be provided only. Tables IX-XI below provides the EM mean, covariance and correlation estimates with Little's MCAR test below.

TABLE IX. EM MEANS WITH LITTLE'S MCAR TEST

VARIABLE	EM MEAN
WorkInfluence_r1	2.91
WorkInfluence_r2	2.82
WorkInfluence_r3	2.79
WorkInfluence_r4	2.65
WorkInfluence_r5	2.91
WorkInfluence_r6	2.40
WorkInfluence_r7	2.85
WorkInfluence_r8	3.30
WorkInfluence_r9	3.17
nicareer1_c1_sum	2.01
nicareer1_c2_sum	2.26
nicareer1_c3_sum	2.14
NICareer2_c1_sum	0.97
NICareer2_c2_sum	1.57
NICareer2_c3_sum	1.25
NIAdvice1_c1_sum	2.75
NIAdvice1_c2_sum	2.64
NIAdvice1_c3_sum	2.66
NIAdvice1_c4_sum	0.89
NIAdvice2_c1_sum	3.08
NIAdvice2_c2_sum	2.86
NIAdvice2_c3_sum	2.79
NIAdvice2_c4_sum	1.43
SHConstraint	0.33
inst_EI_Index	0.00
NIDemo1_c5_sum	2.69
nifreq_dummy_sum	3.79
nilength_dummy_sum	8.75

a. Little's MCAR test: Chi-Square = 1756.714, DF = 1564, Sig. = .000

TABLE X. EM COVARIANCE ESTIMATES WITH LITTLE'S MCAR TEST

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	WorkInfluence_r1	1.055														
2	WorkInfluence_r2	.720	.963													
3	WorkInfluence_r3	.332	.407	.825												
4	WorkInfluence_r4	.649	.647	.477	1.236											
5	WorkInfluence_r5	.372	.317	.204	.309	1.238										
6	WorkInfluence_r6	.668	.618	.376	.712	.497	1.255									
7	WorkInfluence_r7	.467	.464	.330	.524	.351	.683	1.004								
8	WorkInfluence_r8	.341	.303	.229	.353	.234	.404	.475	.913							
9	WorkInfluence_r9	.290	.290	.181	.246	.340	.345	.310	.405	.998						
10	nicareer1_c1_sum	-.016	.089	.072	-.070	.158	.045	.111	.018	.109	5.14027					
11	nicareer1_c2_sum	.092	.161	.071	.025	.355	.132	.072	.049	.163	3.02970	7.00973				
12	nicareer1_c3_sum	.162	.207	.086	.184	.367	.199	.079	.180	.233	2.25366	4.05833	5.53238			
13	NICareer2_c1_sum	.196	.219	.128	.223	.232	.217	.118	.120	.163	1.01926	1.48622	1.25379	1.82836		
14	NICareer2_c2_sum	.195	.250	.079	.331	.269	.194	.124	.140	.123	1.97129	2.96969	2.39291	1.19167	4.18635	
15	NICareer2_c3_sum	.011	.069	.042	.051	.090	.080	.058	.024	.090	1.26152	2.04131	2.11132	.59362	1.21170	2.74348

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	NIAdvice1_c1_sum	.098	.188	-.004	-.147	.344	-.001	-.009	-.035	.145	3.41639	4.53568	3.70984	1.29571	2.67735	1.98561
17	NIAdvice1_c2_sum	.095	.132	.027	-.085	.333	.050	.014	-.070	.118	3.15677	3.65233	2.60874	1.06887	2.34890	1.46747
18	NIAdvice1_c3_sum	-.007	.133	.043	-.028	.031	.009	.053	.012	.041	2.52961	3.19970	2.67003	.96142	1.92979	1.53496
19	NIAdvice1_c4_sum	.047	.116	-.007	.050	.224	.047	.011	.063	.100	1.28577	2.56967	2.18404	.85794	1.41847	1.08868
20	NIAdvice2_c1_sum	.237	.308	.159	.257	.202	.331	.217	.187	.131	2.27486	2.74641	2.38832	1.05719	1.89425	1.37238
21	NIAdvice2_c2_sum	.203	.241	.068	.251	.124	.197	.159	.121	.074	2.32774	2.90723	2.36473	1.09276	1.86419	1.50290
22	NIAdvice2_c3_sum	.239	.260	.078	.341	.287	.286	.184	.135	.143	2.97473	3.76140	3.02222	1.41614	2.71514	1.96140
23	NIAdvice2_c4_sum	-.015	.020	.019	-.103	.139	.015	-.006	.035	.112	1.54820	2.11615	1.79550	.76943	1.22004	.84048
24	SHConstraint	-.020	-.020	-.014	-.017	-.017	-.026	-.014	-.011	-.007	-.08131	-.11164	-.10783	-.03731	-.08027	-.05046
25	inst_EI_Index	-.029	-.044	-.012	-.025	-.027	-.035	-.027	-.035	-.022	-.01645	-.03255	-.10856	-.03563	.02992	-.03810
26	NIDemo1_c5_sum	.251	.391	.256	.484	.210	.396	.326	.258	.102	2.30566	2.88691	2.13500	1.12265	1.93672	1.12405
27	nifreq_dummy_sum	.516	.551	.302	.577	.375	.659	.416	.354	.257	1.72232	2.37783	2.25079	.97309	1.48464	1.09139
28	nilength_dummy_sum	.709	.842	.668	.972	.587	.904	.513	.349	.320	3.46703	5.08994	4.56622	1.92230	3.71887	2.31556

TABLE X, CONT'D. EM COVARIANCE ESTIMATES WITH LITTLE'S MCAR TEST

		16	17	18	19	20	21	22	23	24	25	26	27	28
16	NIAdvice1_c1_sum	8.02034												
17	NIAdvice1_c2_sum	5.55523	7.47867											
18	NIAdvice1_c3_sum	4.46229	4.06571	7.04829										
19	NIAdvice1_c4_sum	2.49476	1.66861	1.76768	3.19502									
20	NIAdvice2_c1_sum	3.72429	3.50050	3.83777	1.36741	6.04019								
21	NIAdvice2_c2_sum	3.98597	3.58607	4.63471	1.63693	4.44963	6.86457							
22	NIAdvice2_c3_sum	4.66216	4.27905	4.48282	2.03233	5.04709	5.57531	8.25889						
23	NIAdvice2_c4_sum	2.65323	2.37659	2.55042	1.18784	2.62183	2.73624	3.35141	3.91965					
24	SHConstraint	-.14436	-.12216	-.11048	-.05288	-.12595	-.12072	-.13892	-.06733	.023230				
25	inst_EI_Index	-.12295	-.01088	-.21996	-.03441	-.24495	-.24455	-.12394	-.06864	.000838	.1562			
26	NIDemo1_c5_sum	2.76543	2.71219	2.59293	1.33164	2.75101	3.09126	3.73006	1.99507	-.132442	-.0360	7.46505		
27	nifreq_dummy_sum	2.90475	2.68231	3.02101	1.23423	3.19526	3.34378	3.25436	1.78265	-.159787	-.3271	3.12357	6.29059	
28	nilength_dummy_sum	5.97923	5.57200	5.08178	2.32820	5.78429	5.79399	6.57729	3.16880	-.422240	-.2701	6.08008	6.77955	17.30756

a. Little's MCAR test: Chi-Square = 1756.714, DF = 1564, Sig. = .000

TABLE XI. EM CORRELATION ESTIMATES WITH LITTLE'S MCAR TEST

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	WorkInfluence_r1	1														
2	WorkInfluence_r2	.714	1													
3	WorkInfluence_r3	.356	.457	1												
4	WorkInfluence_r4	.568	.593	.472	1											
5	WorkInfluence_r5	.325	.290	.201	.250	1										
6	WorkInfluence_r6	.581	.562	.369	.572	.399	1									
7	WorkInfluence_r7	.454	.472	.363	.470	.315	.609	1								
8	WorkInfluence_r8	.347	.323	.264	.333	.220	.378	.496	1							
9	WorkInfluence_r9	.282	.296	.199	.222	.306	.309	.310	.425	1						
10	nicareer1_c1_sum	-.007	.040	.035	-.028	.063	.018	.049	.008	.048	1					
11	nicareer1_c2_sum	.034	.062	.030	.009	.120	.044	.027	.020	.062	.505	1				
12	nicareer1_c3_sum	.067	.090	.040	.070	.140	.076	.034	.080	.099	.423	.652	1			
13	NICareer2_c1_sum	.141	.165	.104	.148	.154	.143	.087	.093	.121	.332	.415	.394	1		
14	NICareer2_c2_sum	.093	.125	.043	.146	.118	.085	.060	.072	.060	.425	.548	.497	.431	1	
15	NICareer2_c3_sum	.006	.043	.028	.028	.049	.043	.035	.015	.055	.336	.465	.542	.265	.358	1

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	NIAdvice1_c1_sum	.034	.067	-.002	-.047	.109	.000	-.003	-.013	.051	.532	.605	.557	.338	.462	.423
17	NIAdvice1_c2_sum	.034	.049	.011	-.028	.109	.016	.005	-.027	.043	.509	.504	.406	.289	.420	.324
18	NIAdvice1_c3_sum	-.002	.051	.018	-.009	.011	.003	.020	.005	.015	.420	.455	.428	.268	.355	.349
19	NIAdvice1_c4_sum	.026	.066	-.004	.025	.112	.023	.006	.037	.056	.317	.543	.519	.355	.388	.368
20	NIAdvice2_c1_sum	.094	.128	.071	.094	.074	.120	.088	.080	.053	.408	.422	.413	.318	.377	.337
21	NIAdvice2_c2_sum	.076	.094	.029	.086	.043	.067	.060	.048	.028	.392	.419	.384	.308	.348	.346
22	NIAdvice2_c3_sum	.081	.092	.030	.107	.090	.089	.064	.049	.050	.457	.494	.447	.364	.462	.412
23	NIAdvice2_c4_sum	-.008	.010	.011	-.047	.063	.007	-.003	.019	.057	.345	.404	.386	.287	.301	.256
24	SHConstraint	-.130	-.132	-.103	-.102	-.098	-.155	-.090	-.074	-.048	-.235	-.277	-.301	-.181	-.257	-.200
25	inst_EI_Index	-.072	-.113	-.033	-.056	-.061	-.078	-.069	-.094	-.056	-.018	-.031	-.117	-.067	.037	-.058
26	NIDemo1_c5_sum	.090	.146	.103	.159	.069	.129	.119	.099	.037	.372	.399	.332	.304	.346	.248
27	nifreq_dummy_sum	.200	.224	.133	.207	.134	.234	.166	.148	.102	.303	.358	.382	.287	.289	.263
28	nilength_dummy_sum	.166	.206	.177	.210	.127	.194	.123	.088	.077	.368	.462	.467	.342	.437	.336

TABLE XI, CONT'D. EM CORRELATION ESTIMATES WITH LITTLE'S MCAR TEST

		16	17	18	19	20	21	22	23	24	25	26	27	28
16	NIAdvice1_c1_sum	1												
17	NIAdvice1_c2_sum	.717	1											
18	NIAdvice1_c3_sum	.593	.560	1										
19	NIAdvice1_c4_sum	.493	.341	.372	1									
20	NIAdvice2_c1_sum	.535	.521	.588	.311	1								
21	NIAdvice2_c2_sum	.537	.500	.666	.350	.691	1							
22	NIAdvice2_c3_sum	.573	.544	.588	.396	.715	.740	1						
23	NIAdvice2_c4_sum	.473	.439	.485	.336	.539	.528	.589	1					
24	SHConstraint	-.334	-.293	-.273	-.194	-.336	-.302	-.317	-.223	1				
25	inst_EI_Index	-.110	-.010	-.210	-.049	-.252	-.236	-.109	-.088	.014	1			
26	NIDemo1_c5_sum	.357	.363	.357	.273	.410	.432	.475	.369	-.318	-.033	1		
27	nifreq_dummy_sum	.409	.391	.454	.275	.518	.509	.452	.359	-.418	-.330	.456	1	
28	nilength_dummy_sum	.507	.490	.460	.313	.566	.532	.550	.385	-.666	-.164	.535	.650	1

a. Little's MCAR test: Chi-Square = 1756.714, DF = 1564, Sig. = .000

The results from Little's MCAR test indicate that there are significant differences at the $p<.01$ level between the missing and present values of means, covariances and correlations, all of which indicates that the missing data is not MCAR (i.e. the pattern of missing data significantly depends upon the data values). However, it is possible that the data could fit the other patterns of MAR or NMAR. However, there are no tests that can accurately determine significant differences in missing and non-missing data and thereby assess for the presence of these two other patterns. Nonetheless, it is recommended that because the data is not MCAR, listwise nor pairwise deletion should be employed (Schlomer et al., 2010; Treiman, 2009); rather an imputation technique should be used, which as mentioned previously involves providing values for missing data.

4.4.2 Handling Missing Data with Multiple Imputation

Imputation essentially involves providing an estimate for a missing value that is based on present values for variables in a dataset. There are a number of imputation techniques that are available in order to retain the sample size by including cases with partial and complete data in analysis, which would therefore ensure statistical power and reduce bias in parameter estimates (De Leeuw et al., 2003; Scheffer, 2002). For the presented dissertation, the multiple imputation (MI) technique will be used. Multiple imputation has been largely identified as the gold-standard for handling missing data, especially for large survey sets (Langkamp et al., 2010; Treinman, 2009; Schlomer et al, 2010). In particular, Langkamp et al. (2011) assert that MI is a superior imputation technique with large survey data sets where more than 10% of the data is missing, which is true for the data used in the presented dissertation. The MI technique essentially involves three steps. First, equations are estimated based on existing values of variables. Next, values are randomly picked based on the predicted distribution and then substituted for the missing value. This process is done several times to ensure that variables with missing values are not among the predictor variables for other variables, resulting in updated values for the predictor variables. In this second step, several data sets are created. Lastly, parameter estimates are created for each data set and then averaged together to create one final unbiased data set where the once missing values now have data. The advantage of MI is that it does not necessarily assume randomness in the missing data pattern (Graham et al., 2007), which is beneficial in the case of the presented research where MCAR is not present and there is no definitive test to confirm MAR or MNAR. Additionally, the MI technique yields unbiased standard errors and coefficients due to the values being an average across multiple data sets, therefore accounting for uncertainty in each imputed estimate and variations across the estimated coefficients. In short, MI results in greater precision and less bias in standard errors and coefficients, which subsequently yields more precise statistical inferences. In general, the drawback attributed to MI is its complexity and time intensive effort to specify models used for estimating missing values and then repeating the cycle to create several data sets, which then requires additional computation to get averages (Schlomer et al., 2010). However, the SPSS software used for analysis in the presented dissertation is equipped with a multiple imputation tool that automates the process. Table XII on the next page summarizes the amount of imputed values for each variable. It is important to note that the African-American/Black, female, assistant professor, associate professor, biology, biochemistry, civil engineering and mathematics variables did not have any missing values, meaning no imputation was necessary for them. Descriptive statistics for the imputed data can be found in Appendix B.

TABLE XII. SUMMARY OF THE AMOUNT OF VALUES IMPUTED FOR EACH VARIABLE WITH MISSING VALUE

Variable	**Number of Imputed Values**
External Internal Index	97
Constraint	110
Strong Ties	
Length of time known	105
Close Friends	107
Frequency of Communication	117
Career Development Network Resources	
Introduced you to potential research collaborators	132
Invited you to join a teaching or research grant proposal team	132
Nominated you for an award	135
Recommended you as an invited speaker/panel member	135
Provided you with research or other funding	135
Mentoring Network Resources	
Reviewed your papers or proposals prior to submission (on which they were not a co-author)	132
Advice on Collaborating with industry or government	135
Advice on Grant getting	135
Advice on Publishing	135
Advice on Teaching	135
Advice on Departmental politics	144
Advice on Student related issues	144
Advice on Interactions with colleagues	144
Advice on Work/family balance	144
Macro Level Self-Perceived Influence	
Selection of new faculty.	207
Selection of unit head.	220
Allocation of your service/committee assignments.	220
The courses that you teach.	222
Who receives tenure or promotion.	229
Allocation of budget/departmental research funding.	232
Admission of new graduate students.	261
Selection of your teaching/research assistants.	278
Selection of reviewers for your own tenure/promotion.	296
Control Variables	
Average Peer Reviewed Publications (articles)	299
Average Research Grants Submitted	336
Average Teaching Grants Submitted	448
SocialPotency	302

4.5 Data Analysis Methods

First, univariate statistics will be given to provide an overall picture of the distribution of data in specific study sample used for analysis. In particular, descriptive statistics will be given (i.e. mean and standard deviation) as well as central tendency values related to the mode and median. Second, bivariate statistics in the form of correlations will be provided to illustrate the directionality and extent of strongly significant relationships present among the variables of interest. Third, given that there are several hypothesized indirect and direct relationships between self-perceived influence and social network structure, racial minority status and network resources, path analysis—which is a form of structural equation modeling (SEM)-- will be used for the primary statistical analysis. This method is appropriate because "the paths can be represented by a set of equations predicting each of the outcomes in turn. The relationships among the equations can be explored to yield insights regarding the relative importance of different paths linking the variables" (Treiman, 2009). This method is an extension of multiple regression analysis, but with additional benefits. In particular, path analysis can simultaneously compare the strength of the direct and indirect relationships presented in proposed models with multiple independent variables and a single dependent variable. Essentially, path analysis can support (or disconfirming) the validity of the unique proposed theoretical framework proposing the direct and indirect pathways between predictor and dependent variables. Additionally, this method can confirm the validity and strength of observed variables and the possible impact of latent constructs (i.e. variables or processes that are not observable in the data set). The simultaneous comparison of relationships, the confirmation of validity and strength of constructs and presence of potential latent variables renders the use of path analysis more valuable for this research than using logistic regression analysis alone, which can only assess the impact of one response variable at a time. Edwards and Lambert (2007) summarize the following general assumptions underlying the use of path analysis:

> "(a) variables are measured without error; (b) residuals are normally distributed with zero mean and constant variance; (c) residuals are uncorrelated with one another and with the predictor variables in the equation in which each residual appears; (d) relationships among variables are unidirectional, thereby ruling out reciprocal relationships and feedback loops; (e) relationships among variables are additive and linear" (p.7)

It is important to note that path analysis does not necessarily determine causality among the variables, but rather the extent to which certain relationships (or paths) are supported in the hypothesized model. In other words, path analysis "yields estimates of relationships among variables under the assumption that the causal structure of these relationships is correctly specified" (Edwards and Lamberts 2007, p.7).

SEM analysis will be done to conduct the path analysis. There are several general steps to conducting path analysis that will be executed for the present research using SPSS AMOS Software™. To initiate the SEM analysis, it is first necessary to specify the path diagram with exogenous and endogenous variables, which is based upon the empirical model provided in chapter three and is posted again at the end of this chapter. Exogenous variables are variables from the observed data set that are caused by factors external to the model and are used to explain the other variables or outcomes in the model, and can thus be considered independent (or predictor) variables. Endogenous variables are variables from the observed data set that are the result of other variables in the model, and can thus be considered dependent variables. As part of depicting the path diagram, it is also necessary to denote the presence of error terms for each endogenous variable. Error terms are extraneous residual variables not in the hypothesized model that can also explain the endogenous variables. Second, a correlation matrix is generated based on weighted data from the study sample to indicate the significance and directionality of relationships between the exogenous and endogenous variables. Third, equations with beta coefficients are created to reflect the hypothesized relationships between the variables and error terms. As part of this step, as an extension of the initial exploratory factor analysis, a confirmatory factor analysis will be conducted to determine if the observed variables designated to reflect certain latent variables do in fact accurately account for those latent variables. Unlike exploratory factory analysis, which determines the factoring of variables for certain constructs based upon theoretical notions, confirmatory factor analysis assesses factoring based upon hypothesized relationships. For this dissertation, confirmatory factor analysis will be conducted among the following three latent variables: tie strength (testing the validity of using the observed variables including close friends, communication frequency and length known), network resources (testing the validity of using the observed variables used for career development and mentoring network resources) and two different types of self-perceived influence. Fourth, the proposed measured model is estimated using multiple regression analysis to solve for the path coefficients and assess the extent to which the hypothesized model is supported and properly identified. As part of this estimation, the total effects of the predictor variables on the dependent variable are determined, which is the sum total of the direct and indirect effects. Lastly, several indices are used to examine the "goodness of fit" of the hypothesized model and re-specified models to the observed data. Moreover, path analysis will be used on both the original data set with missing data and data set with the imputations in order to assess for any significance in findings from each set of estimations for the direct and indirect paths. The next chapter provides the findings of the research based on the data analysis and SEM method used to analyze the study sample as well as a summary of how the findings support or disconfirm the proposed hypotheses and one proposition.

5.0 FINDINGS

5.1 Introduction

This dissertation aims to understand the extent to which STEM faculty feel influential in their organizations (i.e. academic departments) as a result of their racial status and characteristics found in their individual social networks. This inquiry can shed light on the extent to which STEM faculty feel empowered to influence their organizational environment and their experiences in it, especially in the context of reputational gains, which is highly valued in the academic STEM culture. This study specifically aims to understand how self-perceived influence varies among STEM faculty based on their racial status (i.e. African-American/Black vs. White STEM faculty), social network resources, network constraint, tie strength among network connections and the extent to which network connections are internally or externally located in relation to the faculty member's institution. Understanding the role of race in self-perceived influence can contribute to understanding how historically marginalized groups can enhance their status in the academic STEM setting. Lastly, this study aims to understand how the aforementioned network characteristics vary by racial status, which can provide useful insight into the nature of minority networks.

Several hypotheses have been developed proposing how race and social network characteristics directly and indirectly shape self-perceived influence. These hypotheses were based upon the previous literature review that first discusses how reputations and influence are developed and used in the academic STEM culture and connected those values to a conceptualization of self-perceived influence which was based upon power theories, self-efficacy theory, resource dependency theory and reputation development theory. At the core of this model is that self-perceived influence is shaped by social networks (Kempe et al, 2003). To review, self-perceived influence is shaped by access to social capital that can bolster performance attainments, provide constructive verbal persuasions and offer positive vicarious experiences. More specifically, it is the social capital from relationships in the forms of opportunities for learning, collaborative work, feedback, access to resources and information and alignment with other high performing others that matters. Network characteristics such as network constraint, strong ties and the proportion of external to internal ties facilitate access to and flow of that social capital. It is expected that this results in egos increasing their skill sets, performance, confidence, knowledge, reputations and ability to facilitate access to important resources, all of which increase their self-perception of wielding influence. However, minority faculty members tend to be isolated and marginalized, which is expected to result in them having differing network structures than non-minority faculty. Such variations may impact the amount and kinds of social capital that minority faculty member's access, thereby leading to differences in their self-perceived influence.

Hence, social network theory is utilized to explain how certain social network characteristics can help build STEM faculty's network resources that can develop their self-efficacy, resource dependency and reputation, thereby shaping their self-perceived influence. Finally, critical race theory and experiences of minority faculty were reviewed to highlight how race can impact access the structure of minority faculty networks, thereby impacting their access to social network resources that shape self-perceived influence of minority faculty members.

Based upon the data and measures that were reviewed in the previous chapter, this chapter starts by providing an empirical model upon which the findings will be based. This chapter will present results from descriptive statistics, correlation analysis, confirmatory factor analysis and structured equation modeling (SEM) to illustrate the indirect, direct and total effects of race and social network characteristics upon self-perceived influence. Most importantly, findings from four models will be presented. One model will predict macro level self-perceived influence using network resources grouped into one latent variable. A second similar model will be used to predict micro level self-perceived influence. A third model will predict macro level self-perceived influence with network resources grouped into mentoring and career development resources. A fourth model is similar to the third model, except it predicts micro level self-perceived influence. The purpose of differentiating between the construction of network resources and separating out the types of self-perceived influence is to do determine the extent to which different resources may or may not specifically illustrate differences in how they predict different types of self-perceived influence.

5.2 Empirical Models

Figures 2a and 2b below illustrate the hypothesized relationships in two empirical models: one model (Figure 2a) compiles all of the network resources together, and a second model (Figure 2b) groups the network resources into career development network resources and mentoring network resources. It is expected that the hypotheses will behave consistently between both types of models. There are two sets of hypotheses. First, there are hypothesized relationships between several independent variables including the faculty member's minority status, several structural characteristics of their networks (i.e. network constraint, external-internal index and tie strength) and social network resources) and dependent variables (i.e. macro level and micro level self-perceived influence). Second, there are hypothesized relationships between the independent variable of racial minority status and the dependent variables of network resources and network structure characteristics.

It is important to note that several important features of the models. First, individual hypotheses are not created for each type of self-perceived influence because there are qualitative differences between the types of self-perceived influence and it is important to see if the predictor variables consistently account for these differences. Second, there are no specific hypotheses detailing how tie strength, network constraint and external-internal tie ratio impact network resources because the impacts of the already hypothesized relationships between structure and self-perceived influence are based on the mediating impacts of network structure (see Chapter 3). Lastly, while it may seem that the overall network size alone can greatly impact the availability of network resources and subsequently expected to impact self-perceived influence, network size will not be isolated in the model as a predictor variable. The reason for this is because the focus of the dissertation is to understand the role of structural holes in providing social capital, which has been empirically proven to be effectively accounted for through the interactive effects of network size, density and constraint (see Chapter 3).

Figures 2a and 2b illustrate variables as either squares or ellipses. Variables in squares are observed directly from the dataset, whereas variables in ellipses are unobserved (or latent) constructs that are developed from observed data. The unobserved constructs are represented by several observed constructs, which are not illustrated in the model. However, as part of the SEM analysis, confirmatory factor analysis (CFA) will be conducted later to indicate the extent to which the unobserved constructs are strongly indicated by the selected observed variables.

The hypotheses and proposition in the model are denoted by the bolded and numbered 'H' titles on the black arrows. The first set of hypotheses (H1-H4) illustrates the proposed relationships between network resources and structural characteristics on self-perceived influence. There are expected direct effects between more network resources (H1), less network constraint (H2), greater tie strength (H3) and lower external-internal index (H4). The greyed arrows from the network structure characteristics to the network resources will not be hypothesized, but do indicate that network resources are shaped by greater network strength, less constraint and lower external-internal index.

The second set of hypotheses illustrates the proposed direct relationship between minority status and lower self-perceived influence (H5), minority status and fewer network resources (H6), minority status and constraint higher ratio of external to internal ties (H7), minority status and higher external-internal index (H8), minority status and greater tie strength (H9). In addition to the direct relationship between minority status and self-perceived influence, there are expected indirect relationships whereby the impact of minority status on self-perceived influence is mediated by network resources and network structure characteristics. However, proposition one (P1) indicates the direct effect of the faculty's minority status on their self-perceived influence is expected to be greater than the indirect effects of their social network resources and network structure.

Figure 2a. Empirical Model Grouping All Network Resources in Single Variable

(greyed arrows are not formally hypothesized but represent expected impacts between network resources and structure variables)

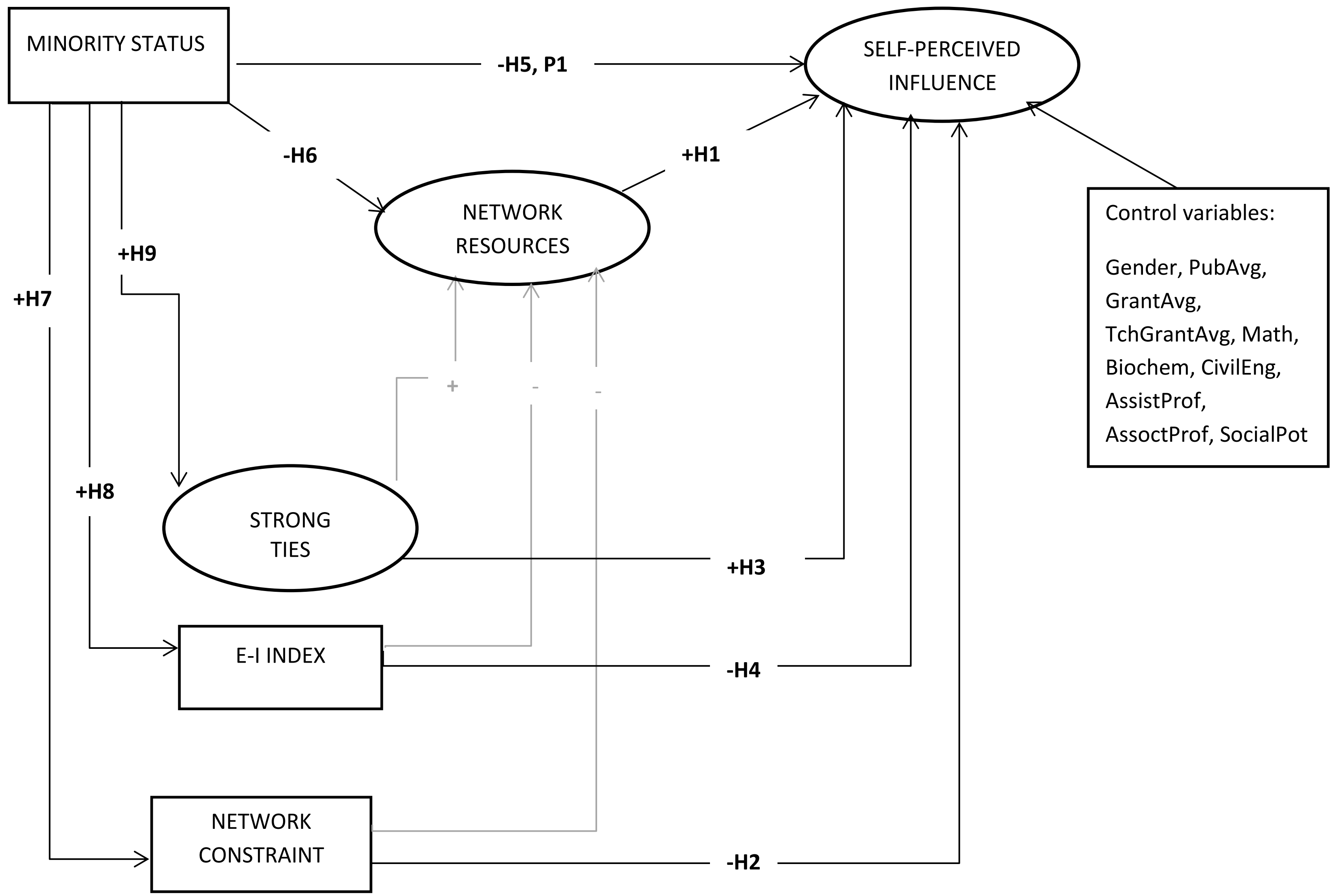
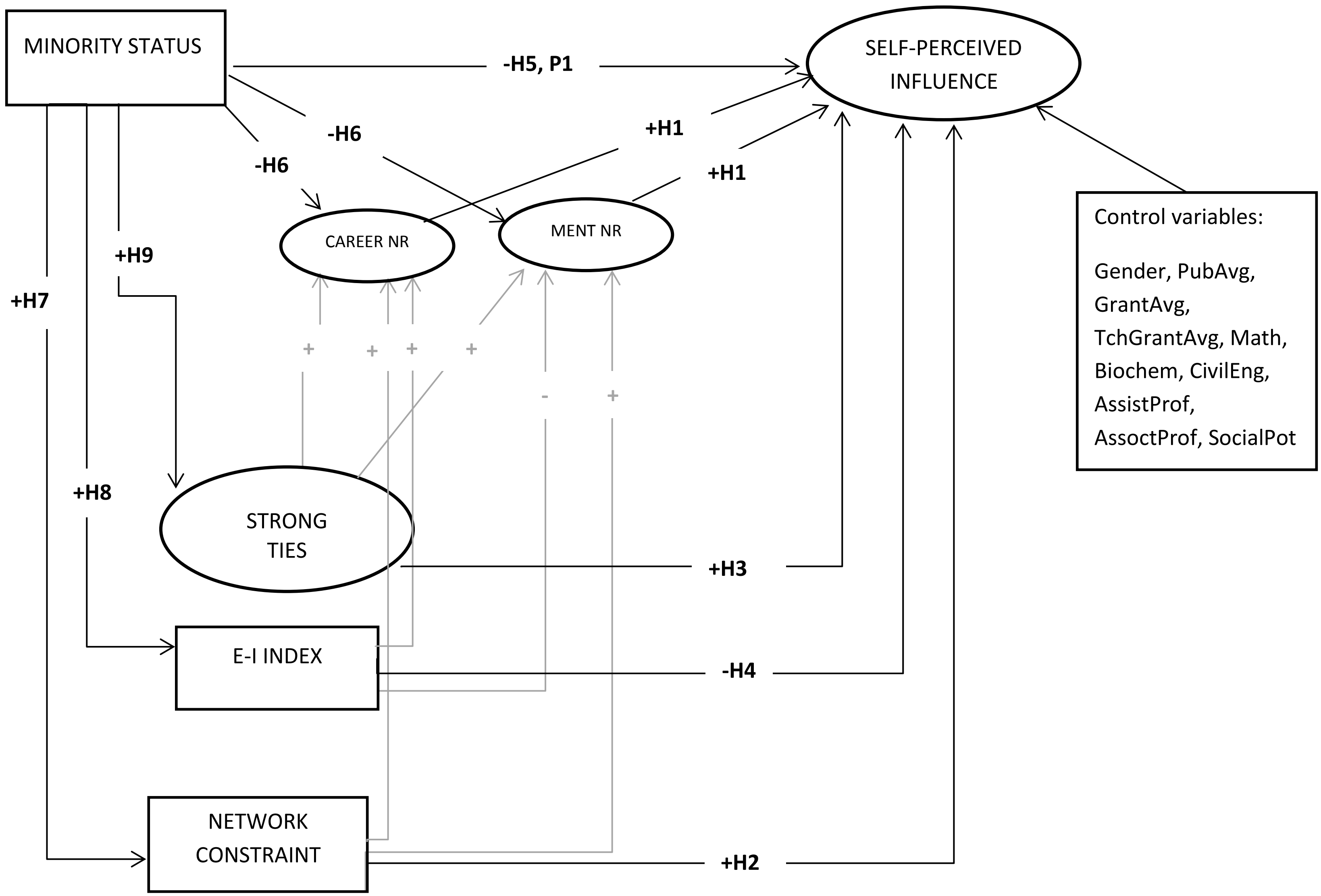


Figure 2b. Empirical Model Utilizing Network Resources Grouped in Career Resources and Mentoring Resources

(greyed arrows are not formally hypothesized but represent expected impacts between network resources and structure variables)



5.3 Descriptive Statistics

Table XIII displays the descriptive statistics for the study sample. The minority status of faculty is indicated by whether or not they are identified as African-American/Black. Ten percent of the study sample (or 132 respondents) are identified as belonging to the minority racial group of African-American/Black. The table also displays univariate statistics for the network characteristics. On average, faculty report having between one and two individuals in their network who provide them with each type of career network resource. However, faculty have slightly more people (between one and three) in their network providing them with each type of mentoring resource. On average, STEM faculty in the study sample report a network constraint of .33, meaning that the investment of time and energy in relationships tends is concentrated among 33% of the interconnected ties in their network. Moreover, this particular statistics indicates that there are fewer structural holes among 33% of their network as compared to the rest of their network. Faculty report an average E-I index of 0, meaning STEM faculty networks generally have an equal balance in their external to internal tie ratio. Several measures are used to indicate tie strength among faculty networks: the sum of network alters who faculty have identified as having known for at least two years, speak to at least monthly, are close friends and are strategically important to the faculty member's career. On average, STEM faculty report having in their network approximately nine individuals whom they have known for at least two years, four individuals whom they speak to at least monthly and three individuals who are close friends.

Interpretations of the variables representing self-perceived influence are based on the question asking faculty to indicate their level of influence compared to their colleagues about several decisions. The response options are based on the following Likert scale: 1-Much less influence, 2-Some what less influence, 3-About the same influence, 4-Somewhat more influence, and 5-Much more influence. Using this scale to interpret the mean values for macro level self-perceived influence, on average, faculty's level of macro level self-perceived influence is 2.82, meaning they do not feel particularly influential in shaping higher level organizational decisions. When looking at more specific macro level self-perceived influence measures, faculty report feeling most influential in selecting new faculty (2.91) and least influential in allocating budget or departmental research funds (2.39). However, faculty exhibit slightly more micro level self-perceived influence (total average of all micro level self-perceived influence variables measuring to 3.06). This indicates that faculty feel more influential in making decisions related to their personal activity and productivity as opposed to higher level organizational decisions. Among the micro level self-perceived influence variables, faculty feel most influential in deciding on the courses they teach (3.30) and least influential in deciding upon the allocation of their service and committee assignments (2.85).

Based on the control variables, the gender, field and rank distribution of the study sample is as follows: 49% women, 32% biology, 21% biochemistry, 23% civil engineering, 22% math, 23% assistant professors, 32% associate professors and 44% full professors. The average productivity of the study sample includes faculty having approximately three articles published yearly, submitting less than one teaching or curriculum grant proposals per year, and submitting two research grant proposals per year. Lastly, the social potency variable was based on several psychometric measures asking faculty the extent to which they agreed with statements that would describe them as being socially dominant and have extroverted personalities. The following Likert scale was used to indicate faculty agreement with given statements: 1-Strongly Agree, 2-Agree, 3-Disagree and 4-Strongly Disagree. Higher scores indicates more social potency. Thus, the average social potency score of 2.72 indicates that faculty do not perceive themselves to be extremely dominant and have extroverted personalities.

TABLE XIII. DESCRIPTIVE STATISTICS, WITHOUT DATA IMPUTATION

	N	Minimum	Maximum	Mean	Std. Deviation
Minority Racial Status					
African-American/Black	1324	0.00	1.00	0.10	0.30
Career Development Network Resources					
Introduced you to potential research collaborators	1185	0.00	19.00	2.27	2.65
Invited you to join a teaching or research grant proposal team	1185	0.00	19.00	2.15	2.35
Nominated you for an award	1181	0.00	9.00	0.97	1.35
Recommended you as an invited speaker/panel member	1181	0.00	19.00	1.57	2.05
Provided you with research or other funding	1181	0.00	19.00	1.25	1.66
Advice on collaborating with industry or government	1181	0.00	19.00	0.89	1.79
Overall Career Development Network Resources	*1185*	*0.00*	*14.33*	*1.53*	*1.50*
Mentoring Network Resources					
Reviewed your papers or proposals prior to submission (on which they were not a co-author)	1185	0.00	19.00	2.01	2.27
Advice on grant getting	1181	0.00	19.00	2.76	2.83
Advice on publishing	1181	0.00	18.00	2.64	2.74
Advice on teaching	1181	0.00	18.00	2.67	2.65
Advice on departmental politics	1172	0.00	19.00	3.10	2.45
Advice on student related issues	1172	0.00	19.00	2.89	2.62
Advice on interactions with colleagues	1172	0.00	21.00	2.82	2.88
Advice on work/family balance	1172	0.00	19.00	1.44	1.98
Overall Mentoring Network Resources	*1185*	*0.00*	*18.63*	*2.54*	*1.99*
Network Structure					
Constraint	1206	.053	1.125	0.33	0.15
inst_E-I_Index	1222	-1.0	1.0	0.00	0.40

	N	Minimum	Maximum	Mean	Std. Deviation
Tie Strength					
Close friends	1210	0.00	19.00	2.69	2.73
Frequency of communication	1200	0.00	19.00	3.82	2.50
Length of time known	1213	0.00	26.00	8.79	4.15
Overall Strong Ties	1220	0.00	17.67	5.09	2.66
Macro Level Self-Perceived Influence					
Selection of new faculty	1104	1	5	2.91	1.03
Selection of unit head	1091	1	5	2.82	0.97
Selection of reviewers for your own tenure/promotion	1012	1	5	2.78	0.90
Who receives tenure/promotion	1082	1	5	2.67	1.11
Allocation of budget/departmental research funding	1080	1	5	2.39	1.12
SPI_MACRO OVERALL	*1108*	*1*	*5*	*2.82*	*0.76*
Micro Level Self-Perceived Influence					
Admission of new graduate students	1050	1	5	2.91	1.11
Allocation of your service/committee assignments	1091	1	5	2.85	1.00
The courses you teach	1089	1	5	3.30	0.95
Selection of your teaching/research assistants	1032	1	5	3.17	1.00
SPI_MICRO OVERAL	*1103*	*1*	*5*	*3.06*	*0.73*
Controls					
Female	1324	0	1	0.49	0.50
Biology	1324	0.00	1.00	0.32	0.47
Biochemistry	1324	0.00	1.00	0.21	0.41
Civil Engineering	1324	0.00	1.00	0.23	0.42
Mathematics	1324	0.00	1.00	0.22	0.42
Assistant Professor	1324	0.00	1.00	0.23	0.42
Associate Professor	1324	0.00	1.00	0.32	0.47
Full Professor	1324	0.00	1.00	0.44	0.50
Average peer reviewed articles published	1005	0.00	53.00	3.21	4.97
Average teaching grants submitted	852	0.00	40.00	0.67	1.82
Average research grants submitted	967	0.00	50.00	2.37	3.21
Social Potency	1005	1	4	2.72	0.41
Valid N	592				

5.4 Correlations

This section provides results for the bivariate statistical analysis (i.e. correlations). Two tables provide the correlations among the variables of interests. Table XIV below provides the correlations among the minority racial status, network constraint, external-internal tie index, the consolidated tie strength variable, the consolidated career network resource variable, the consolidated mentoring network resource variable, the consolidated macro level self-perceived influence variable and the consolidated micro level self-perceived influence variable. Appendix B, which provides Table XXII, contains the extensive correlations that include the non-consolidated versions of the tie strength, network resources and both types of self-perceived influence. The proceeding discussion is based on the findings from Table XXII, which determines if there are significant relationships among the variables of interest as well as the directionality and magnitude of the any present significant relationships. Correlation analysis is an important step as a way to ascertain the possibility of multicollinearity among independent variables, which essentially reflects the fact that observed variables in the model are highly correlated and may measure the same construct (Hoyle, 2012). The problem with such an outcome is that estimations for the individual effects of the predictor variables cannot be accurately made (Hancock and Mueller, 2006). The widely-accepted criteria for determining multicollinearity among correlation coefficients among independent or predictor variables are values that are at least .800, meaning that variables are highly correlated and likely measure the same construct (Allison, 1999) . Based on the results from the correlation table below, none of the values are over .800, meaning that is likely no multicollinearity is present.

TABLE XIV. CORRELATIONS, WEIGHTED, WITHOUT IMPUTATION

		1	2	3	4	5	6	7	8
1	African-American/Black	1							
2	Constraint	.006	1						
3	E-I Index	-.036*	.081**	1					
4	Career Network Resources	.058**	-.374**	-.078**	1				
5	Mentoring Network Resources	.086**	-.393**	-.188**	.685**	1			
6	Strong Ties	.009	-.603**	-.220**	.594**	.679**	1		
7	SPI_MACRO	-.084**	-.206**	-.086**	.163**	.112**	.296**	1	
8	SPI_MICRO	-.049**	-.136**	-.118**	.142**	.085**	.265**	.711**	1
9	SocialPotentcy	-.043**	-.103**	-.063**	.186**	.138**	.215**	.262**	.308**
10	Gender	.003	-.009	-.066**	-.022	.122**	-.020	-.150**	-.167**
11	AssistProf	.053**	.052**	-.007	-.067**	.066**	-.143**	-.375**	-.252**
12	AssoctProf	.053**	.071**	-.162**	-.070**	-.029	-.079**	-.074**	-.115**
13	BioChem	-.006	-.093**	-.023	.036*	.027	.024	.049**	-.012
14	CivilEng	.000	.037*	-.082**	.107**	-.021	-.037*	.027	.075**
15	Math	.017	.181**	.103**	-.196**	-.162**	-.137**	-.001	-.025
16	TeachGrantAvg	.022	.014	.055**	.034	.014	.007	.085**	.054**
17	PubAvg	-.036*	-.076**	.054**	.137**	.032*	.134**	.229**	.176**
18	GrantAvg	-.001	-.015	.016	.123**	.053**	-.001	.044**	.047**

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

TABLE XIV, CONT'D. CORRELATIONS, WEIGHTED, WITHOUT IMPUTATION

		9	10	11	12	13	14	15	16	17	18
9	SocialPotentcy	1									
10	Gender	.016	1								
11	AssistProf	-.027	.167**	1							
12	AssoctProf	-.110**	.131**	-.292**	1						
13	BioChem	.040*	-.014	-.013	-.061**	1					
14	CivilEng	.095**	-.058**	.009	.016	-.160**	1				
15	Math	-.112**	-.124**	-.012	-.029*	-.229**	-.297**	1			
16	TeachGrantAvg	.041*	.098**	-.031	.037*	-.006	.051**	-.051**	1		
17	PubAvg	.119**	-.101**	-.116**	-.091**	.138**	.021	-.120**	.066**	1	
18	GrantAvg	.040*	.044**	.103**	-.019	.049**	.297**	-.250**	.155**	.212**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation tables can also provide some preliminary evidence of support or disconfirmation of the hypotheses. Analysis of the correlation table will be discussed using the following format. First, the relationships between the network structure variables and self-perceived influence will be discussed; second, are the relationships between network resources and self-perceived influence; third are the relationships between minority racial status and network structure and network resource variables; and are the relationships between minority racial status and self-perceived influence.

The correlations between the network structure variables of network constraint, external-internal tie ratio and strong ties and variables indicating both types of self-perceived influence are significant. All of the correlated relationships are significant at the $p<.01$ level with the exception of the relationships between constraint and the micro level self-perceived variable of 'selecting courses to teach', which is significant at the $p<.05$ level. More specifically, the correlation coefficients between network constraint and the macro level self-perceived influence variables are significant and negative and range between -.140 and -.217. The correlation coefficient between network constraint and micro level self-perceived influence are significant, negative and range between -.040 and -.160. The correlation coefficients between external-internal tie ratio and macro level self-perceived influence variables are significant, negative and range between -.048 and -.111. The correlation coefficients between external-internal tie ratio and micro level self-perceived influence are significant, negative and range between -.057 and -.105. Lastly, the correlation coefficients between strong tie variables and the macro level self-perceived variables are all significant, positive and range between .097 and

.259. The correlation between the strong tie variables and the micro level self-perceived variables are all significant, positive and range between .094 and .203. Overall, the correlation coefficients between structural and self-perceived influence variables indicate that less constrained networks with strong ties and connections with more individuals located inside of the faculty's institution are associated with faculty having overall higher levels of macro and micro level self-perceived influence. This provides preliminary support for hypotheses H2 and H3 stating that faculty with stronger, more internally situated and less constrained networks will report higher levels of self-perceived influence.

Among the 30 correlations between the career development network resource and macro level self-perceived influence variables, 24 are significant at the $p<.01$ and $p<.05$ level. In particular, among the 41 significant correlations, all are positive with coefficients ranging between .035 and .422. The only significant, negative relationship is between the network resource variable of 'providing advice about collaborating with industry and government' and the self-perceived influence variable of 'selection of reviewers for your own promotion/tenure', which has a coefficient of -.066. Among the 24 correlations between career network resources and micro level self-perceived resource variables, 17 are positive and significant at the $p<.01$ and $p<.05$ levels. The range of the coefficients of the significant relationships is between .035 and .162. Among the 40 correlations between mentoring network resources and macro level self-perceived influence variables, 27 are positive and significant at the $p<.01$ and $p<.05$ levels. The range of the significant correlation coefficients is between .032 and .521. Among the 32 correlations between the mentoring network resource variables and micro level self-perceived influence variables, 21 are significant at the $p<.01$ and $p<.05$ levels. Twenty of these significant correlations are positive and have coefficients ranging between .035 and .138. The one remaining significant correlation, which is between the resource variable of 'providing advice on work/life family balance' and the self-perceived influence variable of 'having influence over the courses you teach', has a coefficient of -.039. Overall, while there are a number of insignificant correlations, the findings indicate that overall, having more resources is associated with having more of both types of self-perceived influence, which provides preliminary support for the first hypothesis (H1) stating that more network resources would result in higher levels of self-perceived influence.

When examining the relationships between minority racial status and network structure variables, the only significant correlations are between minority racial status and the external-internal tie ratio, has coefficient of -.036 and is significant at the $p<.05$ level. This provides preliminary support for the seventh hypothesis (H7) stating that as opposed to non-minority faculty, minority faculty will have more ties that are located inside of their institution. However, there is no preliminary support for the sixth and eight hypotheses (H6 and H8) asserting that minority faculty will have significantly stronger and more constrained networks than non-minority faculty. Among the 14 correlations between minority racial status and network resources, 11 are positive and significant at the $p<.01$ and $p<.05$ levels. The significant coefficients between minority racial status and network resources range between .032 and .127. This does not provide preliminary support for the fifth hypotheses (H5) stating that minority faculty will have significantly fewer network resources than non-minority faculty.

Finally, the eight out of the nine correlations between the minority status and self-perceived influence variables are negative and significant at the $p<.01$ and $p<.05$ levels, with coefficients ranging between -.039 and -.083. These findings provide preliminary support for the fourth (H4) hypothesis stating that minority faculty will have significantly less self-perceived influence than non-minority counterparts. It is important to emphasize that correlations do not account for the dynamics captured in the direct and indirect effects between predictor and dependent variables illustrated in the empirical model and confirmed by the structured equation modeling analysis.

SEM will be used to examine the support, or lack thereof, for the presented hypotheses and proposition. In particular, the SEM analysis focuses on two primary steps. First, it is important to use confirmatory factor analysis (CFA) of the latent variables (i.e. network resources, strong ties and self-perceived influence) to determine the extent to which the selected observed variables factor (and essentially represent) into the single latent variable. CFA is essentially an extension of exploratory factor analysis (EFA), but is based upon hypothesized relationships. The second goal of the SEM analysis is to ascertain the extent to which the hypothesized direct and indirect paths between the endogenous and exogenous variables are strongly supported. In particular, the direct and indirect paths going from minority racial status to the network resources and network structure characteristics (i.e. tie strength, external-internal tie orientation and network constraint) will be assessed to determine whether or not minority faculty do in fact have different network structures as non-minority faculty, thereby providing insights into how social network theory may need to account for variations in network behavior based on racial status—particularly as it relates to how minorities may employ different strategies (either by environmental constraints or personal choice) to construct their networks and exploit network resources. Next, tie strength, external-internal tie orientation and network constraint directly impact self-perceived influence, as well as how they may impact indirectly impact self-perceived influence by facilitating the development of network resources, which subsequently impacts self-perceived influence. The impact of minority racial status on self-perceived influence will also be assessed based on its direct impact on self-perceived influence. Additionally, the extent to which minority faculty indirectly develop their self-perceived influence will be assessed based upon the structure of their networks and access to network resources. The following details the results from the SEM analysis of the data for four models: (1) predicting macro level self-perceived influence using non-imputed data, (2) predicting macro level self-perceived influence using imputed data, (3) predicting micro level self-perceived influence using non-imputed data, and (4) predicting micro level self-perceived influenced using imputed data. First, CFA results are provided. Second, there will be a discussion the goodness of fit to determine how well the study data sample data fits the specified model upon which the data is run. Lastly, there is a discussion of the path analysis results, which details the nature of the direct and indirect paths.

5.5 Confirmatory factor analysis for macro and micro level self-perceived influence, tie strength and network resources (without data imputation)

Table XV below provides the results for the CFA for both types of level self-perceived influence, tie strength and network resources for data without imputation. The items of particular importance on the table are the factor loadings (standardized estimates) for the observed variables, their p-value significance and R-square statistics. It is important to note that the factor loadings are correlations of the variable and factor in question, thus squaring the factor loading provides the R-square statistic indicating the extent to which the observed variable explains the variance in the latent variable. Observed variables with factor loadings that are at least .455, have p-values that are significant are considered relatively strong indicators of a latent variable (Harrington, 2008). Among the five observed variables indicating the latent variable of macro level self-perceived influence, the standardized factor loadings range between .509 (workinfluence_3) and .853 (workinfluence_2). This means that all five of these variables strongly indicate or reflect the single construct of macro level self-perceived influence. Furthermore, the R-Squared statistics of all five of these observed variables range between .259 (workinflluence_3) and .728 (workinfluence_2), meaning that all of these variable explain between approximately 26% and 73% of the variance in the latent macro level self-perceived influence variable. Among the four observed variables indicating the latent variable micro level self-perceived influence, the standardized loading factors range between .641 (workinfluence_9) and .727 (workinfluence_5). Additionally, the R-square statistics for each of these four variables range between .410 (workinfluence_9) and .528 (workinflluence_9), which indicates that four variables explain between 41% and 53% of the variance in the latent variable micro level self-perceived influence.

For the latent construct of strong ties, the CFA indicates that the all three observed variables (close friends, frequent communication and length of time known) moderately to very strongly indicate the unobserved variable of strong ties. The NIDemo1_c5 variable (i.e. ‘close friends’) has a factor loading of .487 and an R-square of .238, meaning that this variable strongly indicates the strong tie construct as well as explains approximately 24% of the unobserved construct. The nifreq_dummy_sum variable (i.e. 'frequent communication') has a factor loading of .413 and an R-square of .171, meaning that this variable moderately indicates the strong tie construct and explains 17% of its variance. Although the factor loading does not necessarily meet desired factor loading of at least .45, this is a theoretically sound variable that has been empirically proven variable used to indicate tie strength, thus it will remain in the model. The nilength_dummy_sum variable ('length of time known') variable has a factor loading of 1.116 and an r-square of 1.245, meaning that this variable strongly indicates the strong tie construct and explains over 100% of its variance.

Among the fourteen observed variables indicating the unobserved construct of network resources, all of them have high factor loadings and thus relatively high R-squared statistics. To reiterate, the observed variables for the resources include the total number of people in the individual faculty member's network that the faculty member has indicated as providing them with a certain resource. For example, the nicareer1_1_sum variable indicates the total number of people in the faculty member's network that have reviewed his or her papers or proposals prior to submission. When examining the results from the CFA analysis of the network resources, it is efficient to examine the factor loading and R-square statistics of these observed variables by resource type. Among the observed variables used to indicate mentoring networks, the factor loadings range between .583 (total number of people who review papers or proposals prior to submission) to .820 (total number of people whom faculty seek advice about interactions with colleagues). Among the R-square statistics for the observed variables indicating mentoring resources, the statistics range between .34 (total number of people who review papers or proposals prior to submission) and .673 (total number of people whom faculty seek advice about interactions with colleagues), meaning that these variables explain between 34% and 67% of the variance in the latent variable of mentoring network resources. The observed variables indicating the latent construct of career development resources have factor loadings ranging from .547 (total number of people who provide the faculty member with research or other funding) to .783 (total number of people who invited the faculty member with introduced them to potential research collaborators). The R-square statistics for these observed variables range between .299 (total number of people who provide the faculty member with research or other funding) to .613 (total number of people who invited the faculty member with introduced them to potential research collaborators), meaning that these variables explain between approximately 30% and 61% of the variance in the latent variable of career development resources.

Overall, these findings indicate that the observed variables strongly indicate the latent constructs of mentoring and career development resources. When combining all of these observed variables into one latent construct indicating network resources, the results are quite similar. The factor loadings for the observed variables range between .470 (total number of people who provide the faculty member with research or other funding) and .792 (advice on grant getting), meaning that together, these observed variables strongly indicate a single construct of network resources. The R-square statistics for these variables are also relatively high, where the lowest R-square value being .221 (total number of people providing faculty member with research or other funding) and the highest value being .618 (advice on grant getting). This means that these observed values explain between 22% and approximately 62% of the variance in the single construct of network resources.

TABLE XV. CONFIRMATORY FACTOR ANALYSIS FOR TIE STRENGTH, NETWORK RESOURCES, MACRO LEVEL SELF-PERCEIVED INFLUENCE AND MICRO LEVEL SELF-PERCEIVED INFLUENCE, WITHOUT DATA IMPUTATION

VARIABLE DESCRIPTIONS		Estimate	Std. Est.	S.E.	C.R.	P	R-Square
	MACRO LEVEL SPI						
Allocation of budget/departmental research funding.	WorkInfluence_r6	1	0.746				0.557
Who receives tenure or promotion	WorkInfluence_r4	0.907	0.727	0.021	43.203	***	0.528
Selection of unit head.	WorkInfluence_r2	0.958	0.853	0.019	50.465	***	0.728
Selection of new faculty.	WorkInfluence_r1	0.996	0.829	0.02	49.298	***	0.688
Selection of reviewers for your own tenure/promotion.	WorkInfluence_r3	0.524	0.509	0.018	29.789	***	0.259
	MICRO LEVEL SPI						
Admission of new graduate students	WorkInfluence_r5	1	0.727				0.528
Allocation of your service/committee assignments.	WorkInfluence_r7	0.743	0.69	0.017	42.834	***	0.476
The courses that you teach.	WorkInfluence_r8	0.685	0.683	0.016	42.342	***	0.467
Selection of your teaching/research assistants.	WorkInfluence_r9	0.633	0.641	0.016	39.226	***	0.41
	TIE STRENGTH						
Close friends	NIDemo1_c5_sum	1.502	0.487	0.053	28.528	***	0.238
Length of time known	nilength_dummy_sum	4.332	1.116	0.11	39.265	***	1.245
Frequency of communication	nifreq_dummy_sum	1	0.413				0.171
	MENTORING NETWORK RESOURCES						
Reviewed your papers or proposals prior to submission (on which they were not a co-author)	nicareer1_c1_sum	1	0.583				0.34
Advice on Grant getting	NIAdvice1_c1_sum	1.649	0.763	0.046	35.821	***	0.582
Advice on Publishing	NIAdvice1_c2_sum	1.601	0.708	0.047	34.101	***	0.501
Advice on Teaching	NIAdvice1_c3_sum	1.436	0.729	0.041	34.771	***	0.531
Advice on Departmental politics	NIAdvice2_c1_sum	1.518	0.788	0.042	36.535	***	0.62
Advice on Student related issues	NIAdvice2_c2_sum	1.599	0.796	0.043	36.769	***	0.633
Advice on Interactions with colleagues	NIAdvice2_c3_sum	1.833	0.82	0.049	37.447	***	0.673
Advice on Work/family balance	NIAdvice2_c4_sum	0.986	0.676	0.03	33.056	***	0.457
	CAREER DEVELOPMENT NETWORK RESOURCES						
Advice on Collaborating with industry or government	NIAdvice1_c4_sum	0.538	0.618	0.015	36.994	***	0.382
Provided you with research or other funding	NICareer2_c3_sum	0.412	0.547	0.013	32.406	***	0.299
Recommended you as an invited speaker/panel member	NICareer2_c2_sum	0.672	0.624	0.018	37.39	***	0.39
Nominated you for an award	NICareer2_c1_sum	0.354	0.553	0.011	32.812	***	0.306
Invited you to join a teaching or research grant proposal team	nicareer1_c3_sum	0.919	0.772	0.02	47.12	***	0.597
Introduced you to potential research collaborators	nicareer1_c2_sum	1	0.783				0.613

VARIABLE DESCRIPTIONS		Estimate	Std. Est.	S.E.	C.R.	P	R-Square
	ALL NETWORK RESOURCES						
Advice on Collaborating with industry or government	NIAdvice1_c4_sum	0.744	0.573	0.025	30.204	***	0.328
Provided you with research or other funding	NICareer2_c3_sum	0.53	0.47	0.021	25.667	***	0.221
Recommended you as an invited speaker/panel member	NICareer2_c2_sum	0.927	0.576	0.031	30.349	***	0.332
Nominated you for an award	NICareer2_c1_sum	0.478	0.5	0.018	27.009	***	0.25
Invited you to join a teaching or research grant proposal team	nicareer1_c3_sum	1.142	0.642	0.035	33.023	***	0.412
Introduced you to potential research collaborators	nicareer1_c2_sum	1.318	0.691	0.038	34.882	***	0.477
Reviewed your papers or proposals prior to submission (on which they were not a co-author)	NIAdvice2_c4_sum	0.929	0.66	0.028	33.723	***	0.436
Advice on Grant getting	NIAdvice2_c3_sum	1.695	0.786	0.044	38.205	***	0.618
Advice on Publishing	NIAdvice2_c2_sum	1.455	0.75	0.039	37.005	***	0.563
Advice on Teaching	NIAdvice2_c1_sum	1.41	0.758	0.038	37.283	***	0.575
Advice on Departmental politics	NIAdvice1_c3_sum	1.35	0.71	0.038	35.582	***	0.504
Advice on Student related issues	NIAdvice1_c2_sum	1.561	0.715	0.044	35.763	***	0.511
Advice on Interactions with colleagues	NIAdvice1_c1_sum	1.652	0.792	0.043	38.403	***	0.627
Advice on Work/family balance	nicareer1_c1_sum	1	0.605				0.366

5.6 SEM model results predicting macro level self-perceived influence (without data imputation)

This section discusses the results from estimated SEM models predicting macro level self-perceived influence when using data without imputation. Model 1 predicts macro level self-perceived influence using a consolidated network resource variable and Model 2 uses network variables grouped into career development and mentoring categories.

This section starts with a review of the goodness of fit indices, which determines how well the data fit the proposed models. Several goodness of fit indices are used to determine the extent to which a study data sample fits a specified model, and therefore indicating the quality of the model. For SEM analysis these include the chi-square, root mean square error of approximation (RMSEA). There are also a number incremental fit indices and parsimony fit indices used to indicate goodness of fit. These incremental and parsimony fit indices compare the chi-square value to the baseline model. There are no golden rules for determining how many or which goodness of fit indices are to be reported (Hooper et al., 2008). However, it is expected that several indices are reported. It is important to note large samples (N>500) will typically result in high chi-square statistics as well as a p-value of .000, indicating that the model should be rejected. In such cases, other fit indices are used to indicate goodness of fit with studies employing large sample sizes. In particular, reporting the RMSEA, comparative fit index (CFI), parsimony goodness of fit index (PGFI) and parsimonious normed fit index (PNFI) for studies with large sample sizes is acceptable (Hooper et al., 2008). The acceptable range of the RMSEA statistic is between 0 and .10, where values less than .5 indicates a well fitted model, values between. 5 and up to .8 indicate a model of moderate fit and values between .8 and .1

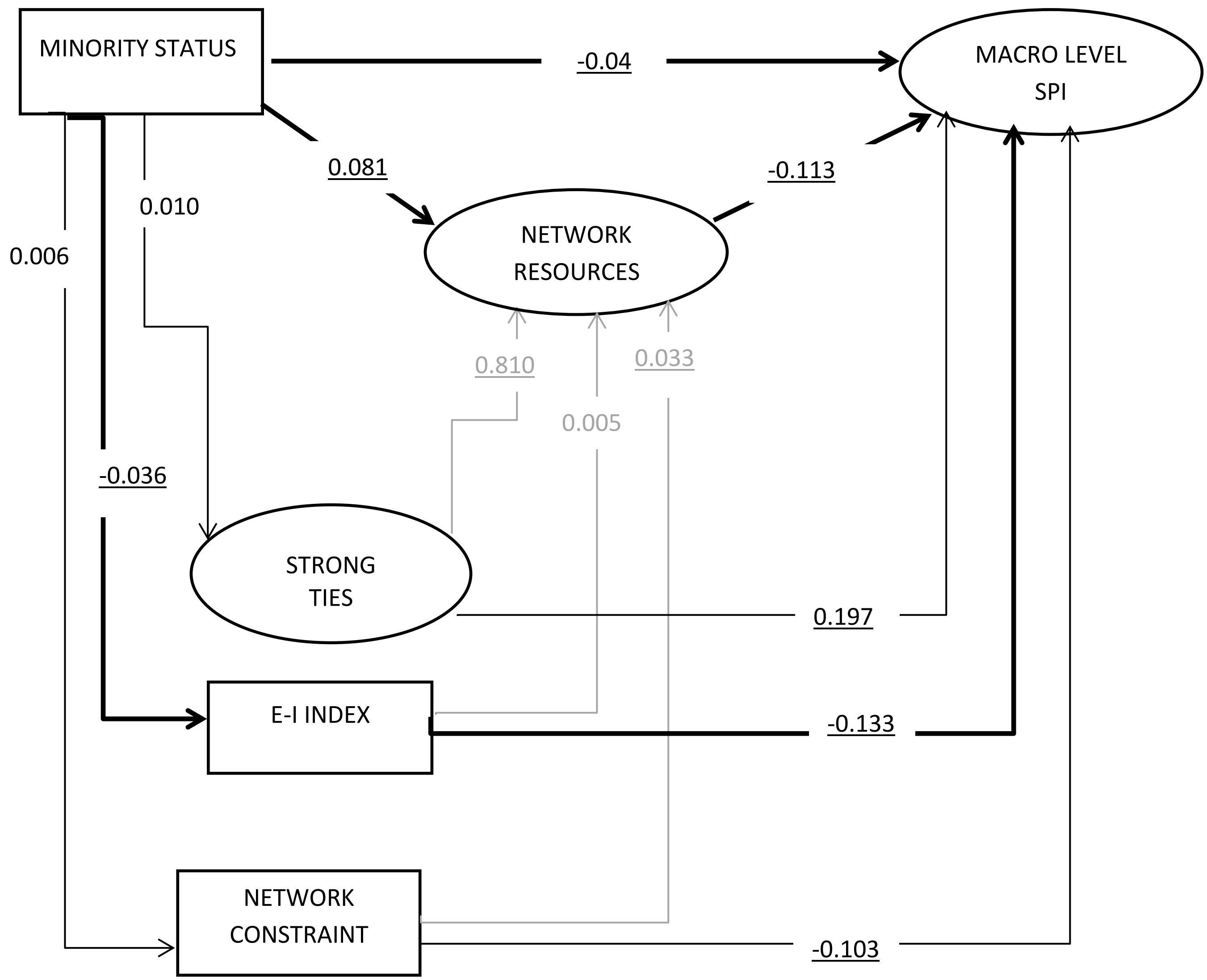
indicate a mediocre fitting model (Brown, 2012). However, Chen et al. (2008) posit that while desirable and convenient, the use of these cutoff points and subsequent interpretations of the RMSEA statistics should be used with caution. Their analysis revealed that these cutoff points have resulted in even ill-fitting models being accepted, while well-fitted models being rejected. However, Chen et al. (2008) do not provide alternative cut off points. Thus, it may be more useful to still utilize the range of 0 to .10 to indicate acceptance of a model based on the RMSEA statistics, but without using the terms good, moderate or mediocre. The CFI statistic ranges between 0 and 1, where the values closer to one indicating a better fit. There are no strict bound for the parsimony fit indices (PGFI and PNFI), but generally, values over .50 are deemed to indicate well-fitting models.

Second, the direct and indirect effects of the independent and dependent variables are discussed. Reporting the results of the total, direct and indirect effects will include the standardized estimates (std. est.), standard errors (SE) and level of significance in relation to the p-value. Table XVI provides the total, direct and indirect effects of the predictor variables on macro level self-perceived influence when using network resources as a consolidated predictor variable. Table XVII provides the total, direct and indirect effects of the predictor variables on macro level self-perceived influence when grouping network resources into career development and mentoring network resources. Several important points should be made about interpreting the total, direct and indirect effects. The direct effects reflect the impacts of predictor variables on the dependent variables without accounting for mediating variables. The indirect effects reflect the impacts of predictor variables on the dependent variables through a mediating variable (Garson, 2008). Furthermore, the overall indirect effects are a sum of the products of the direct effects between the predictor variable, mediating variable(s) and dependent variable (Garson, 2008). The total effects are a summary of the direct and indirect effects (Hoyle, 2012). Finally, there is a summary of the findings, which emphasizes whether or not the hypotheses are actually supported based upon the theoretical foundation presented in chapter three positing the mechanics through which the independent and dependent variables are related. Furthermore, the summary of the findings focus on the extent to which the total effects are shaped by the direct and indirect effects.

Figure 3a and 3b on the next two pages provides a summary both models with the estimates of the paths and goodness of fit indices. The paths with bolded arrows and underlined estimates are significant and indicate support or disconfirmation of the hypotheses. The grayed arrows represent paths that are not hypothesizes. However, if the grayed estimates are underlined, they are significant. When interpreting the significance of an indirect path, it is necessary to consider the significance of all individual direct paths that comprise the indirect path. For example, in Figure 3a, the entire indirect path from minority racial status to macro level self-perceived influence that is mediated just by external-internal ratio is significant because the path from minority racial status to external-internal index is significant and the path from external-internal index to macro level self-perceived influence is significant. However, the indirect path between minority racial status and macro level self-perceived influence that is mediated by both external-internal index and network resources is insignificant because the path from external internal index to network resources is insignificant.

Figure 3a. Model 1: Estimated Paths with All Network Resources in Single Variable Predicting Macro Level SPI, without imputation

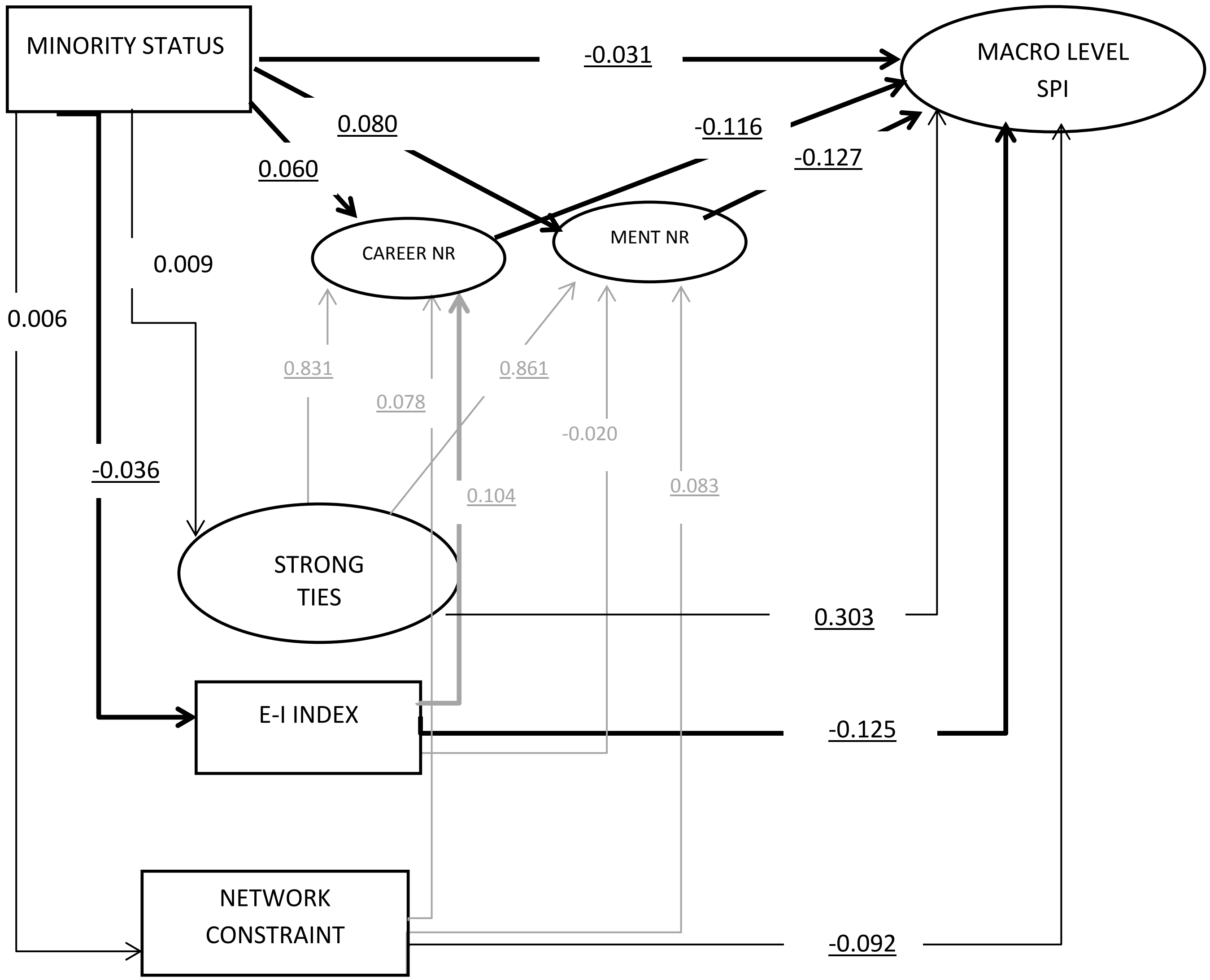
(greyed arrows are not formally hypothesized, but represent effects of structural variables on network resources)



Goodness of Fit Indices: Chi-Sq 18506.594 Sig p<.01, RMSEA 0.093, CFI 0.681, PGFI 0.670, PNFI 0.625

Figure 3b. Model 2: Estimated Paths with Grouped Network Resources Predicting Macro Level SPI, without imputation

(greyed arrows are not formally hypothesized, but represent effects of structural variables on network resources)



Goodness of Fit Indices: Chi-sq 17279.300 Sig p<.01, RMSEA 0.090, CFI 0.703, PGFI 0.683, PNFI 0.639

TABLE XVI. MODEL 1: MACRO LEVEL SPI, NETRESOURCES CONSOLIDATED, WEIGHTED DATA WITHOUT IMPUTATION

		TOTAL EFFECTS			DIRECT EFFECTS			INDIRECT EFFECTS		
HYPOTHESES/PROPOSITION	***PATH***	***Std. Est.***	***S.E.***	***Sig***	***Std. Est.***	***S.E.***	***Sig***	***Std. Est.***	***S.E.***	***Sig***
H1 (+)	NetResources--->SPIMACRO	-0.113	0.035	***	-0.113	0.035	***	...	...	...
	StrongTies--->NetResources	0.810	0.009	***	0.810	0.009	***	...	...	...
	Ext-IntTie--->NetResources	0.005	0.013	NS	0.005	0.013	NS	...	...	...
	NetConstraint--->NetResources	0.033	0.016	**	0.033	0.016	**	...	...	...
H2 (-)	NetConstraint--->SPIMACRO	-0.107	0.020	***	-0.103	0.020	***	-0.004	0.002	**
H3 (+)	StrongTies--->SPIMACRO	0.105	0.023	***	0.197	0.023	***	-0.092	0.041	***
H4 (-)	Ext-IntTie--->SPIMACRO	-0.133	0.016	***	-0.133	0.016	***	-0.001	0.002	NS
H5 (-),P1	AfAmBl--->SPIMACRO	-0.044	0.016	***	-0.040	0.015	**	-0.004	0.006	NS
H6 (-)	AfAmBl--->NetResources	0.089	0.016	***	0.081	0.012	***	0.008	0.014	NS
H7 (+)	AfAmBl--->NetConstraint	0.006	0.016	NS	0.006	0.016	NS	...	...	...
H8 (+)	AfAmBl--->Ext-IntTie	-0.036	0.016	**	-0.036	0.016	**	...	...	...
H9 (+)	AfAmBl--->StrongTies	0.010	0.018	NS	0.010	0.018	NS	...	...	...
Controls	Gender--->SPIMACRO	-0.086	0.016	***	-0.086	0.016	***	...	...	...
	Math--->SPIMACRO	0.085	0.017	***	0.085	0.017	***	...	...	...
	BioChem--->SPIMACRO	-0.011	0.016	NS	-0.011	0.016	NS	...	...	...
	CivEng--->SPIMACRO	-0.014	0.017	NS	-0.014	0.017	NS	...	...	...
	AssistProf--->SPIMACRO	-0.414	0.017	***	-0.414	0.017	***	...	...	...
	AssoctProf--->SPIMACRO	-0.163	0.016	***	-0.163	0.016	***	...	...	...
	PubAvg--->SPIMACRO	0.109	0.016	***	0.109	0.016	***	...	...	...
	TeachGrntAvg--->SPIMACRO	0.080	0.015	***	0.080	0.015	***	...	...	...
	GrntAvg--->SPIMACRO	0.038	0.016	**	0.038	0.016	**	...	...	...
	SocPot--->SPIMACRO	0.221	0.015	***	0.221	0.015	***	...	...	...

TABLE XVII. MODEL 2: MACRO LEVEL SPI,CAREER DEV AND MENTOR NETWORK RESOURCES, WEIGHTED DATA WITHOUT IMPUTATION

		TOTAL EFFECTS			DIRECT EFFECTS			INDIRECT EFFECTS		
HYPOTHESES/PROPOSITION	*PATH*	*Std. Est.*	*S.E.*	*Sig*	*Std. Est.*	*S.E.*	*Sig*	*Std. Est.*	*S.E.*	*Sig*
H1 (+)	CareerNetResources--->SPIMACRO	-0.116	0.042	***	-0.116	0.042	***	...	...	...
H1 (+)	MentNetResources--->SPIMACRO	-0.127	0.046	***	-0.127	0.046	***	...	...	...
	StrongTies--->CareerNetResources	0.831	0.010	***	0.831	0.010	***	...	...	...
	StrongTies--->MentNetResources	0.861	0.009	***	0.861	0.009	***	...	...	...
	Ext-IntTie--->CareerNetResources	0.104	0.014	***	0.104	0.014	***	...	...	...
	Ext-IntTie--->MentNetResources	-0.020	0.013	NS	-0.020	0.013	NS	...	...	...
	NetConstraint---CareerNetResources	0.078	0.017	***	0.078	0.017	***	...	...	...
	NetConstraint--->MentNetResources	0.083	0.015	***	0.083	0.015	***	...	...	...
H2 (-)	NetConstraint--->SPIMACRO	-0.112	0.020	***	-0.092	0.022	***	-0.020	0.007	***
H3 (+)	StrongTies--->SPIMACRO	0.098	0.023	***	0.303	0.067	***	-0.205	0.055	***
H4 (-)	Ext-IntTie--->SPIMACRO	-0.134	0.016	***	-0.125	0.017	***	-0.009	0.005	*
H5(-),P1	AfAmBl--->SPIMACRO	-0.043	0.016	**	-0.031	0.016	**	-0.012	0.007	*
H6(-)	AfAmBl--->CareerNetResources	0.065	0.017	***	0.060	0.014	***	0.004	0.014	NS
H6(-)	AfAmBl--->MentNetResources	0.089	0.016	***	0.080	0.013	***	0.009	0.015	NS
H7 (+)	AfAmBl--->NetConstraint	0.006	0.016	NS	0.006	0.016	NS	...	...	...
H8 (+)	AfAmBl--->Ext-IntTie	-0.036	0.016	**	-0.036	0.016	**	...	...	...
H9 (+)	AfAmBl--->StrongTies	0.009	0.018	NS	0.009	0.018	NS	...	...	...
Controls	Gender--->SPIMACRO	-0.086	0.016	***	-0.086	0.016	***	...	...	...
	Math--->SPIMACRO	0.084	0.017	***	0.084	0.017	***	...	...	...
	BioChem--->SPIMACRO	-0.011	0.016	NS	-0.011	0.016	NS	...	...	...
	CivEng--->SPIMACRO	-0.013	0.017	NS	-0.013	0.017	NS	...	...	...
	AssistProf--->SPIMACRO	-0.416	0.017	***	-0.416	0.017	***	...	...	...
	AssoctProf--->SPIMACRO	-0.163	0.016	***	-0.163	0.016	***	...	...	...
	PubAvg--->SPIMACRO	0.110	0.016	***	0.110	0.016	***	...	...	...
	TeachGrntAvg--->SPIMACRO	0.080	0.015	***	0.080	0.015	***	...	...	...
	GrntAvg--->SPIMACRO	0.039	0.016	**	0.039	0.016	**	...	...	...
	SocPot--->SPIMACRO	0.221	0.015	***	0.221	0.015	***	...	...	...

5.6.1 Goodness of fit for models 1 and 2: SEM results for predicting macro level self-perceived influence without imputed data

The following describes the findings from the goodness of fit indices for both models predicting macro level self-perceived influence. The first model, which predicts macro level self-perceived influence utilizing network resources grouped into one construct, has the following statistics for the goodness of fit indices: RMSEA of .093, CFI of .681, PGFI of .670 and PNFI of .625. According to the aforementioned criteria, this model has an acceptable level of fit. For the second model, which predicts macro level self-perceived influence with network resources grouped into mentoring and career development resources, the following statistics are present for the goodness of fit indices: RMSEA of .900, CFI of .703, PGFI of .683 and PNFI of .639. Based on these statistics, it is reasonable to conclude that this model not only falls within the bounds of an acceptable model, but also has a slightly better fit than the model that consolidates the network resource variable. The next section provides the results from the path analysis for both models predicting macro level self-perceived influence.

5.6.2 Model 1: Path analysis among minority racial status, network structure, consolidated network resources and macro level self-perceived influence (without imputed data)

This section provides results illustrating the total, direct and indirect effects for two models. Estimates of the total, direct and indirect effects for model one in Table XVI below provides results for the model predicting macro level self-perceived influence for the model using a consolidated network resource variable. This section is organized as follows. First, path analysis results discuss the significance, directionality and magnitude of the impact of network resources and network structure on macro level self-perceived influence. Second, there is a discussion of the path analysis results that includes minority racial status impacts on network resources, network structure and macro level self-perceived influence.

5.6.3 Model 1: Direct and indirect effects of network structure and consolidated network resources on macro level self-perceived influence (without imputed data)

Table XVI shows a negative direct effect of network resources on macro level self-perceived influence: std. est.=-0.113, S.E.0.035, $p<.01$. This indicates STEM faculty members with fewer network resources have higher levels of macro level self-perceived influence. The results of the effects of network resources is an unexpected finding and does not support H1 indicating that more network resources will enhance faculty members' notions of their ability to influence higher level organizational decisions. Network constraint has a significant negative effect: std. est.= -0.103, S.E.= 0.02, $p<.01$. Tie strength has a positive significant effect: std. est.= 0.197, S.E.=0.023, $p<.01$. Lastly, and external-internal tie ratio has a negative significant effect: std. est.=-0.133, S.E.=0.016, $p<.01$. These are expected findings that support H2, H3 and H4 proposing that faculty members with networks that are less constrained, have more strong ties and a higher ratio of internally to external ties (EI index) have more macro level self-perceived influenced.

Considering the impact of network resources, how might the significance of the indirect effects of network structure on macro level self-perceived influence be interpreted? The following statistics show the significant indirect effects of network structure variables: network constraint (std. est.= -0.004, S.E.=0.002, $p<.05$) and tie strength (std. est.=-0.092, S.E.=0.041, $p<.01$). In particular these results demonstrate that for every one unit decrease in tie strength STEM faculty members are expected to have an increase of .092 unit of macro level self-perceived influence as a result of fewer strong ties resulting in less network resources. Also, every one unit decrease network constraint results in a .004 decrease in macro level self-perceived influence because more constraint also results in a decrease in the acquisition of network resources. The following interprets the indirect effects of strong ties and network constraint on macro level self-perceived influence. When STEM faculty have connections to network alters characterized by low levels of emotional closeness and trust (i.e. fewer strong ties), their alters are less likely to provide network resources (Burt, 2000). Second, the reduction in resource provision is also likely when STEM faculty have smaller personal networks, fewer connections among their networks and less reliance on one contact for resources (i.e. less network constraint) (Burt, 2001). The subsequent impact of faculty receiving fewer resources as a result of these particular structural arrangements is increased levels of macro level self-perceived influence.

The overall picture of the significant direct and indirect effects of network structure and network resources on macro level self-perceived influence are illustrated in Figure 3a. Based on this picture, the following story emerges about the role of network resources and network structure. While network resources provide STEM faculty with opportunities to enhance their reputations and build self-efficacy (Kilduff & Krackhardt, 1994; Tsui, 1984; Hackman & Oldham, 1980; Spreitzer, 1996; Gist & Mitchell, 1992), these findings imply a disadvantage associated with acquiring resources. In particular, as faculty members acquire more resources from their network members, they may be placed in a position of dependence. Being more reliant upon colleagues for network resources mitigates faculty member's ability to develop a strong sense of independence and self-empowerment. Essentially, this reliance reflects the dynamic of resource dependency whereby individuals are more influential and powerful because people depend upon them for resources (Emerson, 1962). Moreover, resource dependence may make faculty feel more responsible to their colleagues, resulting in faculty feeling less able to exercise their own agendas in the larger context of organizational development. Such a lack of independence and diminished self-empowerment can mitigate a faculty member's perspective of how much they can influence high level decisions that shape organizational development and environment.

Additionally, certain structural characteristics serve to lessen or enhance the extent to which faculty feel able to influence organizational culture and climate. The impacts of the significant effects of network structure on self-perceived influence are more evident when comparing them to their overall, significant total effects. The total effects of tie strength (std. est. = 0.105, S.E.=0.023, $p<.01$) appear to more attributable to its direct effects than to the indirect effects. The total effects of network constraint (std. est.= -0.107, S.E.=0.020, $p<.01$) appear to be more reflective of its direct effects. Overall, this implies that these two network structure variables impact macro level self-perceived influence both directly and indirectly through resources. I interpret the indirect effects as follows. As mentioned previously, the presence of strong ties implies greater trust and emotional closeness between people, which fosters the sharing of resources. More network constraint implies that faculty and their colleagues exist in networks without many structural holes (i.e. smaller, more interconnected and are more reliant upon one contact for information). Highly constrained small communities of faculty may facilitate the flow of resources among individuals due to norms of reciprocity or other social mechanisms. The significance of the effect of the external-internal tie ratio is attributable to its direct effect (std. est.= -0.133, S.E.=0.016, p<.01). This can be interpreted as follows. When faculty member's networks are more internally situated, they are likely to increase their visibility (i.e. reputation) within their organization, thus providing them with the prestige that can afford them a stronger voice in higher level decision-making.

But the larger direct effects of more strong ties, a higher ratio of internal to external ties ratio and less network constraint imply that these specific structural arrangements provide additional benefits outside of mitigating resources dependence. These particular direct effects may provide the opportunity build self-efficacy and heighten visibility (i.e. reputations) among colleagues within the institution. In particular, self-efficacy can be built through enhanced emotional closeness that provides faculty with positive, confidence-building feedback about their performance, worth and value (Bandura, 1981). Additionally, visibility is heightened when it spreads among a larger set of more disconnected alters (Burt, 2000). When visibility is heighted within the organization, there is a greater chance of having the privilege to have a voice in macro level decision making. The subsequent result is faculty feeling more valued and empowered to influence high level organization decisions.

5.6.4 Model 1: Direct effects and indirect effects of minority racial status on macro level self-perceived influence using consolidated network resources (without imputed data)

Table XVI demonstrates that the direct effect of minority racial status on macro level self-perceived influence is negative and significant: std. est.= -0.04, S.E.=0.015, p<.01. This means that African-American/Black STEM faculty have significantly less macro level self-perceived influence than White STEM faculty. This supports H5 asserting that minority faculty would have less self-perceived influence than non-minority faculty. But is this because they are isolated from critical social networks in the workplace that would facilitate their career development and integration into organizational life, thus enhancing their reputations, self-efficacy, and power in their organizations by placing them in positions whereby organizational members are dependent upon them for critical resources? Or is another dynamic at work? Further examining the direct effects of minority racial status on network variables and subsequent indirect effects of minority racial status on macro level self-perceived influence can provide insights into these questions.

The direct effects of minority racial status on network resources is positive and significant (std. est.=0.081, S.E.=0.012, p<.01). This demonstrates that that African-American/Black STEM faculty members derive significantly more resources from their network members than White faculty. This does not support H6 asserting that minority faculty would have significantly less resources than non-minority faculty. The significant direct of effects of minority status on the network structure variables is evident only with the external-internal tie ratio (std. est.= -0.036, S.E. 0.016, $p<.05$). In other words, African-American/Black STEM faculty have networks with more internally oriented ties than non-minority STEM faculty. Thus overall, H7, H8 and H9 stating that minority STEM faculty would have more constrained networks, a higher ratio of external to internal ties and more strong ties are not supported.

Figure 3a provides an overall picture of how these direct effects of minority status on network variables shape the subsequent significant indirect effect on macro level self-perceived influence. Thus, an interesting story emerges about the extent to which minority STEM faculty develop perceptions of their influence in high level organizational decisions as a result of their networks. Moreover, the total effects of minority status on macro level self-perceived influence is underscored by its indirect effects, which is mediated by network resources and network structure. Figure 3a shows that there are two significant indirect effects of minority racial status on macro level self-perceived influence. The first significant indirect path mediated by network resources alone indicates that as African-American/Black faculty members attain more network resources, they subsequently have significantly lower levels of macro level self-perceived influence than White faculty. However, the second significant indirect path shows an unexpected finding. This second significant indirect path mediated by external-internal tie ratio indicates that as African-American/Black faculty networks become more internally situated, they will actually experience higher levels of macro level self-perceived influence. Thus, it appears that while African-American/Black STEM faculty are nurtured and supported in their professional development with the help of resources from colleagues (especially from ones inside of their institution), there is an adverse effect when it comes to their inclusion in shaping organizational culture and environment. In particular, it would appear that this support and nurturing also serves to make minority faculty more dependent upon their colleagues, thus limiting their sense of value in autonomously influencing macro level organizational decisions. This particular finding may illustrate a particular aspect of critical race theory, whereby substantive institutional diversity is not fully achieved due to the limited substantive inclusion of minorities in organizational life. In particular, this limitation is achieved when minority faculty members are placed in more subservient roles that does not allow them to create their own power bases by being in positions of being sought after for resources and not just provided resources. Thus, it is important to understand the nature, quality and balance of social capital exchange between minority faculty and their network alters. However, these findings also indicate that if minority faculty members are able to construct their networks to be more internally situated, they may be able to leverage the benefits of being more integrated in their organization in a way that offsets the negative impacts of resource dependency. In particular, the benefits of enhanced self-efficacy and heighted institutional reputation may mitigate the impact of a hostile academic environment that tends to devalue minority faculty. In short, network structure is critical in helping minority STEM faculty developing a sense of inclusion in shaping their organizational environment and culture.

However, despite the significance of these two indirect effects of minority racial status, Table XVI demonstrates that the total effects are more reflective of the direct effects. In other words, the lower levels of macro level self-perceived influence experienced by minority faculty are over and above the mitigating role of network variables. This supports P1 asserting that the direct effects of minority racial status on self-perceived influence are greater and more significant than its indirect effects.

5.6.5 Model 1: Direct effects of control variables on macro level self-perceived influence using consolidated network resources (without imputed data)

The total effects of the control variables on macro level self-perceived influence are depicted through direct paths only. The negative, significant effect of gender (std. est.= -0.086, S.E.=0.016, p<.01) means that women STEM faculty have significantly less macro level self-perceived influence than men STEM faculty. The direct effects of the discipline demographic control variables include the following: mathematics (std. est.=0.085, S.E.=0.017, p<.01), biochemistry (std. est.=-0.011, S.E.=0.016, NS) and civil engineering (std. est.=-0.014, S.E.=0.017, NS). This means that mathematic faculty have significantly higher levels of macro level self-perceived influence than biology faculty, whereas faculty in biochemistry and civil engineering have no significantly different levels of macro level self-perceived influence than biology faculty. The effects of the rank demographic variables include the following: assistant professors (std. est.= -0.414, S.E. 0.017, p<.01) and associate professors (std. est.= -0.163, S.E.=0.016, p<.01). This means that assistant and associate STEM professors have significantly less macro level self-perceived influence than full STEM professors. The effects of the productivity measures on macro level self-perceived influence include the following: the average number research grants submitted yearly (std. est.=0.038, S.E.=0.016, p<.05) the average number of teaching grants submitted yearly (std. est.=0.08, S.E. 0.015, p<.01) and the average number of published peer reviewed articles (std. est.=0.109, S.E.=0.016, p<.01). This means that faculty members who are productive in terms of producing more teaching and research grants as well as publications have higher levels of macro level self-perceived influence. The effect of social potency (std. est.=0.221, S.E. 0.015, p<.01) means that faculty with social dominant personalities have higher levels of macro level self-perceived influence. When differentiating between network resources, are these overall results also present Model 2?

5.6.6 Model 2: Path analysis among minority racial status, network structure, career development network resources, mentoring network resources and macro level self-perceived influence (without imputed data)

Table XVII provides the results for Model 2 predicting macro level self-perceived influence separating the career and network resources. Following the pattern used in previous discussion about Model 1, there will first be a review of the impacts of the network characteristics on self-perceived influence. There will be an emphasis on whether or not certain network resources result in variations in macro level self-perceived influence. Additionally, it will be determined whether or not structural characteristics have different impacts on macro level self-perceived influence based on network resource type. Second, there will be discussion of the findings related to how minority racial status analysis including minority racial status. In particular, it will be determined if the significance of minority racial status on network resources varies by type of resource. Lastly, the findings will illustrate whether or not minority STEM faculty experience varying extents of macro level self-perceived influence when considering the different types of network resources.

5.6.7 Model 2: Direct and indirect effects of network structure, career development network resources and mentoring network resources on macro level self-perceived influence (without imputed data)

Table XVII shows that the direct effects of both kinds of network resources on macro level self-perceived influence are similar to Model 1. The direct effects of career development resources are negative and significant: std. est. = -0.116, S.E.=0.042, $p<.01$. The same is true for mentoring network resources: std. est. = -0.127, S.E. = 0.046, $p<.01$. This means that having fewer types of both kinds of resources result in faculty having more macro level self-perceived influence. Thus, the first hypothesis H1 is consistently supported in this model. This can be interpreted as the reduced self-perceived influence is most likely due to the previously mentioned dynamics of resource dependence rather than particularly unique features of the type resource. The direct effects of network structural variables behave the same way in Model 2 as in Model 1 as well. Thus, H2, H3 and H4 are also supported in Model 2.

The direct effects of the network structural variables on the individual career and mentoring network resources are generally similar to what was found in Model 1. In other words, STEM faculty members with stronger ties and more constrained networks have greater career and mentoring network resources. Grouping the network resources reveals that the direct effects of external-internal tie ratio is significant on helping faculty acquire career development resources (std. est. = 0.104, S.E. = 0.014, $p<.01$). In other words, as STEM faculty increase their ratio of external ties to internal ties, they acquire more career development resources. The subsequent indirect effects of these three structural variables on macro level self-perceived influence in Model 2 are thus also similar to the findings from Model 1. In particular, as STEM faculty structure networks that have more strong ties, less constraint and ties that are more internally situated, they are less reliant upon career network resources and mentoring network resources, which leads to them having more macro level self-perceived influence.

However, Figure 3b clearly illustrates that there is a notable difference in the effect of the external-internal tie ratio on network resources and subsequent impact on macro level self-perceived influence between Model 1 and Model 2. In Model 2, the direct effects of external-internal tie ratio is only significant in relation to career network resources (std. est.=0.104, S.E.=0.014, $p<.01$). This means that as STEM faculty have a higher ratio of external to internally located ties, they are able to acquire significantly more career development network resources. Subsequently, the only significant indirect effect of external-internal tie ratio on macro level self-perceived influence is mediated through career development network resources (std. est.= -0.009, S.E. = 0.005, $p<.10$). In other words, faculty can reduce their dependence and subsequent reduced level of macro level self-perceived influence as they gather more career development resources from individuals outside of their organization. Moreover, when differentiating between both types of network resources, the significance of the indirect effect of the external-internal tie ratio is captured in Model 2. This indirect effect was not captured in Model 1. Career development resources are consequential in building reputations. By attaining more of these resources outside of the organization, faculty members are able to spread their reputations in a broader context and reduce their dependence upon colleagues within their organization. Consequently, faculty members with visibility within the overall academic science community may feel more empowered to provide valued insight into organizational development if they do not feel their reputational enhancement does not depend upon colleagues within their organization. The mentoring network resources are advice oriented and are more relevant to helping faculty function within their organization, thus they do not necessarily offer faculty members the opportunity to heighten their visibility and subsequent feelings about contributing to larger decisions about organizational development.

Overall, these findings imply that the indirect effect of external-internal tie ratio on macro level self-perceived influence may be due to the unique nature of career network resources. In particular, having more externally situated ties provides faculty with opportunities to more broadly enhance their reputations from invitations, recommendations, nomination and advice about collaborating in the non-academic environment from colleagues in different parts of the academic science community. However, more externally situated ties do not necessarily aid faculty in navigating and functioning within their specific institutions This may be why having a higher ratio of external ties does not have the same significant effect on the amount of mentoring network resources acquired by STEM faculty members. Does differentiating between network resource type illustrate more nuanced differences in the effects of minority racial status?

5.6.8 Model 2: Direct and indirect effects of minority racial status, network structure, career development network resources and mentoring network resources on macro level self-perceived influence (without imputed data)

The direct effects of minority racial status in Model 2 mirror the findings in Model 1. Just as in the previous model, there is a significant, negative direct effect of minority racial status on macro level self-perceived influence: std. est.= -0.031, S.E. = 0.016, $p<.05$. Thus, H5 is consistently supported across both models. The differentiation of the network resources does not appear to illustrate any differences in the extent to which minority faculty attain network resources. African-American/Black faculty are found to have significantly more career development (std. est.= 0.060, S.E.=0.014 and $p<.01$) and mentoring network resources (std.est.=0.080, S.E.= 0.013, $p<.01$) than White faculty. Thus, H6 also remains consistently unsupported across both models. Furthermore, the fact that African-American/Black faculty have significantly more mentoring network resources than career development network resources ($p<.01$ level) may indicate that African-American/Black faculty are less dependent upon their contacts for reputational development resources as opposed to insights that would help them navigate their work environments. Lastly in Model 2, the effects of minority racial status on the structural variables mirror the results from Model 1. Thus, H7, H8 and H9 are also unsupported in Model 2. This will be further addressed in the conclusion chapter.

Figure 3b show four significant indirect effects between minority racial status and macro level self-perceived influence. One path is mediated by career network resources, a second path is mediated by mentoring network resources and a third path is mediated by the external-internal tie ratio. These paths demonstrate that just as in Model 1, as minority STEM faculty rely more upon their alters for both career development and mentoring resources, they will not feel as influential in macro level decisions. However, Model 2 confirms the finding in Model 1 illustrating that as minority STEM faculty leverage more internally located ties, they will feel more empowered to influence organizational development.

Unlike Model 1, Model 2 presented in Table XVII demonstrates the significance of the indirect effect of minority racial status on macro level self-perceived influence (std. est.= -0.012, S.E. = 0.007, p<.10). This negative indirect effect is likely due to the mediating effects of career and mentoring network resources, whereby minority faculty have lower macro level self-perceived influence due them having significantly more of both types of resources. In other words, this model underscores the possible resource dependency present among minority faculty that, which is consistent irrespective of resource type. However, there is an important difference between Figure 3b and 3a that shows a different indirect effect of minority racial status. In Figure 3b, there is a significant indirect effect of minority racial minority racial status mediated by external-internal tie ratio and career network resources. In particular, this indirect path illustrates that as minority faculty leverage more career development resources from internally situated ties, they develop significantly higher levels of macro level self-perceived influence than non-minority faculty. Garnering invitations, nominations and recommendations from internally located network members can particularly benefit minority faculty by enhancing their visibility within their organization. Also, these endorsements from peers may boost minority faculty member's confidence, thereby overcoming the common stigma of being perceived as non-productive or non-valuable. Thus, these mediating effects of a higher internal to external tie ratio and career development resources appear to have significant effects in empowering minority STEM faculty to wield their influence in macro level organizational decisions. In particular, for minority STEM faculty, garnering resources that may enhance internal visibility can offset the dependence upon alters that may make minority faculty feel less empowered. However, it is important to note that while the overall indirect effect of minority racial status on macro level self-perceived influence is seen in Model 2, its direct effects are still greater. Thus, P1 is still supported in this model. This means that direct effects of minority racial status outweigh the mediating effects of career resources, mentoring resources and external-internal tie ratio. Nonetheless, differentiating the network resources demonstrates more nuanced and specific indirect effects of minority racial status on macro level self-perceived influence.

5.6.9 Model 2: Direct effects of control variables on macro level self-perceived influence with career development network resources and mentoring network resources (without imputed data)

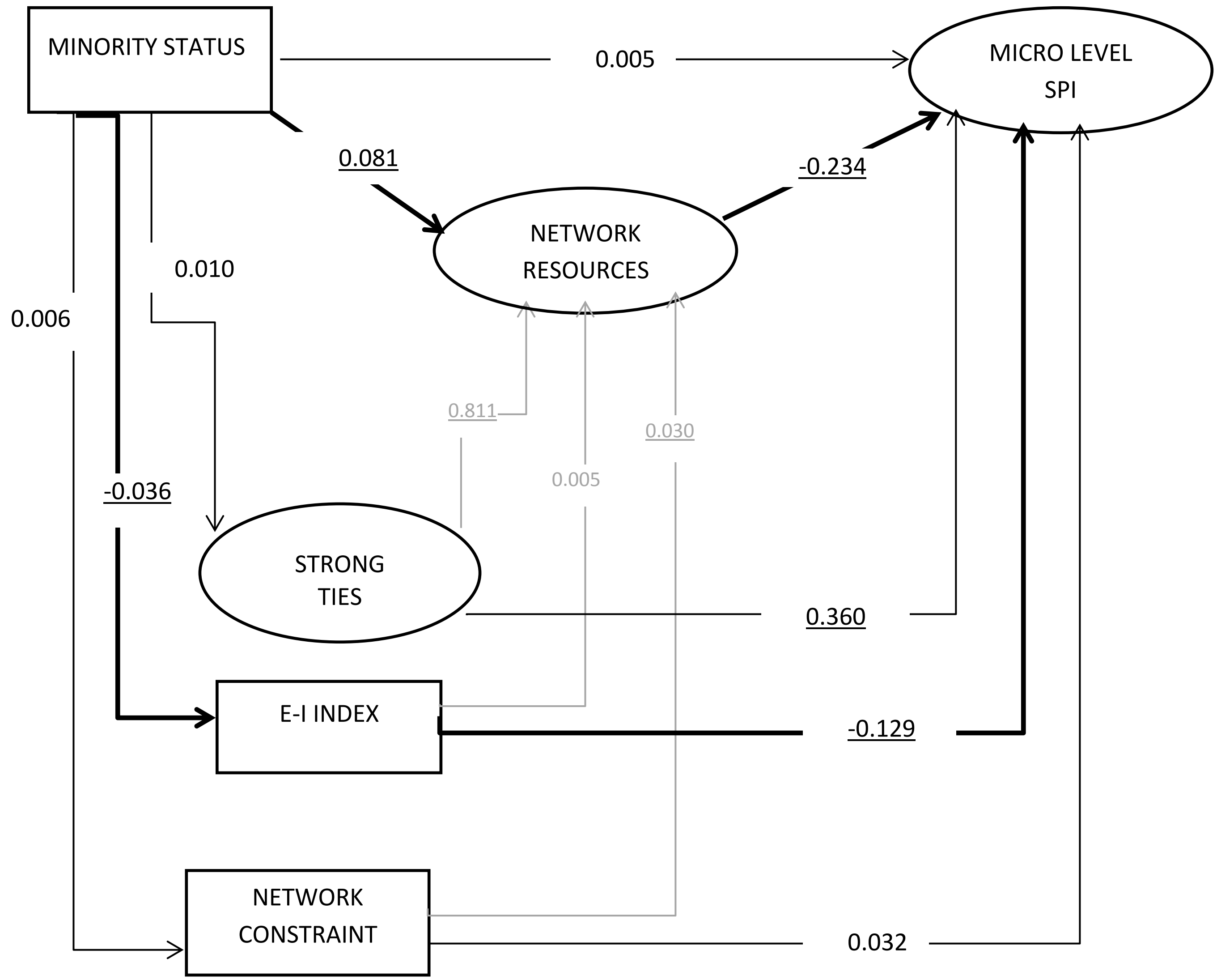
The direct effects of the control variables on macro level self-perceived influence in Model 2 are the same as what was found in Model 1. In other words, even when specifically categorizing network resources, the impacts of gender, rank, scientific discipline, productivity and social potency do not change when considering network resources as a consolidated variable. Thus, both models consistently demonstrate that women STEM faculty members have significantly less macro level self-perceived influence than men STEM faculty members. Mathematics faculty members have significantly more macro level self-perceived influence than biology faculty members. Junior faculty members have significantly less macro level self-perceived influence than senior faculty members. As faculty members produce more grants and publications have significantly more macro level self-perceived influence than lower producing faculty. Lastly, faculty members with more socially dominant and extroverted personalities have significantly more macro level self-perceived influence than faculty members with less social dominant and introverted personalities.

5.7 SEM results for models predicting micro level self-perceived influence (without data imputation)

This section discusses the results from estimated SEM models predicting micro level self-perceived influence (models three and four) when using data without imputation. A particular goal of this section is to determine whether or not the predictor variables behave similarly when considering a qualitatively different type of self-perceived influence. Table XVIII provides estimation results for the total, direct and indirect effects when considering the consolidated network variable (Model 3). Table XIX provides the estimation results for the total, direct and indirect effects when considering network resources grouped into career development and mentoring network resources (Model 4). Figures 4a and 4b on the next two pages illustrate the results of the significant paths from Model 3 and Model 4 respectively. Following the pattern of what was reported for the models estimating macro level self-perceived influence, there will first be a review of the goodness of fit indices, which determines how well the data fit the proposed models. Second, the impact of the direct and indirect effects between the independent and dependent variables are discussed. Finally, there is a summary of the findings, which emphasizes whether or not the hypotheses are actually supported based upon the theoretical foundation presented in chapter three positing the mechanics through which the independent and dependent variables are related. Overall, the indirect and direct effects of minority status, network resources and network structure characteristics on micro level self-perceived influence, as well as the indirect and direct impacts of minority status on the network variables are very similar the results found in the previous models predicting macro level self-perceived influence. Thus, the mechanics of tie strength, network constraint, and external-internal tie ratio operate very similarly in their impact on the extent to which faculty feel influential in shaping both types of organizational decisions. Additionally, results from the models predicting micro level self-perceived influence show that even when considering a different type of organizational decision, the minority faculty networks still behave relatively consistently.

Figure 4a. Model 3: Estimated Paths with All Network Resources in Single Variable Predicting Micro Level SPI, without Imputation

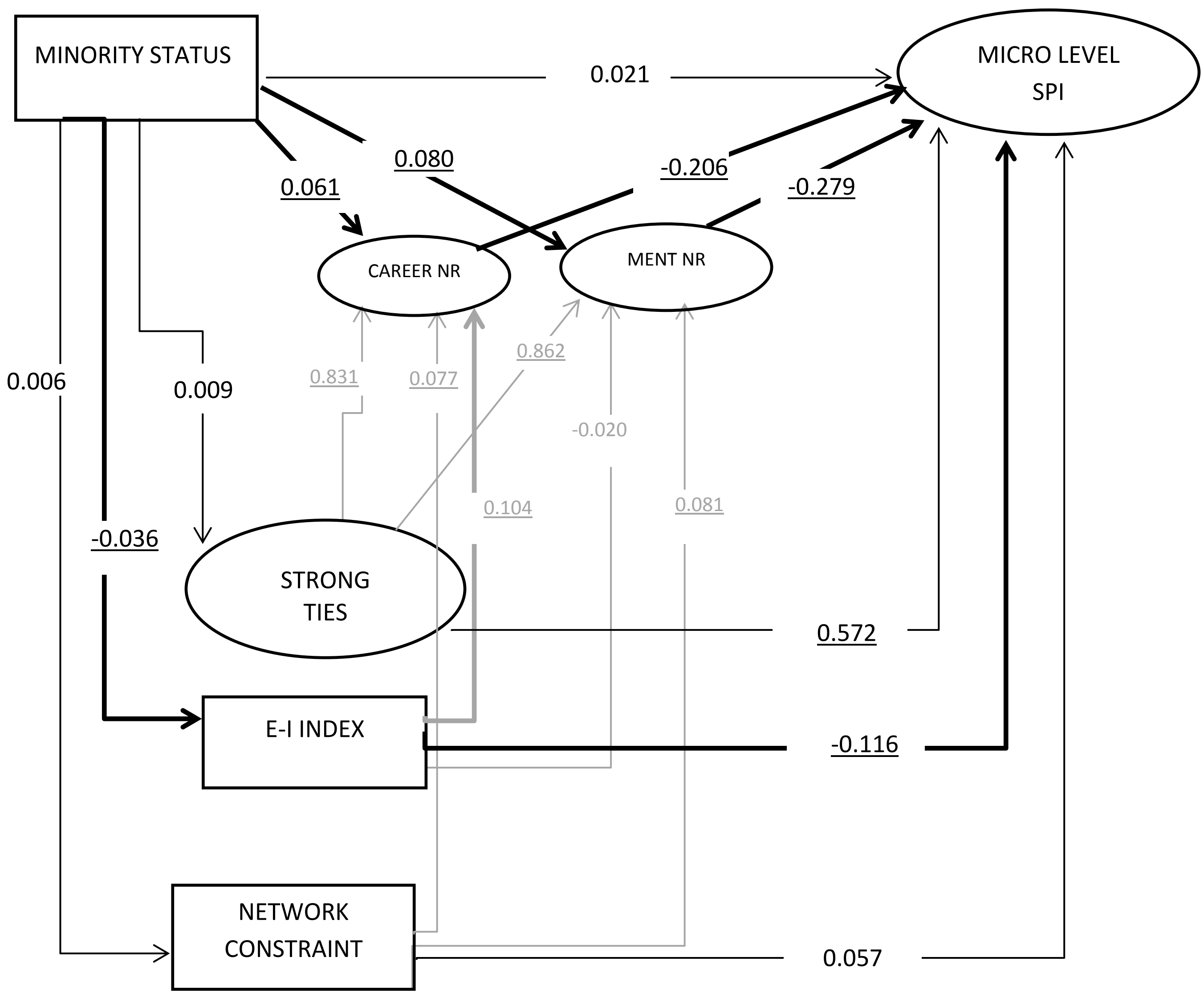
(greyed arrows are not formally hypothesized, but represent effects of structural variables on network resources)



Goodness of Fit Indices: Chi-sq 17758.072 Sig p<.01, RMSEA 0.094, CFI 0.651, PGFI 0.667, PNFI 0.595

Figure 4b. Model 4: Estimated Paths with Grouped Network Resources Predicting Micro Level SPI, without Imputation

(greyed arrows are not formally hypothesized, but represent effects of structural variables on network resources)



Goodness of Fit Indices: Chi-sq 16529.253 Sig p<.01, RMSEA 0.091, CFI 0.676, PGFI 0.680, PNFI 0.612

TABLE XVIII. MODEL 3: MICRO LEVEL SPI, CONSOLIDATED NETWORK RESOURCES, WEIGHTED DATA WITHOUT IMPUTATION

HYPOTHESES/PROPOSITION	PATH	TOTAL EFFECTS			DIRECT EFFECTS			INDIRECT EFFECTS		
		Std. Est.	S.E.	Sig	Std. Est.	S.E.	Sig	Std. Est.	S.E.	Sig
H1 (+)	NetResources--->SPIMICRO	-0.234	0.042	***	-0.234	0.042	***	...	...	...
	StrongTies--->NetResources	0.811	0.010	***	0.811	0.010	***	...	...	...
	Ext-IntTie--->NetResources	0.005	0.013	NS	0.005	0.013	NS	...	...	...
	NetConstraint--->NetResources	0.030	0.015	*	0.030	0.015	*	...	...	...
H2 (-)	NetConstraint--->SPIMICRO	0.025	0.023	NS	0.032	0.023	NS	-0.007	0.004	**
H3 (+)	StrongTies--->SPIMICRO	0.170	0.026	***	0.360	0.049	***	-0.190	0.034	***
H4 (-)	Ext-IntTie--->SPIMICRO	-0.130	0.018	***	-0.129	0.018	***	-0.001	0.003	NS
H5 (-),P1	AfAmBl--->SPIMICRO	-0.007	0.017	NS	0.005	0.018	NS	-0.013	0.007	**
H6 (-)	AfAmBl--->NetResources	0.089	0.017	***	0.081	0.012	***	0.008	0.014	NS
H7 (+)	AfAmBl--->NetConstraint	0.006	0.016	NS	0.006	0.016	NS	...	...	...
H8 (+)	AfAmBl--->Ext-IntTie	-0.036	0.016	*	-0.036	0.016	*	...	...	...
H9 (+)	AfAmBl--->StrongTies	0.010	0.018	NS	0.010	0.018	NS	...	...	...
Controls	Gender--->SPIMACRO	-0.126	0.018	***	-0.126	0.018	***	...	...	...
	Math--->SPIMACRO	0.025	0.020	NS	0.025	0.020	NS	...	...	...
	BioChem--->SPIMACRO	-0.079	0.018	***	-0.079	0.018	***	...	...	...
	CivEng--->SPIMACRO	0.010	0.020	NS	0.010	0.020	NS	...	...	...
	AssistProf--->SPIMACRO	-0.326	0.019	***	-0.326	0.019	***	...	...	...
	AssoctProf--->SPIMACRO	-0.201	0.019	***	-0.201	0.019	***	...	...	...
	PubAvg--->SPIMACRO	0.083	0.019	***	0.083	0.019	***	...	...	...
	TeachGrntAvg--->SPIMACRO	0.029	0.018	*	0.029	0.018	*	...	...	...
	GrntAvg--->SPIMACRO	0.029	0.019	NS	0.029	0.019	NS	...	...	...
	SocPot--->SPIMACRO	0.308	0.018	***	0.308	0.018	***	...	...	...

TABLE XIX. MODEL 4: MICRO LEVEL SPI, CAREER DEVELOPMENT AND MENTOR NETWORK RESOURCES, WEIGHTED DATA WITHOUT IMPUTATION

		TOTAL EFFECTS			DIRECT EFFECTS			INDIRECT EFFECTS		
HYPOTHESES/PROPOSITION	***PATH***	***Std. Est.***	***S.E.***	***Sig***	***Std. Est.***	***S.E.***	***Sig***	***Std. Est.***	***S.E.***	***Sig***
H1 (+)	CareerNetResources--->SPIMICRO	-0.206	0.050	***	-0.206	0.050	***	...	...	...
H1 (+)	MentNetResources--->SPIMICRO	-0.279	0.056	***	-0.279	0.056	***	...	...	...
	StrongTies--->CareerNetResources	0.831	0.010	***	0.831	0.010	***	...	...	...
	StrongTies--->MentNetResources	0.862	0.009	***	0.862	0.009	***	...	...	...
	Ext-IntTie--->CareerNetResources	0.104	0.014	NS	0.104	0.014	***	...	...	...
	Ext-IntTie--->MentNetResources	-0.020	0.014	***	-0.020	0.014	NS	...	...	...
	NetConstraint---CareerNetResources	0.077	0.017	***	0.077	0.017	***	...	...	...
	NetConstraint--->MentNetResources	0.081	0.015	***	0.081	0.015	***	...	...	...
H2 (-)	NetConstraint--->SPIMICRO	0.019	0.023	NS	0.057	0.026	**	-0.038	0.010	***
H3 (+)	StrongTies--->SPIMICRO	0.161	0.026	***	0.572	0.083	***	-0.411	0.070	***
H4 (-)	Ext-IntTie--->SPIMICRO	-0.132	0.018	***	-0.116	0.020	***	-0.016	0.008	**
H5(-),P1	AfAmBl--->SPIMICRO	-0.007	0.018	NS	0.021	0.019	NS	-0.029	0.010	***
H6(-)	AfAmBl--->CareerNetResources	0.065	0.018	***	0.061	0.015	***	0.004	0.015	NS
H6(-)	AfAmBl--->MentNetResources	0.089	0.017	***	0.080	0.013	***	0.009	0.016	NS
H7 (+)	AfAmBl--->NetConstraint	0.006	0.016	NS	0.006	0.016	NS	...	...	...
H8 (+)	AfAmBl--->Ext-IntTie	-0.036	0.016	**	-0.036	0.016	**	...	...	...
H9 (+)	AfAmBl--->StrongTies	0.009	0.019	NS	0.009	0.019	NS	...	...	...
Controls	Gender--->SPIMACRO	-0.126	0.018	***	-0.126	0.018	***	...	...	...
	Math--->SPIMACRO	0.025	0.020	NS	0.025	0.020	NS	...	...	...
	BioChem--->SPIMACRO	-0.078	0.018	***	-0.078	0.018	***	...	...	...
	CivEng--->SPIMACRO	0.011	0.020	***	0.011	0.020	***	...	...	...
	AssistProf--->SPIMACRO	-0.329	0.019	***	-0.329	0.019	***	...	...	...
	AssoctProf--->SPIMACRO	-0.201	0.019	***	-0.201	0.019	***	...	...	...
	PubAvg--->SPIMACRO	0.083	0.019	***	0.083	0.019	***	...	...	...
	TeachGrntAvg--->SPIMACRO	0.029	0.018	*	0.029	0.018	*	...	...	...
	GrntAvg--->SPIMACRO	0.029	0.019	NS	0.029	0.019	NS	...	...	...
	SocPot--->SPIMACRO	0.309	0.018	***	0.309	0.018	***	...	...	...

5.7.1 Goodness of fit for models 3 and 4: SEM results for predicting micro level self-perceived influence (without data imputation)

The following statistics for the model fit indices were present in Model 3 predicting micro level self-perceived influence using a consolidated network resource variable: RMSEA of .094, CFI of 0.651, PGFI of 0.667 and PNFI of 0.595. Based on the criteria provided for acceptable fitting models, this model predicting micro level self-perceived influence falls within the boundaries of being an acceptable fitting model. Model 4 predicting micro level self-perceived influence grouping the network resources into career development and mentoring categories has the following statistics for the goodness of fit indices: RMSEA of .091, CFI of 0.676, PGFI of 0.680 and PNFI of 0.612. This means that Model 4 is also an acceptable fitting model.

5.7.2 Model 3: path analysis among minority racial status, network structure, consolidated network resources and micro level self-perceived influence (without imputed data)

The proceeding section uses Table XVIII to discuss the results of Model 3 predicting micro level self-perceived influence utilizing a single network resource variable has two primary parts. First, there will be a report of the direct and indirect effects of the network structure characteristics and network resources on micro level self-perceived influence. Second, there is a discussion of the direct and indirect effects of minority racial status on network structure, network resources and micro level self-perceived.

5.7.3 Model 3: Direct and indirect effects of network structure and consolidated network resources on micro level self-perceived influence (without imputed data)

Table XVIII shows that the direct effect of network resources on micro level self-perceived influence is negative and significant: std. est. = -0.234, S.E. = 0.042, $p<.01$. In other words, having fewer network resources results in STEM faculty members having an enhanced sense of their influence on organizational decisions that are closer within their locus of control. Similarly to Model 1, this finding does not support H1 proposing that more network resources would result in higher levels of self-perceived influence. In Model 3, only tie strength and external-internal tie ratio have significant direct effects on increasing micro level self-perceived influence. In particular, tie strength has the following direct effect: std. est.= 0.360, S.E.=0.049, $p<.01$. The direct effects of external-internal tie ratio has the following direct effect: std. est.= -0.129, S.E.=0.018.$p<.01$. This means that STEM faculty members with networks containing more strong ties and a higher ratio of internal to external ties have higher levels of micro level self-perceived influence. These findings support H3 and H4. However, H2 is not supported in Model 3, which hypothesizes that less constrained networks would result in higher levels of self-perceived influence.

How might these findings about the significant direct effects of network resources, tie strength and external-internal tie ratio be interpreted when considering the unique nature of micro level decisions? Similar to the findings in Models 1 and 2, depending upon colleagues for critical resources that enhance reputations and facilitate navigation within the organization may supplant a faculty member's sense of exercising their own agenda. Thus, STEM faculty members depending upon resources and insights from others may mitigate a faculty member's sense of authoritatively wielding their own professional authority and shaping their own experiences within their departments. However, having more emotionally close connections and more internally located colleagues can result in STEM faculty getting encouragement and positive feedback about their performance, value and professional authority, which will subsequently enhance their sense of confidence about their ability to navigate and perform within their departments (i.e. self-efficacy). An organizational actor's enhanced notion of self-efficacy is essentially a reflection of their empowerment, which is expressed in their ability to shape their own experiences and exercise their own agenda.

Understanding how network structure variables impact network resources can provide subsequent insight into the indirect effects of network structure on micro level self-perceived influence. In Model 3, only tie strength and network constraint have significant impacts on network resources. In particular, tie strength has the following direct effect on network resources: std. est. = 0.811, S.E. = 0.010, $p<.01$). Network constraint has the following direct effect on network resources: std. est. = 0.030, S.E. = 0.015, $p<.10$. Similar to what was found in Models 1, Model 3 also supports the assertion that networks with emotionally close and highly trusted ties facilitate the provision of network resources. Additionally, sharing resources with others is also enabled by having networks that are smaller, denser and more hierarchical (i.e. having fewer structural holes).

Tie strength and network constraint are the only network structure variables having significant indirect effects on micro level self-perceived influence. In particular, tie strength has the following indirect effect: std. est. = -0.190, S.E. = 0.034, p<.01. The network constraint variable has the following indirect effect: std. est. = -0.007, S.E. = 0.004, p<.05. Similar to what was found in Model 1, these findings indicate that when STEM faculty members have fewer stronger ties and less constrained networks, they acquire fewer network resources. Consequently, STEM faculty reduce their reliance upon colleagues for resources, thereby making them more confident in exercising their own agenda and wielding their own professional influence (i.e. having increased levels of micro level self-perceived influence).

The following summarizes the impact of network structure variables on micro level self-perceived influence. The significant total effect of tie strength (std. est. = 0.170, S.E.= 0.026, p<.01) is attributable both to how this variable impacts network resources and how it also enhances self-efficacy and empowerment. However, because the direct effect is greater than its indirect effect, the overall impact of tie strength on micro level self-perceived influence is more attributable to how it supports STEM faculty in building the personal confidence to invoke their own agenda and exert their professional authority in their academic departments. The significant total effects of external-internal tie ratio (std. est. = -0.130, S.E.= 0.018, p<.01) on micro level self-perceived influence are only attributable to the significance of having support from more internally situated colleagues. It is only the indirect effect of network constraint that significantly impacts micro level self-perceived influence, meaning that this network construct is only viable in shaping micro level self-perceived influence because of how it mitigates resource dependence.

How does the role of minority racial status impact micro level self-perceived influence, especially when considering the aforementioned findings about the impacts of network structure and network resources?

5.7.4 Model 3: Direct and indirect effects of minority racial status, network structure and network resources on micro level self-perceived influence (without imputed data)

Table XVIII demonstrates that unlike what was found in Model 1, minority racial status has no significant direct effects on micro level self-perceived influence. This means that African-American/Black STEM faculty members have no significantly different amount of micro level self-perceived influence compared to White STEM faculty members. In other words, overall, minority STEM faculty do not feel significantly more or less empowered in their ability to shape their experiences and agenda in their academic STEM departments. Thus, H5 stating that minority faculty would have significantly less self-perceived influence than non-minority faculty is not supported in Model 3. However, similar to Model 1, the findings in Model 3 indicate that the direct effects of minority racial status on network resources is also positive and significant (std. est. = 0.081, S.E. = 0.012, $p<.01$). In other words, this model also shows that minority STEM faculty members have significantly more network resources than non-minority STEM faculty members, thus confirming H6. The direct effects of minority racial status on network structure variables in Model 3 are also similar to what was found in Model 1. Model 3 demonstrates a significant direct effect of minority racial status on external-internal tie ratio: std. est. = -0.036, S.E. = 0.016, $p<.10$. Thus, H7, H8 and H9 are not supported from findings in Model 3.

What are the indirect effects of minority racial status on micro level self-perceived influence and network resources? Its indirect effect (std. est. = -0.013, S.E. = 0.007, $p<.05$) indicates that mediating effects of network variables makes the significantly diminished levels of micro level self-perceived influence more prominent. Figure 4a illustrates two significant indirect effects. First, similar to Model 1, as minority STEM faculty acquire more network resources from colleagues (i.e. become more dependent), they will feel significantly less autonomous in shaping their own experiences and agenda in their academic institutions than non-minority STEM faculty. However, similar to Model 1, the second significant indirect effect in Model 3 mediated by the external-internal tie ratio indicates that as minority STEM faculty leverage the benefits of having more internally situated colleagues, they will feel more empowered and confident in shaping micro level decisions. Overall, although the there is a positive indirect effect of minority racial status on micro level self-perceived influence via the mediating effect of external-internal tie ratios, it appears that the significant overall indirect effect of minority racial status is mostly due to the negative significance of minority STEM faculty being more dependent upon network resources. Although the external-internal tie ratio is significant for minority STEM faculty, the fact that the overall indirect effect of minority racial status on network resources is insignificant means that significant acquisition of network resources for minority STEM faculty is not necessarily due to the effects of having more internally situated ties. Lastly, it is important to note that the because only the indirect effect of minority racial status on micro level self-perceived influence is not significant, P1 proposing that the direct effects of racial status on self-perceived influence would be greater is not supported by this model.

Overall, the findings from the models analyzed up to this point indicate that the limitations minority STEM faculty experience in terms of their personal perceptions of power and influence are shaped by the realm of organizational decision. The significant direct effects of minority racial status on macro level self-perceived influence indicate that minority STEM faculty members feel limited in exercising their voice in matters that shape their organizational environment. However, the direct effects of minority racial status on micro level self-perceived influence do not demonstrate any significant differences. In other words, minority STEM faculty do not appear to feel more significantly limited in exercising their influence over decisions that directly impact their personal outcomes and activity within their organizations. Why might there be differences in the direct effects of minority racial status on distinctive types of self-perceived influence? These differences may be accounted for using critical race theory, which explains the limited inclusion of minorities in academia. In particular, critical race theory asserts that racial bias is perpetuated by institutional culture, practices and policies that value the interests and advancement of non-minorities over minorities (Delgado & Stefanic, 2000). Moreover, critical race theory posits that because racism is such an insidious part of society, racial bias is quite entrenched in practices, polices and culture to the point where it becomes the status quo (Delgado & Stefanic, 2000; Ladson-Billings, 1998). Macro-level decision making involves organizational decisions that strongly reflect and impact institutional culture. Thus, the risk of having more involvement of minority organizational members involved in macro level decision making is that their agendas and priorities may eventually erode the status quo. Limiting the involvement of minority STEM faculty in such decisions can make them feel less powerful in changing their environments. However, micro level organization decisions are bounded to the activities and areas that are salient to the professional authority of the faculty member. These decisions have a much less impact on larger institutional practices, policies and culture. Thus, it is not necessary to limit the role of minority STEM faculty in these types of decisions.

5.7.5 Model 3: Direct effects of control variables on micro level self-perceived influence with consolidated network resource variable, without data imputation

The direct effects of the control variables on micro level self-perceived influence in Model 3 are similar to what was found in Model 1. Among the demographic control variables women STEM faculty have significantly lower levels of micro level self-perceived influence than men STEM faculty (std. est. = -0.126, S.E. = 0.018, p<.01). Assistant professors (std. est. = -0.326, S.E. = 0.019, p<.01) and associate professors (std. est. = -0.201, S.E. = 0.019, p<.01) have significantly lower micro level self-perceived influence than full professors. Biochemistry faculty (std. est. = -0.079, S.E. = 0.018, p<.01) have significantly less micro level self-perceived influence than biology faculty. In particular, increased productivity also enhances micro level self-perceived influence. In particular, published peer reviewed articles (std. est. = 0.083, S.E. = 0.019, p<.01) and submitted teaching grants (std. est. = 0.029, S.E. = 0.018, p<.10) enhance STEM faculty's perceptions of influence micro level decisions. Lastly, faculty members with higher levels of social potency (std. est. = 0.308, S.E. = 0.018, p<.01) also have enhanced perceptions of their micro level self-perceived influence.

5.7.6 Model 4: Path analysis for models predicting micro level self-perceived influence using career development and advice network resources (without imputed data)

The results for Model 4 in Table XIX predict micro level self-perceived influence with grouping career development and mentoring network resources separately. The results are very similar to what was present in the Model 2, which predicted macro level self-perceived influence using grouped variables.

5.7.7 Model 4: Direct and indirect effects of network structure, career development and mentoring network resources on micro level self-perceived influence (without imputed data)

Similar to the findings from Model 2, the results from Table XIX indicate that the direct effects of career development network resources are negative and significant (std. est. = -0.206, S.E. = 0.050, p<.01). The direct effects of mentoring network resources are also similar (std. est. = -0.279, S.E. = 0.056, p<.01). In other words, as faculty members acquire both types of resources they experience significantly lower levels of micro level self-perceived influence. Thus, H1 remains supported in Model 4. The findings from Model 4 indicate that the direct effects of strong ties and external-internal tie ratio on micro level self-perceived influence are similar to what was found in Model 2. In particular, networks that are more internally oriented provide faculty with enhanced perspectives of their micro level self-perceived influence (std. est. = -0.116, S.E. = 0.020, p<.01). Networks with more strong ties also provide faculty with higher levels of micro level self-perceived influence (std. est. = 0.572, S.E. = 0.083, p<.01). Thus, H3 and H4 also remain supported in this model.

However, unlike what was found about the role of network constraint in predicting macro level self-perceived influence, the role of network constraint is different in shaping micro level self-perceived influence. Moreover, Model 4 reveals the significance of the direct effects of network constraint on micro level self-perceived influence, which was not revealed in Model 3. In particular, Model 4 demonstrates that direct effects of network constraint on micro level self-perceived influence is positive and significant (std. est. = 0.057, S.E. = 0.026, $p<.05$). STEM faculty who have more constrained networks experience higher levels of micro level self-perceived influence. Thus, H2 proposing that less constrained networks would result in higher levels of micro level self-perceived influence is not supported in this model. Why might the benefits of network constraint work in the opposite way in shaping micro level self-perceived influence? Less constrained networks offer faculty STEM members more opportunities to build their visibility and reputations, which may provide them with the prestige to more fully participate in larger organizational decision making. However, constrained networks may more strongly build and reinforce self-efficacy that makes STEM faculty members more comfortable and confident in their professional performance and value, thereby making them more self-assured in exercising their professional authority. This is because a constrained network is essentially a tightly knit community of colleagues that can offer network members with more fortified and redundant socio-emotional support and security that comes with tightly interconnected colleagues (Burt, 2000; Burt et al., 1998).

The results from Model 4 about the direct effects of network structure on network resources are similar to what was found in other models. Stronger network ties provide faculty with significantly more career development (std. est. = 0.831, S.E. = 0.010, p<.01) and mentoring network resources (std. est. = 0.862, S.E. = 0.009, p<.01). More constrained networks also provide faculty members with significantly more career development (std. est. = 0.077, S.E. = 0.017, p<.01) and mentoring network resources (std. est. = 0.081, S.E. = 0.015, p<.01). Lastly, networks that have a higher ratio of external to internal ties only offer significantly more career development resources (std. est. = 0.104, S.E. = 0.014, p<.01).

Given the similar impact of network structure on network resources presented in the previous models, Model 4 and Figure 4b also demonstrate indicate the indirect effects of network structure on micro level self-perceived influence are similar to what was found in previous models. In particular, Model 4 demonstrates there are significant indirect effects of network constraint (std. est. = -0.038, S.E. = 0.010, p<.01). There are also significant indirect effects of tie strength (std. est.= -0.411, S.E. = 0.070, p<.01). Lastly, there are significant indirect effects of external-internal tie ratio (std. est. = -0.016, S.E. = 0.008, p<.05). Overall, this means that faculty members experience higher levels micro level self-perceived influence as they reduce their dependence upon their network alters for career and mentoring network resources as a result of having fewer strong ties, less network constraint and having a higher ratio of internal ties. However, similar to Model 2, it is important to note that the significance of the indirect effect of external-internal tie ratio is only present through the mediating effect of career development network resources. There may not be any significant indirect effects of the external-internal tie ratio mediated by mentoring network resources because external connections are likely not to provide faculty members with advice that is relevant to how they function and navigate within their specific institutions.

5.7.8 Model 4: Direct and indirect effects of minority racial status, network structure, career development and mentoring network resources on micro level self-perceived influence (without imputed data)

Given that the results of the direct and indirect effects of minority racial status in Model 4 are similar to what was found in previous models, there will be an overall summary of the results in Model 4. The insignificance of the direct effects of minority racial status on micro level self-perceived influence in Model 4 mirrors the findings in Model 3. Thus, H5 stating that minority STEM faculty would have significantly lower levels of self-perceived influence remains unsupported in this model. The direct effect of minority racial status on network structure also mirrors what was found in Model 3, whereby minority STEM faculty are seen to have networks that are significantly more internally situated. Thus, H7, H8 and H9 remain unsupported in Model 4.

The indirect effects of minority racial status on micro level self-perceived influence and network resources found in Model 4 and Figure 4b mirror what was found in Model 3. More specifically, the significance of the indirect effects of minority racial status on micro level self-perceived influence appear attributable to several factors. Minority STEM faculty experience significantly less micro level self-perceived influence than non-minority STEM faculty as they depend more upon colleagues for career development and mentoring network resources. However, minority STEM faculty appear to develop significantly higher levels of micro level self-perceived influence than non-minority faculty as a result of leveraging the benefits from more internally situated networks. Such benefits of internally situated networks include reinforcement of self-efficacy regarding one's perspective on their personal ability to perform and be valuable within the organization. Leveraging the benefits of having a higher ratio of internal ties allows minority STEM faculty to offset their dependency upon career network resources, resulting in them having significantly higher levels of micro level self-perceived influence. Lastly, similar to Model 3, there is no support in Model 4 for P1 asserting that the direct effects of racial status would be greater than its indirect effects.

5.7.9 Model 4: Direct effects of control variables micro level self-perceived influence using career and mentoring network variables (without imputed data)

The direct effects of control variables on micro level self-perceived influence are generally consistent with what was found in Model 3. In other words, women STEM faculty are still seen to have significantly less micro level self-perceived influence than men STEM faculty. STEM faculty members who produce more articles and teaching grants exhibit higher levels of micro level self-perceived influence. STEM faculty with higher levels of social potency are still seen to exhibit higher levels of micro level self-perceived influence. The only exception about the direct effects on the control variables in Model 4 is seen among the effects of the civil engineering discipline. Unlike what was found in Model 3, Model 4 demonstrates that civil engineering faculty have significantly more micro level self-perceived influence than biology faculty.

5.8 Summary of SEM results using imputed data

Appendix C provides the descriptive statistics, correlation table, CFA analysis output, and estimates of total, direct and indirect effects that based on imputed data. Using imputed data yields a sample size of 1,295. Overall, the results from the CFA analysis and estimated models using imputed data are very similar to the results found when using the non-imputed data set. In particular, this means that the observed variables consistently indicate the latent variables of strong ties, macro level self-perceived influence, micro level self-perceived influence and network resources. Additionally, the similar results found in the imputed data sets confirm the dynamics between network structure and network resources and their subsequent interactive function on self-perceived influence. Also, the imputed data set confirms the role of minority racial status on network structure and network resources and their interactive influence on self-perceived influence.

Overall, the support or disconfirmation of the hypotheses follows the same pattern in the models using the non-imputed data set. There are only two exceptions in the path estimates between the imputed and non-imputed data set. First, the indirect effect of minority racial status on macro level self-perceived influence is insignificant, whereas it was significant in the model using non-imputed data. Second, in Models 3 and 4 using imputed data, the direct and total effects of network constraint on micro level self-perceived are positive and significant, which was not consistently the case in the same models using non-imputed data. The significant effect of network constraint is likely picked up in the model using the imputed data set because of the increased availability of observed data, which removes potential bias in the estimates therefore providing a more accurate picture of how variables behave (Allison, 2003;

Alf et al., 2009). Based on this finding, H2 remains unsupported using the imputed data predicting the role of network constraint on micro level self-perceived influence. Nonetheless, this is an important finding that indicates that faculty with networks with fewer ties that are more interconnected and rely upon a single dominant contact for resources experience more micro level self-perceived influence. This confirms that the more constrained networks may offer self-efficacy benefits that reinforce faculty member's confidence in their personal value, ability and performance, thereby making them more assured and assertive in making decisions that shape their experiences and productivity as well as fortify their professional authority. As mentioned previously, this impact of more constrained networks may be due to the fact that tightly knit community of colleagues can offer reinforced and fortified socio-emotional support that builds self-efficacy, thereby making faculty members feel more confident and empowered.

5.9 Overall summary of findings (without data imputation)

The results from the four models predicting macro and micro level self-perceived influence can be summarized according to the extent to which they support the presented hypotheses. A summary of hypothesis support is provided in Table XX.

1. H1 asserting that more network resources provide self-perceived influence is not supported by any of the models. Overall, it appears that while career and mentoring resources are important, they can place faculty members in positions of dependence. More specifically, faculty with more resources from their network alters are reliant upon colleagues to build their reputations and help them navigate through organizational life, both which can supplant a faculty member's autonomy in fulfilling their own agenda at

the macro and micro organizational level. In other words, resource dependence will make it less likely for faculty to feel empowered to assert themselves in organizational decision making because they may feel more responsible to the individuals who provide them with critical resources.

2. H2, H3 and H4 positing that faculty with networks containing more strong ties, a higher ratio of internal ties to external ties and that are less constrained would have more self-perceived influence were partially supported. The direct effects of these structural arrangements on self-perceived influence can be interpreted as follows. More strong ties imply more emotional closeness, which provides socio-emotional support that boosts self-efficacy, resulting in faculty feeling more empowered and valued in their organization. Such feelings of empowerment and value that are relevant to how faculty function within their organization are particularly augmented when it comes from colleagues within the same organization. Subsequently, faculty members with networks containing these particular structural arrangements have higher levels of micro level self-perceived influence. The same benefits of having more strong ties and having a higher ratio of internal ties can also be realized in enhancing macro level self-perceived influence. However, the role of network constraint on self-perceived influence depends upon the type of self-perceived influence in question. Having a less constrained network offers faculty members the opportunity to build their reputations and visibility, thereby affording them the privilege of shaping macro level decisions. However, based on the imputed data set, the significance of network constraint on micro level self-perceived influence illustrates that more constrained networks increase

this type of self-perceived influence. This is likely due to the building and reinforcement of self-efficacy that comes from a tightly knit community of colleagues. Network structural variables also have indirect effects on self-perceived influence through the mediating impact on network resources. In particular, having fewer strong ties and less network constraint the overall dependency that faculty have on their network alters for resources. However, the role of external-internal tie ratio in reducing network dependence depends upon the type of network resource. Having a higher ratio of internally situated ties significantly only reduces the number of career network resources, thus lessening resource dependence. Faculty with less dependence can therefore experience enhanced perceptions of being able to exert their influence in decision making without feeling responsible to them.

3. H5 positing that minority faculty would have less self-perceived influence is partially supported by these models. While minorities generally have less macro level self-perceived influence, they generally do not have significantly different levels of micro level self-perceived influence than non-minority STEM faculty. However, it appears that in both instances when less self-perceived influence is present it is at least partially due to the fact that minority faculty are more dependent upon alters for resources. This counters H6 stating that they would have less network resources. This implies that African-American/Black faculty may be more adept at leveraging their networks to attain beneficial resources, but this places them in more dependent positions on colleagues, thereby hampering their ability to build their perceptions of individual value and worth in shaping organizational life as well as being fully autonomous in developing

and wielding their organizational influence. The exception is minority faculty who are able to develop more internally situated networks that possible allows them to leverage the reputational benefits of career developments, therefore enhancing their self-perceived influence. The fact that they have more internally situated networks does provide some evidence that minority STEM faculty are included in and supported by key networks within their organization. However, without leveraging the reputational and self-efficacy enhancing benefits of these resources, there is a risk that minority faculty will become disadvantaged by resource dependency. For minority faculty, the acquisition of resources does not appear to be a result of what was hypothesized in H7, H8 and H9. Contrary to what was hypothesized in H7, H8 and H9, minority faculty only have a significantly higher ratio of internal ties and not any significant differences in terms tie strength and constraint. Thus, strong ties and network constraint do not appear to impact how minority faculty attain career development and mentoring network resources. However, having a higher ratio of internal ties tends to help them utilize career network resources in a way that may heighten their reputation rather than induce resource dependency. The result is that the indirect effect of external-internal tie ratio on self-perceived influence is particularly beneficial for minority STEM faculty. However, the fact that the direct effect of minority status on macro level self-perceived influence is greater than its indirect effects, which supports proposition one, indicates that there is perhaps another intervening variable that can explain how and why minority faculty feel less influential in shaping their organizations. The findings provide some potential empirical evidence of critical race theory at work in the specific realm of the academic STEM environment. In particular, these findings imply that substantive diversity, whereby minority faculty are perceived as valued participants in organizational development, is limited in the academic STEM environment. Therefore, they are hindered by the diminished perspective of not being able have a voice in organizational development. In particular, minority STEM faculty appear to feel less able to shape the academic environment in ways that can possibly benefit them, reaffirm their professional authority and mitigate the unique barriers they face in organizational advancement. Furthermore, these findings illustrate that limitations in can be significantly attributed to how minority STEM faculty enact and use their professional networks. Lastly, these findings about minority status on network factors confirms that minority social networks do behave differently than non-minority networks with regards to how network structure facilitates access to network resources, meaning that race is a crucial factor in considering the dynamics assumed by social network theory.

TABLE XX. SUMMARY OF HYPOTHESIS SUPPORT BASED ON DIRECT EFFECTS

HYPOTHESES	**SUPPORTED OR NOT SUPPORTED BASED ON DIRECT EFFECTS**	
	MACRO LEVEL SPI	***MICRO LEVEL SPI***
H1 - STEM faculty with more network resources will report higher levels of self-perceived influence.	☒	☒
H2 - STEM faculty with lower network constraint will report significantly higher levels of self-perceived influence.	☑	☒
H3: STEM faculty with more strong ties will report higher levels of self-perceived influence.	☑	☑
H4: STEM faculty with a higher ratio of internally ties to external ties will report higher levels of self-perceived influence.	☑	☑
H5: Overall, African-American/Black STEM faculty will report lower levels of self-perceived influence than non-minority STEM faculty.	☑	☒
H6: African-American/Black faculty will report having overall less network resources than non-minority STEM faculty.	☒	☒
H7: African-American/Black STEM faculty will report having more constrained networks than non-minority STEM faculty.	☒	☒
H8: African-American/Black STEM faculty will report having a higher portion of external to internal ties than non-minority STEM faculty.	☒	☒
H9: African-American/Black STEM faculty will report having more strong ties than non-minority STEM faculty.	☒	☒

Several observations can be made from the findings that illuminate our understanding about the relevance of social networks and race in the development of STEM faculty. In particular, these findings illustrate that for STEM faculty, one of the substantive outcomes of reputational benefits is feeling empowered in organizational decision-making. Moreover, these findings imply that the power dynamics of resource dependency are strongly indicated in the extent to which STEM faculty can leverage this reputational benefit. Thus, the cultural norm in science institutions portending that influence is a pure product of merit is not necessarily straight forward. Moreover, these findings indicate that the structure of STEM faculty's professional networks provide additional benefits in building their self-perceived influence other than through reducing resource dependency. More specifically, structural elements may provide socio-emotional support through the building of self-efficacy. Overall, this finding suggests that the development and empowerment of STEM faculty is not just a matter of functional and instrumental support that reflects the imperative of merit.

Observations can also be made about the specific realm of minority STEM faculty in predominately white institutions. Overall, minority STEM faculty members in these institutions do not appear to lack for career development and mentoring resources derived from the professional networks located in their organizations. Nonetheless, racial bias is still likely present in these institutions resulting in minority STEM faculty feeling limited in their inclusion in organizational decision-making, which underscores the idea that scientific institutions are not bastions of racial neutrality. In particular, racial bias appears to be partially attributable to resource dependency dynamics. The findings imply that certain structural characteristics—specifically network constraint and tie strength—do not appear to be as beneficial in helping minority STEM faculty mitigate the effects of resource dependency. However, what is important for minorities in overcoming racial bias and mitigating resource dependency is whether or not their career development resources come from connections inside or outside of their organization. Because such resources provide reputational benefits, it appears that for minority STEM faculty building their internal reputations among colleagues is particularly important in overcoming racial bias and resource dependency. Although these findings about these specific structures variables in minority networks do not support the proposed hypotheses, these findings suggest that the application of social network theory in understanding the advancement and development of STEM faculty should carefully consider the role of race. The next and final chapter discusses the possible theoretical, practical and policy implications of the overall findings from this research.

6.0 CONCLUSION

6.1 Overview

This dissertation sought to address the following research questions: 1) *Does network structure significantly explain the level of self-perceived influence held by academic science faculty in organizational decision making?;* 2) *are there differences in the level of self-perceived influence held by URM academic science faculty versus non-URM academic science faculty;* and 3) *do URM and non-URM social networks explain self-perceived influence in the same way?* Using literature about self-efficacy, resource dependency, reputation development, social networks, critical race theory, the general experiences of minority faculty and the status of minorities in STEM, a theoretical foundation was used to establish several hypothesis essentially proposing responses to the aforementioned research questions. The core argument of this dissertation is that despite the ethos of merit that affords academic STEM faculty privileges of influence, networks do matter in how personal perception of influence are constructed because they provide more opportunities for building self-efficacy, reputation development and resource dependency. In particular, the impacts of social network structure (i.e. tie strength, network constraint and external-internal tie ratio) and network resources on self-perceived influence were examined. Moreover, the hypotheses proposed that despite the ethos of neutrality and merit present in academic STEM institutions, the racial bias against underrepresented minority STEM faculty members (i.e. African-American/Black STEM faculty) would result in them having more limited perspectives of their organizational decision-making influence than their non-minority counterparts. Though critical race theory is a useful lens to examine institutional racism experienced by minority faculty, this dissertation went a step further to examine how racial bias may result in qualitatively different network structures between minority and non-minority STEM faculty, which would lead to different outcomes between minority and non-minority STEM faculty.

In order to address the research questions, structured equation modeling was used to analyze of a subset of STEM faculty members who responded to a national online survey. Responses from African-American/Black and White STEM faculty from research extensive and intensive universities were analyzed. The findings revealed that more career development and mentoring network resources reduced STEM faculty's level of self-perceived influence in organizational decision-making. This relationship is likely due to the resource dependency created when STEM faculty rely upon their network alters to provide them with resources, which may essentially make faculty feel more responsible to network alters, thereby preventing STEM faculty from actually exercising their agendas, autonomy and professional authority. Moreover, tie strength, external to internal tie ratio and network constraint were found to not only impact the acquisition of network resources, but also have direct effects on self-perceived influence. In particular, the findings suggest that these structural variables enhance STEM faculty member's self-efficacy and visibility, which would subsequently make them feel empowered and confident as well as afford them the privilege of influencing organizational decision making.

It was found that minority STEM faculty's perspective on their decision making power was in fact limited when compared to white STEM faculty. More specifically, while they were not found to have significantly different levels of micro level self-perceived influence, they did have significantly lower levels of macro level self-perceived influence. In other words, overall, minority STEM faculty perceive themselves to be less influential in decisions that impact overall organizational development than white STEM faculty. But, overall, minorities do not feel significantly less empowered in shaping their personal activities and experiences than whites. However, although the direct effect of racial status had such impacts on overall perceptions of influence in organizational decision-making, resource dependency also plays a role in reducing minority STEM faculty's sense of empowerment, value and role in organizational decision making (both at the macro and micro level). In particular, minorities were found to have more career development and mentoring network resources. This means that although minority STEM faculty appear to not be totally isolated from important networks within their organization and do get important professional development resources, they were limited in translating the acquisition of network resources into building self-perceived influence. In particular, the presence of having a higher ratio of internally situated ties is a unique structural characteristic of minority STEM faculty networks that can be used to help them leverage the self-efficacy and reputation enhancing benefits of career development network resources to enhance their levels of self-perceived influence in organizational decision-making.

6.2 Policy Implications of Research

These findings have several policy implications for academic STEM departments. First, human resource management policies in academic STEM institutions aimed at securing organizational commitment from faculty and reducing turn-over may benefit from understanding how faculty's professional networks shape their perceptions of worth and value. By understanding the how networks impact resource dependency, self-efficacy and reputation development, human resource management policies can encourage an organizational environment that accomplishes a balance of resource exchange and positive interaction between colleagues that builds reputations as well as personal worth. Such an environment will likely increase substantive interactions among colleagues that will also result in them feeling more valued within the organization, thereby enhancing organizational commitment and reducing turnover. This is particularly important for more junior faculty who may become more stifled in their advancement if they are consistently reliant upon their colleagues to the detriment of their own independence.

Consistent with the assertions of critical race theory suggesting that institutional norms and values limit minority inclusion in the academic environment, these findings suggest that organizational practices and policies are crucial in removing the barriers that minority STEM faculty feel in the academic institution. Thus, the second policy implication of these findings is that they can especially inform diversity policies that counter the stigmas that minority STEM faculty feel regarding their value and inclusion within their organization. By purposively including minorities including minority STEM faculty in a wide range of larger organizational decisions, academic STEM departments can achieve more substantive diversity that may secure long term commitment from current minority faculty. Moreover, purposeful inclusion in macro level decision making can help academic departments develop reputations for creating environments that not only value the development of minority STEM faculty, but also value their contributions to organizational development, which may help attract more minority STEM faculty. Third, an awareness of how minority networks impact minority STEM faculty's perspectives on their involvement in organizational decision-making can inform policies that encourage a substantive and balanced exchange of resources between minority and non-minority faculty members. In particular, policies advanced by departmental leaders that encourage a thorough acknowledgement and recognition of minority STEM faculty contributions can signal to organizational members that the value of minority STEM faculty members does not merely lie in their ability to advance superficial diversity, but truly promote the scientific institution as a whole. These types of may encourage STEM faculty members to seek out the resources of their minority colleagues, thereby mitigating racial stereotypes and imbalances in resource exchange. As such, it may be worthwhile for departments to revisit their promotion and tenure processes to thoroughly determine if there are deficiencies in how minority faculty contributions are acknowledged and valued. Furthermore, it may be worthwhile for STEM departments to consider additional ways to acknowledge the productivity and contributions of minority and non-minority STEM faculty contributions, especially ways that promote and heighten the internal visibility of faculty members.

6.3 Theoretical Implications

What are the theoretical implications of this dissertation and the subsequent possibilities for future research? First, clearly these findings suggest that network structure and resources significantly impact STEM faculty member's personal perspective of their organizational value and worth. Moreover, although this dissertation focused on the role of network structure and resources on self-perceived influence, the findings also have implications for understanding STEM faculty's productivity and how that can also influence perceptions of their value and worth in their organizations. Thus, overall these findings indicate that there is further room to explore the intersection of social network theory and STEM human capital development. In particular, it is worthwhile to explore the nature of resource exchange among STEM scientists and how the nature of not only acquiring but also giving resources can impact the resource dependence that shapes self-perceived influence and subsequent outcomes such as satisfaction. In essence, the concept of resource exchange and dependency among academic scientists is relevant in the context of collaboration activity. Thus, in light of these implications, the findings from this dissertation may be especially relevant in expanding research about the determining factors of effective collaboration and its subsequent outcomes, which has conducted by the likes of Bozeman and Corley (2004), Bozeman and Gaughn (2011), Katz and Martin (1997), Lee and Bozeman (2005) and Melin (2000).

Second, it is worthwhile to understand the role of social network structure in facilitating resource acquisition and other dynamics that can shape self-perceived influence. In other words, although this dissertation focused on how network constraint, tie strength and external-internal tie ratio shaped self-efficacy, reputation enhancement and resource development, there are other dynamics salient to self-perceived influence that may be impacted by network structure. For instance, the particular structural variables examined in this dissertation can also impact the degree to which STEM faculty are influenced by colleagues in how they make organizational decisions. Organizational actors play a role in influencing the behavior and actions of their peers, especially as it relates to reinforcing organizational norms and values (Katz & Kahn, 1978; Trevino, 1986; Kilduff, 1990, 1992). Although the decisions related to the micro level self-perceived construct seem more personal, they do reflect cultural norms and values in the academic environment. For example, faculty members are expected to have a major role in selecting graduate students for admission and perform certain duties related to their committee and service work. Often times these decisions stem from criteria that are based upon the values or agenda of their institution, discipline and etc. (Kuncel et al., 2001; Gardner, 2009). Thus, such cultural and organizational imperatives may be reinforced among a tightly knit community of faculty members (i.e. constrained networks with a greater presence of strong ties) (Burt, 2001). Another example is that certain network structures may encourage a shared responsibility or burden among colleagues, which can support faculty in exercising their agendas and priorities. Hence, strongly tied constrained networks may provide STEM faculty members with the option to more share their service and teaching responsibilities amongst each other, thereby providing them the freedom in deciding how they will engage in these commitments.

Moreover, it is important to explore the indirect effects of other network structure variables on STEM faculty member's self-perceived influenced in organizational decision making, which are mediated by resource acquisition or dependence. For example, the demographic composition of a STEM faculty member's network may impact the type and amount of network resources they receive, thereby shaping their self-perceived influence. For example, homophily theory and mentoring theory suggests that connections and resource provision is more prevalent among colleagues who share similar features such as race and gender (McPhereson et al, 2001; Dreher & Cox, 1996; Thomas, 1990). This implication is especially relevant to understanding the resource acquisition of minority STEM faculty—an area that is informed by little research. Moreover, it would be worthwhile to study and consider possible race-based variations in the nature of resource exchange among minority and non-minority STEM faculty. Considering the role of peers in influencing the actions and behaviors of fellow organizational actors, it may be worthwhile to examine how network structure impacts the organizational decision-making processes and behaviors of STEM faculty. For example, Wasserman and Faust (1994) assert that there are other network structures empirically proven to be relevant in social influence include social cohesion (i.e. the extent to which network ties are indirectly or directly tied to each other) and equivalence (i.e. the extent to which network members have the same set of connections). Both of these structural elements can impact the reach and impact of personal influence on network actors. Thus, by understanding how social influence is mediated by network structure, more can be understood about the extent to which faculty members may base their decision making upon the actions of their network alters other than through the provision of network resources. Considering these implications, the findings from this dissertation may also be relevant in expanding the work done by organizational behavior and human resource management scholars who study the role of relationships or peer influence in the empowerment and perceived control outcomes of organizational actors (Bandura, 1986; Pfeffer & Salinack, 1978; Emerson, 1987; Parker & Price, 1987).

What are the theoretical implications of this research that are germane to minority network structures and minority faculty experiences? Based on some theory and research, it was expected that minority STEM faculty would have significantly more strong ties, more constrained networks and a higher ratio of external ties as compared to whites was not supported from the findings of this research. It was also expected that minorities would have fewer network resources than whites. Rather, it was found that there are no significant differences between minority and white STEM faculty with regards to tie strength and network constraint. However, minorities were found to have a significantly higher ratio of internally situated ties than whites. Lastly, it was found that minority STEM faculty have significantly more support from their professional network connections, which is different from what is generally reported about minority faculty in multiple fields. How might these findings be explained? The general expectation of and need for collaborative activity among academic scientists may mean that all STEM faculty members put forth relatively equal effort in developing strong ties with other academic scientists as a means to fulfill these expectations and achieve production efficiency. This means that there may not be any racially based differences among STEM faculty in the quantity of strong ties, which facilitate collaboration activities. As for network constraint, it is possible that the strong imperative for academic scientists to develop their reputations both within and outside of their institutions encourage all scientists to develop a network that has many structural holes (i.e. less constrained networks), which facilitates visibility throughout the scientific community. Thus again, given that all scientists are expected to fulfill this cultural norm, there may not be any racially based differences in network constraint. However, there may be institutional or policy based racial barriers that hinder minorities from advancing and successfully functioning within their institutions, thus having internally situated connections who can serve as allies and advisors in overcoming such bias can be quite beneficial for minority STEM faculty. Lastly, the fact that minority STEM faculty have more self-perceived influence as a result of getting career development resources from internal ties indicates that their internal reputations are more important for their empowerment, as opposed to white faculty. This may be because enhanced internal reputations may counter the impacts of negative stereotypes. Consequently, it is not necessarily surprising that minority STEM faculty have a significantly higher ratio of internal to external ties than whites.

It is important to note that although findings about network resources and external-internal tie ratio are unexpected, they are not necessarily inconsistent with theory and findings from other research. Although minorities may seek some support outside of their institutions, organizations have increasingly sought to provide minorities with supportive internal resources as a means to help them succeed professionally. Fellow organizational members are often the means through which these resources come. In the specific context of academic science, non-minority faculty may have a strong motivation to provide their minority counterparts with invitations, collaboration opportunities and nominations because there is an imperative to promote diversity within the academic science institution. Moreover, these imperatives often have ramifications for individual productivity. For instance, some research grants require minority involvement on projects. However, given the isolation that minorities still report experiencing in majority institutions, it is possible that the resource provision and career support given to STEM minority faculty may not be very substantive or more profound impacts for longer term career development.

Despite the unexpected findings, there is an indication that minority STEM faculty members do have unique network features, affirming that race is a critical variable to consider when understanding the dynamics and application of social network theory. With this in mind, it will be worthwhile to further explore the network structure arrangements that may contribute to minority STEM faculty members having significantly more network resources than non-minority STEM faculty members. In addition to examining resource acquisition, it is important to understand how minorities may be able to translate the support they receive from network alters in the mitigation of their resource dependence. Knowing how minorities can achieve a balance of network support and reduced resource dependence can further our understanding of how minorities can utilize and structure their networks for advancement in the workplace. In particular, it is important to understand the long-term substantive value of the resources that minorities receive. Additionally, it is important to understand the extent to which minorities are sought after for resources and the types of resources they provide, which can indicate the extent to which they are considered powerful and valued. In short, these findings further our understanding about the experiences of minority STEM faculty in majority institutions, especially when considering the role of their professional networks. Thus, when considering the application of social network theory in understanding STEM human capital development, race is a variable that should not be ignored. Furthermore, when seeking to understand the race-based differences of faculty, the field should be considered. When considering these implications, the findings from dissertation can contribute to the scholarly work focused on understanding the positive determinants of minority faculty success, inclusion, recruitment, and retention—especially relationally based determinants (Aguirre, 2000, 1995, Aguirre et al., 1993; Johnsrud & Sadao, 1998; Lewellen-Williams et al.,2006; Stanley, 2006; Turner et al., 2008; Jayakumar et al., 2009; Soloranzo, 1995).

6.4 Practical Implications and Research Limitations

In closing, it is useful to use the findings in reconsidering the two primary questions presented in the beginning of the dissertation that carry significant practical implications. First, is why does understanding self-perceived influence in organizational decision-making specifically among academic STEM scientists matter? The organizational commitment of academic STEM faculty is of paramount importance in ensuring the efficiency and success of the academic science institution in fulfilling their important role in scientific knowledge production and developing the STEM workforce. Furthermore, the participation of STEM faculty in organizational decision making can ensure that their valued perspectives and professional authority are well-considered in how academic institutions fulfill their aforementioned roles. In particular, as academic scientists have a role in shaping the determinants of institutional norms and values as well as function, they can more effectively protect their interests. For example, the increasing demand for academic STEM faculty to acquire large grants and make subsequent contributions in output has placed a staggering amount of pressure on academic STEM faculty to increase their levels of productivity as well as dictate the types of output they produce (Stephan, 2012). By having a more prominent role in decision making, STEM faculty can have more influence in mitigating the stresses and pressure of meeting production demands as well as ensuring their academic freedom.

The second question is why is it especially necessary to understand differentiations in self-perceived influence among STEM faculty based upon minority racial status? As mentioned in the literature review of this dissertation, underrepresented minorities have experienced many barriers in attaining levels of representation and inclusion in the STEM fields that are comparable to non-minorities. Moreover, the overall experiences of minority faculty in multiple fields indicate that the academic institution is still a rather hostile environment that hinders their significant inclusion in academic life and acknowledgment of their value and worth. However, little work has been done to understand the intersection of minority experiences as faculty members in the academic STEM institution. Thus, this dissertation seeks to further the understanding of how minorities interpret their role and treatment in the academic professoriate ranks as a means to promote the equitable participation and inclusion of minorities in STEM. Furthermore, the extent to which minority STEM faculty feel influential may go a long way in determining the extent to which they will make efforts to participate in organizational decision making and subsequently have a hand and voice in eliminating the barriers faced by marginalized groups and affirming their value in the academic science institution. In particular, because these findings indicate that internal reputation development is significant for minority STEM faculty, their involvement in organizational decision making can help shape the criteria used for reputational development. Consequently, minority STEM faculty can have a say in how their value is cultivated and acknowledged. Thus, it is important to know more about the actual involvement of minority faculty (STEM and non-STEM fields) in specific organizational decisions. Lastly, these findings suggest that the development and maintenance of networks should be considered in the development future generations of minority STEM faculty. In particular, it would be worthwhile to specifically and thoroughly consider structural changes or consistencies in the networks of minority STEM graduate students over time. Is the fact that minority STEM faculty have significantly more resources a product of long term relationships that were forged during their times as graduate students? Additionally, it is important to consider why internal reputational development is so important for minority faculty. Is it possible that there are institutional policies and practices that do not equally recognize minority faculty contributions, thus having them rely upon their colleagues to provide reputation enhancing resources? This may shed some light into why and how minority STEM graduate students are able to pursue faculty positions.

Moving forward, the primary limitations of the research can provide a foundation for conducting further inquiries. For instance, the research is limited by not knowing the full picture of resource exchange between faculty members and their colleagues. By knowing about the resources that faculty give and receive, it may be possible to understand more about the resource dependency dynamics that limit self-perceived influence. Another limitation is that the actual influence of STEM faculty is not known. Having this information can provide further insights into the connection between perceived influence and exercised influence. The limitation of using quantitative data means that there is a narrow perspective on the dynamics of resource exchange. Narratives of faculty members about their relationships with colleagues can provide a broader perspective about how resource exchanges impact their empowerment and career outcomes.

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APPENDICES

APPENDIX A

TABLE XXI. SAMPLE OF PROGRAMS PROMOTING DIVERSITY OF MINORITIES IN STEM

SPONSOR	NAME OF PROGRAM, FELLOWSHIP, GRANT, AND/OR SCHOLARSHIP	SUMMARY DESCRIPTION
Alfred P. Sloan Foundation	Alfred P. Sloan Foundation Minority PhD (MPHD) Program	The MPHD Program has two components. The Ph.D. component offers substantial scholarship support to underrepresented minority students who are beginning their doctoral work in engineering, natural science and mathematics. The smaller Feeder component offers underrepresented minority B.S. or M.S. students access to select faculty and departments that have demonstrated success in sending their students on to doctoral programs.
American Association of Colleges of Nursing (AACN)	AfterCollege-AACN Scholarship Fund	The AfterCollege-AACN Scholarship Fund supports students who are seeking a baccalaureate, master's or doctoral degree in nursing. Special consideration is given to students in a graduate program with the goal of becoming a nurse educator; students completing an RN-to-BSN or RN-to-MSN program; and students enrolled in an accelerated program.
American Chemical Society (ACS)	Scholarships for African American, Hispanic, and American Indian students in the chemical sciences	The ACS awards renewable scholarships to underrepresented minority students who want to enter the fields of chemistry or chemistry-related fields. Awards of up to $5,000 are given to qualified students. African American, Hispanic, or American Indian high school seniors or college freshmen, sophomores, or juniors pursuing a college degree in the chemical sciences or chemical technology are eligible to apply.
American Chemical Society (ACS)	Women of Color in STEM Resources	An ACS website reflecting a compilation of resources on the specific intersection of gender and ethnicity in STEM disciplines.
American Dental Education Association (ADEA) & Academy for Academic Leadership (AAL)	ADEA/AAL Faculty of Color Tuition Scholarships for Professional Development	The ADEA/AAL Faculty of Color Tuition Scholarships for Professional Development supports professional development activities for faculty of color in dental education, including allied dental education, in the early to middle stage of their careers.
American Medical Association (AMA)	Minority Scholars Award	The AMA Foundation, in collaboration with the AMA Minority Affairs Section (MAS), with support from Pfizer Inc., offers approximately eight to thirteen Minority Scholars Awards annually, each in the amount of a $10,000 scholarship, to medical students.

APPENDIX A (CONTINUED)

TABLE XXI CONT'D. SAMPLE OF PROGRAMS PROMOTING DIVERSITY OF MINORITIES IN STEM

SPONSOR	NAME OF PROGRAM, FELLOWSHIP, GRANT, AND/OR SCHOLARSHIP	SUMMARY DESCRIPTION
American Medical Association (AMA) Foundation & Association of Black Cardiologists (ABC)	The Dr. Richard Allen Williams & Genita Evangelista Johnson/Association of Black Cardiologists Scholarship	The AMA Foundation and the ABC with support from founding donor Genita Evangelista Johnson partner to create an annual scholarship that provides $5,000 to a first- or second-year African American medical student with an expressed interest in cardiology.
American Physical Society (APS)	APS Minority Scholarship	The APS Minority Scholarship helps increase the number of underrepresented minorities obtaining degrees in physics. It provides funding and mentoring to minority physics students, helping them enhance their education and successfully prepare for a variety of careers.
American Physical Society (APS)	Porter Physiology Development Program	The Porter Physiology Development Program provides 1- to 2-year full-time graduate fellowships in programs leading to the Ph.D. (or D.Sc.) in the physiological sciences at U.S. institutions.
American Physical Society (APS)	The Bridge Program	The Bridge Program provides funding to create sustainable transition (bridge) programs and a national network of doctoral granting institutions that provide substantial mentoring for students to successfully complete Ph.D. programs.
Association of American Medical Colleges (AAMC)	Minority Faculty Career Development Seminar	The Minority Faculty Career Development Seminar is a three-day seminar designed for junior faculty who are members of underrepresented racial and ethnic minority groups aspiring to leadership positions. Sessions will identify professional goals, develop key leadership competencies, and provide strategies to succeed as a minority faculty member.
Bill & Melinda Gates Foundation	Gates Millennium Scholars (GMS) Program	The GMS Program selects 1,000 talented students annually to receive good-through-graduation scholarships. Scholars receive financial as well as personal and professional development through leadership programs along with academic support throughout their undergraduate and doctoral programs.
Boston Medical Center and Boston University School of Medicine (BUSM)	Minority Physician Recruitment Program	The Minority Physician Recruitment Program works collaboratively with the BUSM Office of Diversity & Multicultural Affairs to make students aware of research, mentorship, and networking opportunities in order to enhance their development as future physicians.

APPENDIX A (CONTINUED)

TABLE XXI CONT'D. SAMPLE OF PROGRAMS PROMOTING DIVERSITY OF MINORITIES IN STEM

Burroughs Wellcome Program	Postdoctoral Enrichment Program (PDEP)	PDEP provides a total of $50,000 over three years to supplement training and career development activities of postdoctoral fellows in a degree-granting institution (or its affiliated graduate and medical schools, hospitals and research institutions) whose research training and professional development in biomedical or medical research are already supported.
CDM Smith & United Negro College Fund (UNCF)	CDM Smith/UNCF Scholars Program	CDM Smith in association with the UNCF, has established a scholarship and summer internship program for undergraduate students (or students who are enrolled to start a Master's program) who have a 3.0 graduate point average or better and who are majoring in a variety of engineering, science or construction disciplines.
Congressional Hispanic Caucus Institute, Inc. (CHCI)	CHCI Graduate STEM Fellowship	The CHCI Graduate Fellowship Program seeks to enhance participants' leadership abilities, strengthen professional skills and produce more competent and competitive Latino professionals.
Cornell University Graduate School & Alfred P. Sloan Foundation	Cornell University Graduate School University Center of Exemplary Mentoring	In collaboration with the Sloan Foundation, the University Center of Exemplary Mentoring program is designed to expand, strengthen, and institutionalize efforts aimed at minority recruitment, mentoring, educational support, and professional development.
CVS MinuteClinic & United Negro College Fund (UNCF)	MinuteClinic/UNCF Family Nurse Practitioner Graduate Scholarship	Minute Clinic partners with the UNCF to provide scholarship support for graduate students pursuing careers as Family Nurse Practitioners.
Dr. Marsha D. Roberts & United Negro College Fund (UNCF)	Marsha D. Roberts, MD Scholarship	Dr. Marsha D. Roberts partners with the UNCF to establish a scholarship to encourage minority students to pursue a future career in medicine. Candidates must be attending an accredited four-year institution in the state of California as a full-time student. In addition, the applicants will have to be enrolled in Pre-Medicine and other targeted science majors.
Georgia Tech College of Engineering & Alfred P. Sloan Foundation	Georgia Tech College of Engineering University Center of Exemplary Mentoring	In collaboration with the Sloan Foundation, the University Center of Exemplary Mentoring program is designed to expand, strengthen, and institutionalize efforts aimed at minority recruitment, mentoring, educational support, and professional development.

APPENDIX A (CONTINUED)

TABLE XXI CONT'D. SAMPLE OF PROGRAMS PROMOTING DIVERSITY OF MINORITIES IN STEM

Institute for Broadening Participation	Minorities Striving and Pursuing Higher Degrees of Success in Earth System Science (MS PHD'S®)	The program provides students with professional development opportunities, science exposure, networking opportunities, and mentoring relationships. For mentors, the program offers on-going mentoring activities with a highly talented group of minority students who are committed to achieving successful science careers.
Institute for Broadening Participation	Underrepresented Minority Postdoctoral Enrichment Program	The Underrepresented Minority (URM) Postdoctoral Enrichment Program provides up to ten $50,000 awards over three years to support career development activities for URM postdoctoral fellows whose training and professional development are guided by mentors committed to helping them advance to stellar careers in biomedical or medical research.
Intel Corporation & United Negro College Fund (UNCF)	Intel Scholarship Program	Intel Corporation partners with the UNCF to sponsor the Intel Scholarship Program for talented students in need. In addition, UNCF works with Intel to identify qualified scholarship recipients who could potentially become future interns at Intel.
Johnson & Johnson & the American Association of Colleges of Nursing (AACN)	J&J/AACN Minority Nurse Faculty Scholars Program	The AACN partners with the Johnson & Johnson Campaign for Nursing's Future to offer scholarships to minority nurses pursuing advanced degrees and willing to teach nursing students after graduation.
KPMG Foundation	The KPMG Foundation Minority Accounting Doctoral Scholarships	The KPMG Foundation awards scholarships to minority accounting doctoral students. The total awarded for the 2013-2014 academic year was $450,000. The foundation has had a positive influence in helping to increase the number of diverse faculty members.
Merck & the United Negro College Fund (UNCF)	UNCF/Merck Postdoctoral Science Research Fellowship	The UNCF/Merck Postdoctoral Science Research Fellowship provides support to African American post-graduates to obtain postdoctoral training or to continue to conduct postdoctoral, pre-professional research projects.
Merck Company Foundation & the United Negro College Fund (UNCF)	UNCF/Merck Graduate Science Research Dissertation Fellowship	The UNCF/Merck Graduate Science Research Dissertation Fellowship provides support to African American graduate students as they complete coursework, conduct research, and prepare the dissertation required for the doctoral degree in the biomedically relevant life or physical sciences.

APPENDIX A (CONTINUED)

TABLE XXI CONT'D. SAMPLE OF PROGRAMS PROMOTING DIVERSITY OF MINORITIES IN STEM

Merck Company Foundation & the United Negro College Fund (UNCF)	UNCF/Merck Undergraduate Science Research Scholarship	The UNCF/Merck Undergraduate Science Research Scholarship Award promotes the interest of African American undergraduate students in furthering their science education and pursuing biomedical science careers by providing tuition support and opportunities for research experience in a state-of-the-art industrial laboratory.
National Aeronautics and Space Administration (NASA) Office of Education	Minority University Research and Education Project (MUREP) Interns	MUREP provides 16-week internships at a NASA center or facility to under-represented students in STEM disciplines at minority serving institutions.
National Aeronautics and Space Administration (NASA)	NASA Science and Technology Institute for Minority Institutions (NSTI-MI)	NSTI-MI is a research opportunity project for faculty and an internship project for undergraduate and graduate students at U.S. minority serving institutions.
National Aeronautics and Space Administration (NASA)	Harriett G. Jenkins Pre-doctoral Fellowship Project (JPFP)	JPFP provides competitive fellowships for up to three years to underserved graduate students in science, technology, engineering and education. The JPFP also provides summer internships at NASA Centers. Twenty fellows are selected annually.
National Aeronautics and Space Administration (NASA) Office of Education	University Research Center (URC)	URCs are multidisciplinary research units established at minority institutions to focus on a specific area of NASA interest. Currently, NASA supports URCs at 11 Historically Black Colleges or Universities, also known as HBCUs, and three Other Minority Universities, or OMUs.
National Aeronautics and Space Administration (NASA) Office of Education	Minority University Research and Education Programs	The NASA Office of Education provides funding for Minority University Research and Education Programs, or MUREP, to increase the participation of minority-serving institutions in NASA research and development and to increase the number of minority students pursuing higher education in science, technology, engineering and mathematics. A variety of projects exists for students and faculty.
National Action Council for Minorities in Engineering (NACME)	NACME's Scholars (Block Grant) Program	The NACME's Scholars (Block Grant) Program provides scholarship support in the form of a lump sum grant to partner institutions who enroll students from three sources – first year students identified by NACME or the partner universities, transfer students from two-year colleges, and currently enrolled students who have completed at least one year of engineering study.

APPENDIX A (CONTINUED)

TABLE XXI CONT'D. SAMPLE OF PROGRAMS PROMOTING DIVERSITY OF MINORITIES IN STEM

National Center for Faculty Development and Diversity	Faculty Success Program	The program is for advanced graduate students, post-docs, tenure-track faculty and tenured faculty who are looking for the perfect combination of empirically-tested methods to improve research productivity, intense accountability, coaching, and peer support.
National Institutes of General Medical Sciences (NIGMS)	Bridges to the Doctorate	Bridges to the Doctorate promotes the successful completion of doctoral degrees by students from underrepresented groups through supporting comprehensive science education and research-readiness student development programs that help diverse students in M.S. degree programs transition to Ph.D. degree programs at research-intensive partner institutions.
National Institutes of General Medical Sciences (NIGMS)	Initiative for Maximizing Student Development (IMSD)	IMSD is designed to increase the number of undergraduate and graduate students from underrepresented groups who complete Ph.D. degrees and enter the research workforce, and also to enhance the diversity of students in awardee institutions' Ph.D. programs.
National Institutes of General Medical Sciences (NIGMS)	Institutional Research and Academic Career Development Award (IRACDA)	IRACDA provides support for a traditional mentored postdoctoral research experience in the biomedical and behavioral research enterprise to develop critical academic skills, including teaching, through workshops and through mentored teaching assignments.
National Institutes of General Medical Sciences (NIGMS)	MARC Ancillary Training Activities	MARC Ancillary Training Activities provides ancillary training support for national conferences, short courses, or other well-defined training activities that further the NIGMS mission of increasing the diversity of the National Institutes of Health funded biomedical and behavioral research workforce.
National Institutes of General Medical Sciences (NIGMS)	MARC Undergraduate Student Training in Academic Research (U-STAR) Awards	MARC U-STAR awards provide support for undergraduate students who are underrepresented in the biomedical and behavioral sciences to improve their preparation for high-caliber graduate training at the Ph.D. level. The program also supports efforts to strengthen the science course curricula, pedagogical skills of faculty and biomedical research training at institutions with significant enrollments of students from underrepresented groups.
National Institutes of General Medical Sciences (NIGMS)	Native American Research Centers for Health (NARCH)	NARCH supports partnerships between American Indian/Alaska Native (IA/AN) tribes or tribally based organizations and institutions that conduct intensive, academic-level biomedical, behavioral and health services research. NARCH provides opportunities for conducting research, research training and faculty development to meet the needs of AI/AN communities.

APPENDIX A (CONTINUED)

TABLE XXI CONT'D. SAMPLE OF PROGRAMS PROMOTING DIVERSITY OF MINORITIES IN STEM

National Institutes of General Medical Sciences (NIGMS)	Postbaccalaureate Research Education Program (PREP)	PREP is designed to increase the number of baccalaureates from underrepresented groups who go on to Ph.D. or M.D.- Ph.D. degree programs, and also to enhance the diversity of students in awardee institutions' Ph.D. and/or M.D.-Ph.D. programs through supporting institutional programs that provide extensive research training and academic preparation at research-intensive institutions through 1- to 2-year research apprenticeships.
National Institutes of General Medical Sciences (NIGMS)	Research Initiative for Scientific Enhancement (RISE)	RISE awards research education grants to institutions focused on developing new or expanding existing effective institutional developmental programs designed to academically and scientifically prepare underrepresented students in the biomedical or behavioral sciences for competitive research careers.
National Institutes of General Medical Sciences (NIGMS)	Support of Competitive Research (SCORE) Research Advancement Award	SCORE Research Advancement Awards support faculty research development through increasing the research capability and competitiveness at three formative career stages: Research Advancement; Pilot Project; and Research Continuance.
National Institute of Neurological Disorders and Stroke (NINDS)	NINDS Faculty Development Award to Promote Diversity in Neuroscience Research	NINDS Faculty Development Award to Promote Diversity in Neuroscience Research provides junior faculty support and protected time (up to three years) for an intensive, supervised career development experience in neuroscience research.
National Science Foundation (NSF)	The Louis Stokes Alliances for Minority Participation (LSAMP)	LSAMP assists universities and colleges in diversifying the STEM workforce through their efforts at significantly increasing the numbers of students successfully completing high quality degree programs in STEM disciplines. Particular emphasis is placed on transforming STEM education through innovative recruitment and retention strategies and experiences in support of groups historically underrepresented in STEM discipline.
National Science Foundation (NSF)	Centers of Research Excellence in Science and Technology (CREST)	CREST provides support to enhance the research capabilities of minority-serving institutions as well as promotes the development of new knowledge, enhancements of the research productivity of individual faculty, and an expanded presence of students historically underrepresented in STEM disciplines.
National Science Foundation (NSF)	Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers (ADVANCE)	ADVANCE is an integral part of the NSF's multifaceted strategy to broaden participation of women, particularly women of color, in the STEM workforce and to support the critical role of advancing the status of women in academic science and engineering.

APPENDIX A (CONTINUED)

TABLE XXI CONT'D. SAMPLE OF PROGRAMS PROMOTING DIVERSITY OF MINORITIES IN STEM

National Science Foundation (NSF)	Alliances for Graduate Education and the Professoriate (AGEP)	AGEP focuses on professionally development of underrepresented minorities in STEM graduate education, and/or postdoctoral training, and their preparation for academic STEM careers at all types of institutions of higher education.
National Society of Black Engineers (NSBE)	NSBE Scholarship Policy	The society offers a variety of NSBE and Corporate-sponsored scholarships and awards to pre-college, collegiate undergraduate and graduate student, and technical professional members.
Ohio State University	Scholarships for Minorities and Women in Engineering	OSU's College of Engineering funds scholarships for engineering students who are new freshmen and members of underrepresented ethnic minority groups and women.
Penn Dental Medicine	Financial Aid and Scholarships » Minority Student Scholarships	Students from underrepresented ethnicities and cultures may be eligible for outside scholarships and financial support from these outside sources.
Penn State The Graduate School	Penn State Graduate School University Center of Exemplary Mentoring	In collaboration with the Sloan Foundation, the University Center of Exemplary Mentoring program is designed to expand, strengthen, and institutionalize efforts aimed at minority recruitment, mentoring, educational support, and professional development.
U.S. Navy - Office of Naval Research	Historically Black Colleges and Universities/Minority Institutions Program	The Department of Navy's Historically Black Colleges and Universities/Minority Institutions (HBCU/MI) Program is designed to increase the participation of HBCU/MIs in the Navy's research, development, test and evaluation (RDT&E) programs and activities. The program strengthens the capabilities of the institutions to conduct basic and applied research, and increases the quality and quantity of science, technology, engineering and mathematics (STEM) programs with a focus on minority researchers and graduates.
U.S. Nuclear Regulatory Commission	Minority Serving Institutions Program (MSIP)	MSIP funds minority serving programs, activities, projects, symposiums and training for the exchange and transfer of knowledge and skills relevant to nuclear safety, security, environmental protection, or other fields. MSIP provides assistance for minority serving programs and activities to include, but not limited to mentoring, leadership development, training, instruction, developmental learning, research and development, program evaluation, and technical assistance. MSIP also provides assistance to include direct institutional subsidies, facilities and equipment acquisition, internships, fellowships, scholarships, and tuition and housing assistance.

APPENDIX A (CONTINUED)

TABLE XXI CONT'D. SAMPLE OF PROGRAMS PROMOTING DIVERSITY OF MINORITIES IN STEM

United Negro College Fund	UNCF Rising Stars Scholarship in Partnership with Target	The UNCF Rising Stars is a scholarship opportunity for current sophomores who will be juniors in the fall, and who are enrolled at any of the 37 UNCF member colleges or universities. The scholarship program provides a total award of $25,000 over 2 years ($12,500 each for the junior and senior academic year) commencing in the fall.
University of Arkansas for Medical Sciences (UAMS)	Minority Faculty Development Caucus (MFDC)	MFDC is designed to substantially increase and retain minority faculty at UAMS through networking, mentoring, research opportunities, and skills-building with a long-term goal of directly improving health care at both the institutional and state level.
University of Florida	General Electric Minority Engineering Faculty Development Initiative Doctoral Fellowship	The fellowships support African Americans, Hispanic Americans, Native Americans, and women who are U.S. citizens and studying engineering with plans to pursue an academic career upon receipt of degree.
U.S. Department of Agriculture (USDA)	Women and Minorities (WAMS) in Science, Technology, Engineering, and Mathematics Fields (STEM) Program	The grant program supports projects that provide STEM knowledge, skills and competency to Women and Minorities from Rural Areas with successful placement (a) in the workforce in STEM fields, or (b) as innovators and entrepreneurs adding value to the STEM fields in areas that have relevancy to the USDA Secretary's priorities.
Xerox	Minority Scholarships	Xerox awards between $1,000 and $10,000 to qualified minorities enrolled in a technical degree program at the bachelor level or above to promote the academic success of minority students.

APPENDIX B

TABLE XXII. FULL CORRELATIONS, WEIGHTED DATA, WITHOUT DATA IMPUTATION

		1	2	3	4	5	6	7	8	9
1	Af-Am/Black	1.00								
2	Constraint	0.01	1.00							
3	inst_E-I_Index	-.036*	.081**	1.00						
4	CAR-AdvColInd/Gov	.127**	-.230**	-.052**	1.00					
5	CAR-IntroResColl	.072**	-.294**	-.041**	.477**	1.00				
6	CAR-InvResGrantTeam	.047**	-.350**	-.125**	.480**	.638**	1.00			
7	CAR-NomAward	0.01	-.225**	-.076**	.377**	.365**	.407**	1.00		
8	CAR-RecSpkr	-0.03	-.275**	0.01	.334**	.488**	.451**	.460**	1.00	
9	CAR-ProvFund	0.03	-.183**	-.035*	.302**	.409**	.495**	.304**	.301**	1.00
10	MENT-RevPaperProp	.048**	-.241**	-.038*	.295**	.494**	.401**	.328**	.402**	.308**
11	MENT-AdvGrant	.101**	-.388**	-.121**	.510**	.583**	.582**	.365**	.472**	.358**
12	MENT-AdvPub	.032*	-.340**	-0.03	.329**	.511**	.405**	.292**	.444**	.306**
13	MENT-AdvTeach	.046**	-.300**	-.227**	.397**	.440**	.412**	.285**	.319**	.273**
14	MENT-AdvDeptPol	.059**	-.365**	-.301**	.352**	.441**	.446**	.361**	.393**	.333**
15	MENT-AdvStudRel	.063**	-.315**	-.241**	.383**	.408**	.366**	.337**	.331**	.296**
16	MENT-AdvIntColleague	.115**	-.299**	-.136**	.415**	.471**	.370**	.362**	.445**	.332**
17	MENT-AdvWorkFamBal	.054**	-.217**	-.094**	.417**	.421**	.357**	.333**	.312**	.254**
18	ST-ClsFrnd	0.01	-.334**	-.085**	.319**	.389**	.327**	.262**	.372**	.209**
19	ST-Length	0.02	-.680**	-.214**	.360**	.481**	.480**	.368**	.468**	.303**
20	ST-Freq	-0.02	-.428**	-.320**	.332**	.395**	.422**	.299**	.315**	.265**
21	SPIMAC-Selection of new faculty.	-.059**	-.177**	-.096**	0.01	.077**	.116**	.155**	.135**	0.01
22	SPIMAC-Selection of unit head.	-.061**	-.162**	-.111**	.048**	.090**	.104**	.185**	.157**	.046**
23	SPIMAC-Selection of reviewers for your own tenure/promotion.	-.081**	-.140**	-.071**	-.066**	.079**	0.02	.073**	.037*	0.02
24	SPIMAC-Who receives tenure or promotion.	-.083**	-.137**	-.048**	.047**	.065**	.084**	.170**	.200**	.049**
25	SPIMAC-Allocation of budget/departmental research funding.	-.048**	-.217**	-.109**	.035*	.093**	.143**	.182**	.109**	.047**
26	SPIMIC-Admission of new graduate students.	-.043**	-.160**	-.057**	.073**	.162**	.158**	.165**	.132**	0.02
27	SPIMIC- Allocation of your service/committee assignments.	-.058**	-.080**	-.078**	-0.02	.067**	.072**	.069**	.060**	0.01
28	SPIMIC-Courses that you teach.	0.00	-.040*	-.105**	0.01	.035*	.101**	.050**	.079**	-0.03
29	SPIMIC-Selection of your teaching/research assistants.	-.039*	-.120**	-.058**	0.02	.130**	.106**	.105**	.096**	0.02

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailec

APPENDIX B (CONTINUED)

TABLE XXII, CONT'D. FULL CORRELATIONS, WEIGHTED DATA, WITHOUT DATA IMPUTATION

		10	11	12	13	14	15	16	17	18	19	20
10	**MENT-RevPaperProp**	1.00										
11	**MENT-AdvGrant**	.487**	1.00									
12	**MENT-AdvPub**	.532**	.711**	1.00								
13	**MENT-AdvTeach**	.440**	.572**	.507**	1.00							
14	**MENT-AdvDeptPol**	.433**	.551**	.500**	.579**	1.00						
15	**MENT-AdvStudRel**	.369**	.526**	.508**	.624**	.681**	1.00					
16	**MENT-AdvIntColleague**	.425**	.558**	.530**	.559**	.694**	.740**	1.00				
17	**MENT-AdvWorkFamBal**	.370**	.475**	.407**	.488**	.523**	.568**	.619**	1.00			
18	**ST-ClsFrnd**	.395**	.399**	.468**	.341**	.415**	.410**	.468**	.354**	1.00		
19	**ST-Length**	.377**	.555**	.537**	.467**	.543**	.524**	.525**	.350**	.581**	1.00	
20	**ST-Freq**	.335**	.452**	.447**	.439**	.521**	.471**	.423**	.315**	.489**	.650**	1.00
21	**SPIMAC-Selection of new faculty.**	0.01	.036*	.060**	0.02	.138**	.084**	.101**	0.02	.097**	.196**	.202**
22	**SPIMAC-Selection of unit head.**	.063**	.078**	.085**	.064**	.120**	.093**	.085**	0.00	.170**	.259**	.222**
23	**SPIMAC-Selection of reviewers for your own tenure/promotion.**	.050**	.036*	.088**	.070**	.063**	.036*	0.03	-0.02	.127**	.195**	.148**
24	**SPIMAC-Who receives tenure or promotion.**	0.01	-0.02	0.01	0.01	.079**	.098**	.102**	-0.03	.215**	.236**	.208**
25	**SPIMAC-Allocation of budget/departmental research funding.**	.061**	.032*	.050**	0.02	.114**	.063**	.075**	0.01	.176**	.247**	.258**
26	**SPIMIC-Admission of new graduate students.**	.058**	.138**	.137**	.035*	.123**	.080**	.089**	.079**	.133**	.203**	.197**
27	**SPIMIC- Allocation of your service/committee assignments.**	.068**	0.00	0.01	0.01	.071**	.079**	.057**	-0.02	.189**	.172**	.203**
28	**SPIMIC-Courses that you teach.**	0.00	-0.02	-0.02	0.00	.080**	0.03	.039*	-.039*	.162**	.105**	.183**
29	**SPIMIC-Selection of your teaching/research assistants.**	.087**	.076**	.096**	0.01	0.03	.037*	.059**	.035*	.094**	.184**	.175**

APPENDIX B (CONTINUED)

TABLE XXII, CONT'D. FULL CORRELATIONS, WEIGHTED DATA, WITHOUT DATA IMPUTATION

		21	22	23	24	25	26	27	28	29
21	**SPIMAC-Selection of new faculty.**	1.00								
22	**SPIMAC-Selection of unit head.**	.724**	1.00							
23	**SPIMAC-Selection of reviewers for your own tenure/promotion.**	.390**	.458**	1.00						
24	**SPIMAC-Who receives tenure or promotion.**	.568**	.612**	.417**	1.00					
25	**SPIMAC-Allocation of budget/departmental research funding.**	.632**	.608**	.343**	.593**	1.00				
26	**SPIMIC-Admission of new graduate students.**	.387**	.334**	.207**	.245**	.427**	1.00			
27	**SPIMIC- Allocation of your service/committee assignments.**	.496**	.512**	.354**	.514**	.631**	.315**	1.00		
28	**SPIMIC-Courses that you teach.**	.333**	.356**	.233**	.358**	.346**	.197**	.491**	1.00	
29	**SPIMIC-Selection of your teaching/research assistants.**	.320**	.346**	.248**	.265**	.315**	.327**	.302**	.430**	1.00

		1	2	3	4	5	6	7	8	9	10
30	**Gender**	0.00	-0.01	-.066**	-.065**	.055**	0.01	0.00	-.084**	-0.03	.087**
31	**SocialPotentcy**	-.043**	-.103**	-.063**	.132**	.194**	.133**	.165**	.147**	0.01	.140**
32	**AssistProf**	.053**	.052**	-0.01	0.01	0.00	-.063**	-.076**	-.114**	-.050**	.053**
33	**AsocttProf**	.053**	.071**	-.162**	-.087**	0.02	-0.01	-.158**	-.115**	-.047**	-0.01
34	**BioChem**	-0.01	-.093**	-0.02	-0.01	.036*	0.00	.085**	0.02	0.03	0.03
35	**CivilEng**	0.00	.037*	-.082**	.267**	0.03	.157**	.102**	-.035*	-.059**	-.086**
36	**Math**	0.02	.181**	.103**	-.163**	-.136**	-.260**	-.148**	-.077**	-.036*	-.181**
37	**TeachGrantAvg**	0.02	0.01	.055**	.066**	0.00	.071**	0.00	-0.01	0.00	0.00
38	**PubAvg**	-.036*	-.076**	.054**	0.01	.115**	.187**	.137**	.110**	0.01	-0.01
39	**GrantAvg**	0.00	-0.02	0.02	.132**	.112**	.168**	.063**	0.02	0.01	0.03

Appendix B (CONTINUED)

TABLE XXII, CONT'D. FULL CORRELATIONS, WEIGHTED DATA, WITHOUT DATA IMPUTATION

		11	12	13	14	15	16	17	18	19	20
30	**Gender**	.089**	.039**	.152**	.055**	.104**	.065**	.185**	-.050**	0.01	-0.03
31	**SocialPotentcy**	.124**	.098**	.078**	.112**	.097**	.111**	.090**	.210**	.183**	.153**
32	**AssistProf**	.113**	.057**	.089**	-0.02	.040**	-0.02	.103**	-.101**	-.168**	-.130**
33	**AsocttProf**	-.075**	-.079**	0.01	.052**	-.038*	-0.03	0.01	-.106**	-.060**	-.034*
34	**BioChem**	.050**	0.02	-0.01	0.03	.036*	0.02	-0.01	-0.03	.062**	0.01
35	**CivilEng**	0.03	-.104**	0.01	-.063**	0.01	0.03	.082**	-.056**	-.046**	0.02
36	**Math**	-.252**	-.094**	-.098**	-.090**	-.066**	-.124**	-.118**	-.032*	-.187**	-.086**
37	**TeachGrantAvg**	0.00	-0.02	0.02	.039*	0.02	0.01	0.02	0.01	-0.02	.038*
38	**PubAvg**	.074**	.110**	-.048**	-0.02	-0.01	.036*	.051**	.151**	.119**	.065**
39	**GrantAvg**	.145**	.064**	0.00	0.01	-0.02	.034*	.051**	-0.03	0.02	0.00

		21	22	23	24	25	26	27	28	29
30	**Gender**	-.108**	-.143**	-0.03	-.198**	-.136**	-.069**	-.106**	-.189**	-.099**
31	**SocialPotentcy**	.236**	.244**	.123**	.195**	.239**	.150**	.252**	.229**	.256**
32	**AssistProf**	-.272**	-.275**	-.230**	-.542**	-.280**	-.088**	-.265**	-.253**	-.123**
33	**AsocttProf**	-.043**	-.071**	0.00	-.062**	-.097**	-.066**	-.101**	-.076**	-.113**
34	**BioChem**	0.01	0.02	0.01	.077**	-0.01	.040**	-0.02	-.064**	0.00
35	**CivilEng**	.033*	0.00	-.076**	-0.03	0.02	.096**	-0.01	0.00	.135**
36	**Math**	0.02	0.01	.056**	0.01	0.01	-.088**	.047**	.034*	-.107**
37	**TeachGrantAvg**	.065**	.077**	0.03	.043*	.079**	.077**	.045*	-0.03	.038*
38	**PubAvg**	.200**	.173**	.069**	.161**	.166**	.200**	.083**	.141**	.087**
39	**GrantAvg**	.065**	0.01	0.00	-.065**	0.01	.140**	-.049**	-.039*	.086**

APPENDIX B (CONTINUED)

TABLE XXII, CONT'D. FULL CORRELATIONS, WEIGHTED DATA, WITHOUT DATA IMPUTATION

		30	31	32	33	34	35	36	37	38	39
30	**Gender**	1.00									
31	**SocialPotentcy**	0.02	1.00								
32	**AssistProf**	.167**	-0.03	1.00							
33	**AsocttProf**	.131**	-.110**	-.292**	1.00						
34	**BioChem**	-0.01	.040*	-0.01	-.061**	1.00					
35	**CivilEng**	-.058**	.095**	0.01	0.02	-.160**	1.00				
36	**Math**	-.124**	-.112**	-0.01	-.029*	-.229**	-.297**	1.00			
37	**TeachGrantAvg**	.098**	.041*	-0.03	.037*	-0.01	.051**	-.051**	1.00		
38	**PubAvg**	-.101**	.119**	-.116**	-.091**	.138**	0.02	-.120**	.066**	1.00	
39	**GrantAvg**	.044**	.040*	.103**	-0.02	.049**	.297**	-.250**	.155**	.212**	1.00

APPENDIX C

TABLE XXIII. DESCRIPTIVE STATISTICS, WITH DATA IMPUTATION

Variable	N	Mean	Std. Deviation
Minority Racial Status			
African-American/Black	1324	0.1	0.3
Career Development Network Resources			
Introduced you to potential research collaborators	1317	2.24	3.14
Invited you to join a teaching or research grant proposal team	1317	2.16	2.31
Nominated you for an award	1316	1	1.85
Recommended you as an invited speaker/panel member	1316	1.62	2.02
Provided you with research or other funding	1316	1.28	1.63
Advice on collaborating with industry or government	1316	0.92	1.75
Overall Career Development Network Resources	1317	1.54	1.49
Mentoring Network Resources			
Reviewed your papers or proposals prior to submission (on which they were not a co-author)	1317	1.95	5.03
Advice on grant getting	1316	2.74	3
Advice on publishing	1316	2.66	2.69
Advice on teaching	1316	2.66	2.6
Advice on departmental politics	1316	3.06	2.51
Advice on student related issues	1316	2.88	2.56
Advice on interactions with colleagues	1316	2.82	2.81
Advice on work/family balance	1316	1.44	1.93
Overall Mentoring Network Resources	1317	2.53	1.97
Network Structure			
Constraint	1316	0.33	0.15
inst_E-I_Index	1319	0	0.41
Tie Strength			
Close friends	1317	2.74	2.81
Frequency of communication	1317	3.83	2.47
Length of time known	1318	8.74	4.15
Overall Strong Ties	1319	5.1	2.6
Macro Level Self-Perceived Influence			
Selection of new faculty	1311	2.92	1.06
Selection of unit head	1311	2.83	1.02
Selection of reviewers for your own tenure/promotion	1308	2.82	0.94
Who receives tenure/promotion	1311	2.68	1.12
Allocation of budget/departmental research funding	1312	2.43	1.17
SPI_MACRO OVERALL	1311	2.83	0.75

APPENDIX C (CONTINUED)

TABLE XXIII CONT'D. DESCRIPTIVE STATISTICS, WITH DATA IMPUTATION

Variable	N	Mean	Std. Deviation
Micro Level Self-Perceived Influence			
Admission of new graduate students	1311	2.91	1.14
Allocation of your service/committee assignments	1311	2.86	1.03
The courses you teach	1311	3.3	1.01
Selection of your teaching/research assistants	1310	3.18	1.01
SPI_MICRO OVERAL	1311	3.06	0.72
Controls			
Female	1324	0.49	0.5
Biology	1324	0.32	0.47
Biochemistry	1324	0.21	0.41
Civil Engineering	1324	0.23	0.42
Mathematics	1324	0.22	0.42
Assistant Professor	1324	0.23	0.42
Associate Professor	1324	0.32	0.47
Full Professor	1324	0.44	0.5
Average peer reviewed articles published	1304	3.29	5.5
Average teaching grants submitted	1300	0.67	2.01
Average research grants submitted	1303	2.32	3.39
Social Potency	1307	2.72	0.46
Valid N	1295		

APPENDIX C (CONTINUED)

TABLE XXIV. CORRELATION TABLE, WITH DATA IMPUTATION

		1	2	3	4	5	6	7	8
1	African-American/Black	1							
2	Constraint	0.028	1						
3	E-I Index	0.024	0.024	1					
4	Career Network Resources	0.048	-.297**	-0.053	1				
5	Mentoring Network Resources	0.04	-.343**	-.123*	.647**	1			
6	Strong Ties	-0.052	-.580**	-.170**	.521**	.630**	1		
7	SPI_MACRO	-.116**	-.133**	-0.06	.107**	0.062	.210**	1	
8	SPI_MICRO	-0.031	-.100**	-0.082	.107**	.064*	.143**	.606**	1
9	SocialPotentcy	0.002	-.093*	-0.01	.196**	.111**	.155**	.177**	.206**
10	Gender	-.097**	-0.045	-.064*	-0.012	.103**	0.019	-.132**	-.140**
11	Assist Prof	.071**	0.051	-0.024	-0.039	.060*	-.157**	-.375**	-.195**
12	Assoct Prof	0.025	0.043	-.115**	-0.018	0.021	-0.023	-0.021	-.064*
13	BioChem	-.064*	-.102**	-0.007	-0.015	0.011	0.019	0.037	-0.037
14	CivilEng	-0.045	.067*	-.099**	.092**	-0.045	-.064*	0.039	.081**
15	Math	0.012	.142**	.075**	-.162**	-.110**	-.092**	-0.046	-0.057
16	TeachGrantAvg	0.013	0.001	0.035	0.025	-0.009	-0.034	0.048	0.03
17	PubAvg	-0.029	-.072*	.080*	.103*	-0.009	.079*	.151**	.078*
18	GrantAvg	0.004	-0.013	-0.003	.105*	0.045	-0.005	0.033	0.022

*** Correlation is significant at the 0.05 level (2-tailed).** **** Correlation is significant at the 0.01 level (2-tailed).**

APPENDIX C (CONTINUED)

TABLE XXIV CONTI'D. CORRELATION TABLE, WITH DATA IMPUTATION

		9	10	11	12	13	14	15	16	17	18
9	SocialPotentcy	1									
10	Gender	.016	1								
11	Assist Prof	-.025	.163**	1							
12	Assoct Prof	-.066	.087**	-.376**	1						
13	BioChem	.021	-.077**	-.019	-.069*	1					
14	CivilEng	.079*	-.030	.025	-.008	-.285**	1				
15	Math	-.104*	.025	-.003	.038	-.276**	-.297**	1			
16	TeachGrantAvg	.022	.031	-.010	-.002	-.007	.062	-.053	1		
17	PubAvg	.080	-.100**	-.112**	-.083*	.116**	.024	-.103**	.034	1	
18	GrantAvg	.009	.026	.080*	-.009	.008	.261**	-.201**	.140*	.171**	1

APPENDIX C (CONTINUED)

TABLE XXV. CONFIRMATORY FACTOR ANALYSIS, WITH DATA IMPUTATION

VARIABLE DESCRIPTIONS	Estimate	Std. Est.	S.E.	C.R.	P	R-Square
MACRO LEVEL SPI						
Allocation of budget/departmental research funding.	1	0.741				0.548
Who receives tenure or promotion	0.926	0.729	0.018	50.612	***	0.532
Selection of unit head.	0.97	0.858	0.016	59.06	***	0.736
Selection of new faculty.	0.994	0.828	0.017	57.422	***	0.686
Selection of reviewers for your own tenure/promotion.	0.533	0.517	0.015	35.527	***	0.268
MICRO LEVEL SPI						
Admission of new graduate students	1	0.723				0.522
Allocation of your service/committee assignments.	0.742	0.688	0.015	50.002	***	0.474
The courses that you teach.	0.683	0.683	0.014	49.597	***	0.467
Selection of your teaching/research assistants.	0.63	0.634	0.014	45.408	***	0.402
TIE STRENGTH						
Close friends	1.494	0.49	0.044	33.684	***	0.24
Length of time known	4.301	1.115	0.093	46.31	***	1.244
Frequency of communication	1	0.414				0.171
MENTORING NETWORK RESOURCES						
Reviewed your papers or proposals prior to submission (on which they were not a co-author)	1	0.58				0.336
Advice on Grant getting	1.63	0.757	0.039	41.534	***	0.572
Advice on Publishing	1.58	0.699	0.04	39.451	***	0.488
Advice on Teaching	1.427	0.725	0.035	40.431	***	0.526
Advice on Departmental politics	1.517	0.788	0.036	42.587	***	0.621
Advice on Student related issues	1.596	0.794	0.037	42.79	***	0.63
Advice on Interactions with colleagues	1.826	0.82	0.042	43.613	***	0.672
Advice on Work/family balance	0.996	0.681	0.026	38.788	***	0.464

APPENDIX C (CONTINUED)

TABLE XXV CONT'D. CONFIRMATORY FACTOR ANALYSIS, WITH DATA IMPUTATION

VARIABLE DESCRIPTIONS	Estimate	Std. Est.	S.E.	C.R.	P	R-Square
CAREER DEVELOPMENT NETWORK RESOURCES						
Advice on Collaborating with industry or government	0.537	0.616	0.012	43.195	***	0.379
Provided you with research or other funding	0.408	0.541	0.011	37.556	***	0.292
Recommended you as an invited speaker/panel member	0.667	0.619	0.015	43.485	***	0.384
Nominated you for an award	0.35	0.548	0.009	38.092	***	0.3
Invited you to join a teaching or research grant proposal team	0.92	0.773	0.017	55.221	***	0.597
Introduced you to potential research collaborators	1	0.784				0.614
ALL NETWORK RESOURCES						
Advice on Collaborating with industry or government	0.738	0.568	0.021	35.136	***	0.323
Provided you with research or other funding	0.513	0.457	0.018	29.315	***	0.209
Recommended you as an invited speaker/panel member	0.918	0.573	0.026	35.374	***	0.328
Nominated you for an award	0.469	0.493	0.015	31.295	***	0.243
Invited you to join a teaching or research grant proposal team	1.13	0.638	0.029	38.435	***	0.406
Introduced you to potential research collaborators	1.309	0.689	0.032	40.719	***	0.475
Advice on Work/family balance	0.935	0.664	0.024	39.626	***	0.441
Advice on Interactions with colleagues	1.681	0.784	0.038	44.56	***	0.615
Advice on Student related issues	1.446	0.747	0.034	43.135	***	0.559
Advice on Departmental politics	1.405	0.758	0.032	43.559	***	0.575
Advice on Teaching	1.337	0.706	0.032	41.429	***	0.498
Advice on Publishing	1.54	0.708	0.037	41.502	***	0.501
Advice on Grant getting	1.633	0.787	0.037	44.681	***	0.62
Reviewed your papers or proposals prior to submission (on which they were not a co-author)	1	0.602				0.362

APPENDIX C (CONTINUED)

TABLE XXVI. MODEL 1: TOTAL, DIRECT AND INDIRECT EFFECTS ON MACRO LEVEL SELF-PERCEIVED INFLUENCE USING CONSOLIDATED NETWORK RESOURCES (WITH DATA IMPUTATION)

		TOTAL EFFECTS			DIRECT EFFECTS			INDIRECT EFFECTS		
HYPOTHESES/PROPOSITION	***PATH***	***Std. Est.***	***S.E.***	***Sig***	***Std. Est.***	***S.E.***	***Sig***	***Std. Est.***	***S.E.***	***Sig***
H1 (+)	NetResources--->SPIMACRO	-0.107	0.031	***	-0.107	0.031	***	...	...	...
	StrongTies--->NetResources	0.814	0.008	***	0.814	0.008	***	...	...	...
	Ext-IntTie--->NetResources	0.013	0.011	NS	0.013	0.011	NS	...	...	...
	NetConstraint--->NetResources	0.072	0.013	***	0.072	0.013	***	...	...	...
H2 (-)	NetConstraint--->SPIMACRO	-0.068	0.017	***	-0.060	0.018	***	-0.008	0.015	***
H3 (+)	StrongTies--->SPIMACRO	0.121	0.02	***	0.208	0.036	***	-0.087	0.01	***
H4 (-)	Ext-IntTie--->SPIMACRO	-0.120	0.013	***	-0.119	0.013	***	-0.001	0.003	NS
H5 (-),P1	AfAmBl--->SPIMACRO	-0.040	0.013	***	-0.039	0.013	***	-0.002	0.02	NS
H6 (-)	AfAmBl--->NetResources	0.086	0.014	***	0.074	0.01	***	0.012	0.092	NS
H7 (+)	AfAmBl--->NetConstraint	0.003	0.014	NS	0.003	0.014	NS	...	...	...
H8 (+)	AfAmBl--->Ext-IntTie	-0.038	0.014	***	-0.038	0.014	***	...	...	...
H9 (+)	AfAmBl--->StrongTies	0.015	0.015	NS	0.015	0.015	NS	...	...	...
Controls	Gender--->SPIMACRO	-0.075	0.014	***	-0.075	0.014	***	...	...	...
	Math--->SPIMACRO	0.074	0.015	***	0.074	0.015	***	...	...	...
	BioChem--->SPIMACRO	-0.016	0.014	NS	-0.016	0.014	NS	...	...	...
	CivEng--->SPIMACRO	0.005	0.015	NS	0.005	0.015	NS	...	...	...
	AssistProf--->SPIMACRO	-0.408	0.014	***	-0.408	0.014	***	...	...	...
	AssoctProf--->SPIMACRO	-0.174	0.014	***	-0.174	0.014	***	...	...	...
	PubAvg--->SPIMACRO	0.119	0.014	***	0.119	0.014	***	...	...	...
	TeachGrntAvg--->SPIMACRO	0.088	0.013	***	0.088	0.013	***	...	...	...
	GrntAvg--->SPIMACRO	0.027	0.014	**	0.027	0.014	**	...	...	...
	SocPot--->SPIMACRO	0.226	0.013	***	0.226	0.013	***	...	...	...

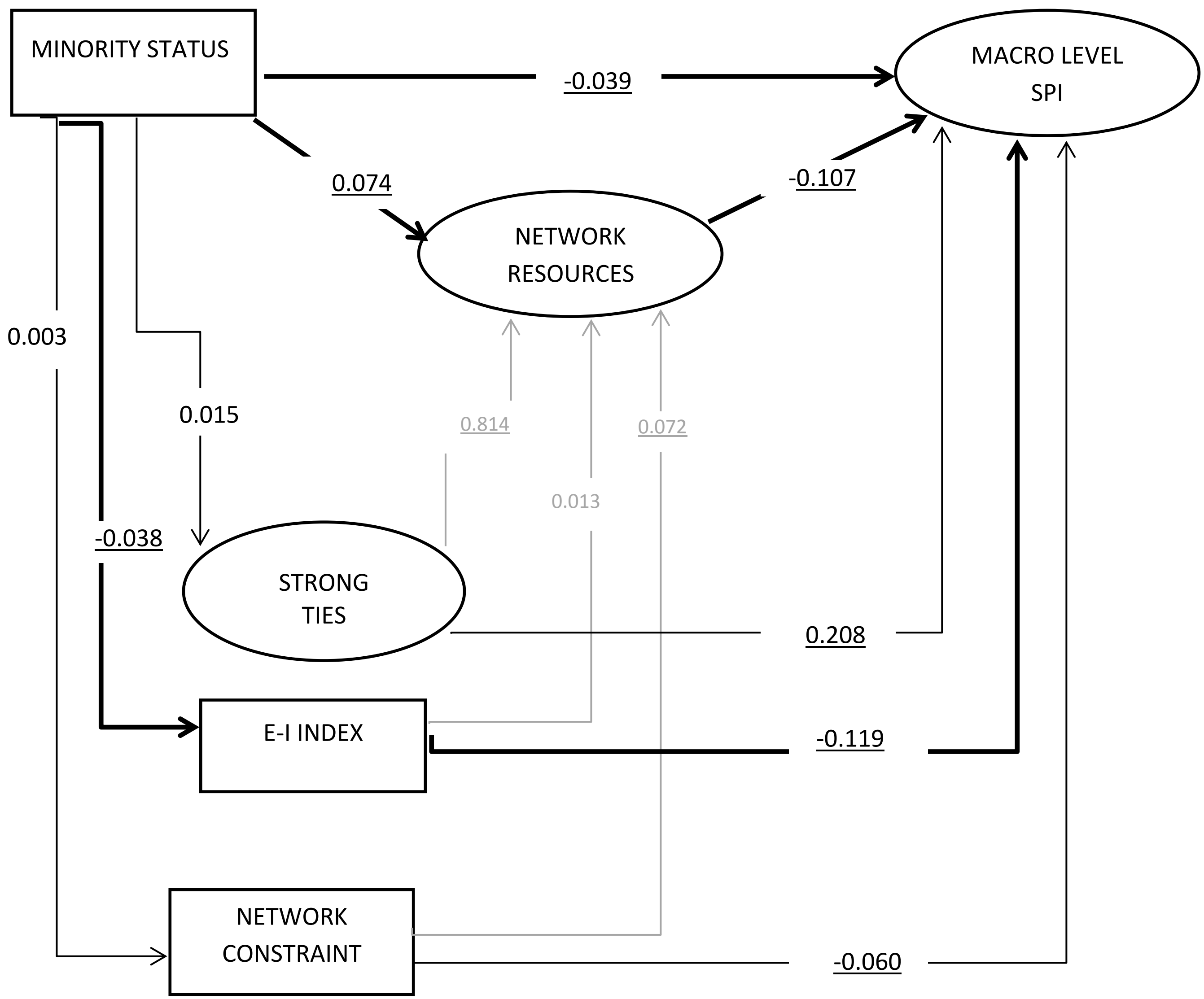
APPENDIX C (CONTINUED)

TABLE XXVII. MODEL 2: TOTAL, DIRECT AND INDIRECT EFFECTS ON MACRO LEVEL SELF-PERCEIVED INFLUENCE USING CAREER DEVELOPMENT AND MENTORING NETWORK RESOURCES (WITH DATA IMPUTATION)

		TOTAL EFFECTS			DIRECT EFFECTS			INDIRECT EFFECTS		
HYPOTHESES/PROPOSITION	***PATH***	***Std. Est.***	***S.E.***	***Sig***	***Std. Est.***	***S.E.***	***Sig***	***Std. Est.***	***S.E.***	***Sig***
H1 (+)	CareerNetResources--->SPIMACRO	-0.130	0.035	***	-0.130	0.035	***	...	...	...
H1 (+)	MentNetResources--->SPIMACRO	-0.109	0.040	***	-0.109	0.040	***	...	...	...
	StrongTies--->CareerNetResources	0.827	0.008	***	0.827	0.008	***	...	...	...
	StrongTies--->MentNetResources	0.860	0.007	***	0.860	0.007	***	...	...	...
	Ext-IntTie--->CareerNetResources	0.115	0.011	***	0.115	0.011	***	...	...	...
	Ext-IntTie--->MentNetResources	-0.016	0.011	NS	-0.016	0.011	NS	...	...	...
	NetConstraint---CareerNetResources	0.096	0.014	***	0.096	0.014	***	...	...	...
	NetConstraint--->MentNetResources	0.126	0.012	***	0.126	0.012	***	...	...	...
H2 (-)	NetConstraint--->SPIMACRO	-0.073	0.017	***	-0.046	0.020	**	-0.026	0.007	***
H3 (-)	Ext-IntTie--->SPIMACRO	-0.121	0.013	***	-0.108	0.014	***	-0.013	0.005	***
H3 (+)	StrongTies--->SPIMACRO	0.114	0.020	***	0.315	0.058	***	-0.201	0.048	***
H4 (-),P1	AfAmBl--->SPIMACRO	-0.040	0.013	***	-0.031	0.014	**	-0.009	0.006	NS
H5 (-)	AfAmBl--->CareerNetResources	0.063	0.014	***	0.056	0.012	***	0.008	0.012	NS
H5 (-)	AfAmBl--->MentNetResources	0.087	0.013	***	0.073	0.010	***	0.013	0.012	NS
H6 (+)	AfAmBl--->NetConstraint	0.003	0.014	NS	0.003	0.014	NS	...	...	...
H7 (-)	AfAmBl--->Ext-IntTie	-0.038	0.014	***	-0.038	0.014	***	...	...	...
H8 (+)	AfAmBl--->StrongTies	0.014	0.015	NS	0.014	0.015	NS	...	...	...
Controls	Gender--->SPIMACRO	-0.077	0.014	***	-0.077	0.014	***	...	...	...
	Math--->SPIMACRO	0.073	0.014	***	0.073	0.014	***	...	...	...
	BioChem--->SPIMACRO	-0.016	0.014	NS	-0.016	0.014	NS	...	...	...
	CivEng--->SPIMACRO	0.007	0.015	NS	0.007	0.015	NS	...	...	...
	AssistProf--->SPIMACRO	-0.411	0.014	***	-0.411	0.014	***	...	...	...
	AssoctProf--->SPIMACRO	-0.175	0.014	***	-0.175	0.014	***	...	...	...
	PubAvg--->SPIMACRO	0.121	0.014	***	0.121	0.014	***	...	...	...
	TeachGrntAvg--->SPIMACRO	0.087	0.013	***	0.087	0.013	***	...	...	...
	GrntAvg--->SPIMACRO	0.027	0.014	**	0.027	0.014	**	...	...	...
	SocPot--->SPIMACRO	0.227	0.013	***	0.227	0.013	***	...	...	...

APPENDIX C (CONTINUED)

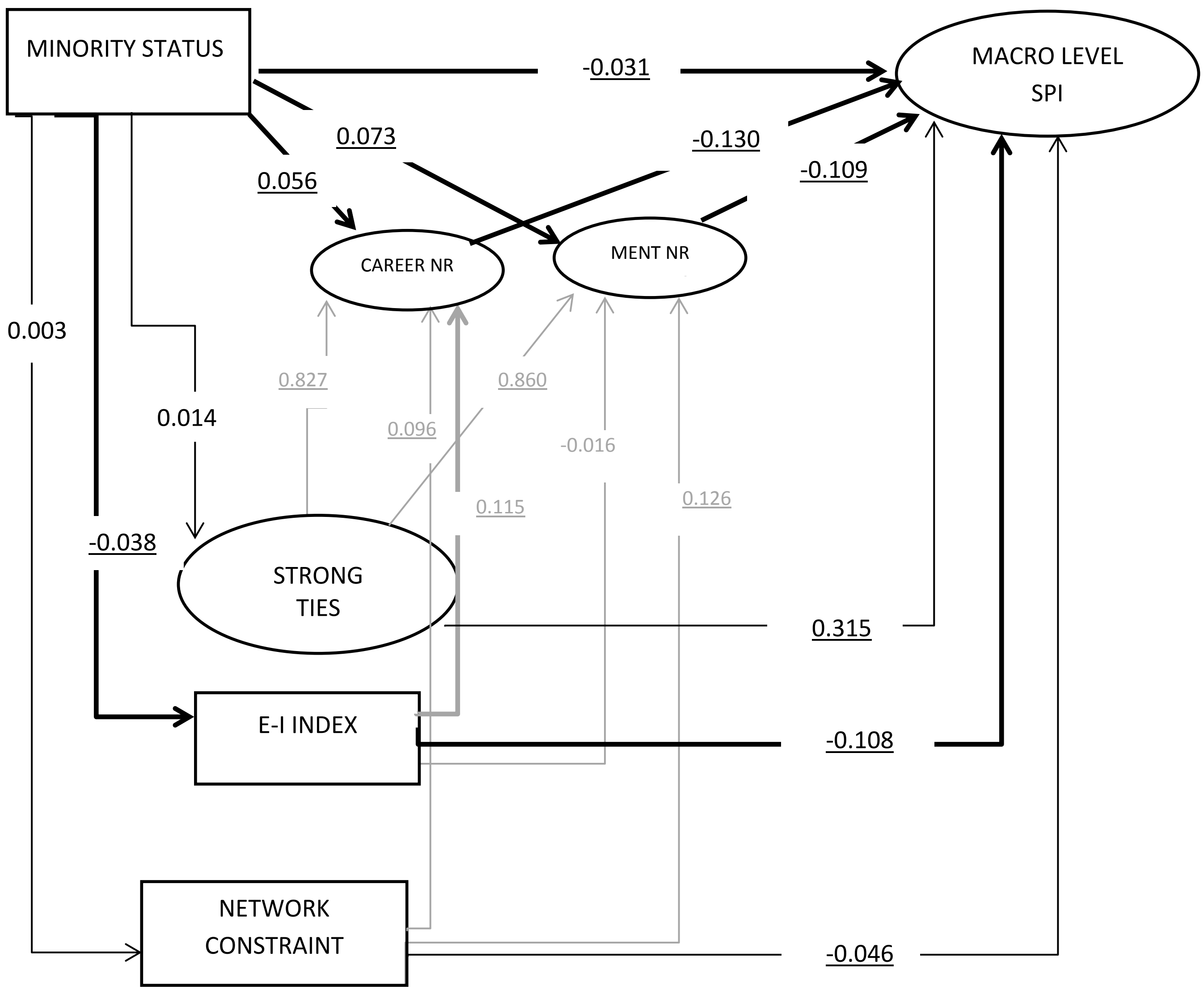
FIGURE 5A. MODEL 1: ESTIMATED PATHS WITH ALL NETWORK RESOURCES IN SINGLE VARIABLE PREDICTING MACRO LEVEL SPI, WITH DATA IMPUTATION



Goodness of Fit Indices: Chi-sq 26090.438 Sig p<.01, RMSEA 0.095, CFI 0.673, PGFI 0.665, PNFI 0.619

APPENDIX C (CONTINUED)

FIGURE 5B. MODEL 2: ESTIMATED PATHS WITH GROUPED NETWORK RESOURCES PREDICTING MACRO LEVEL SPI, WITH DATA IMPUTATION



Goodness of Fit Indices: Chi-sq 24303.608 Sig p<.01, RMSEA 0.092, CFI 0.695, PGFI 0.680, PNFI 0.634

APPENDIX C (CONTINUED)

TABLE XXVIII. MODEL 3: TOTAL, DIRECT AND INDIRECT EFFECTS ON MICRO LEVEL SELF-PERCEIVED SPI USING CONSOLIDATED NETWORK RESOURCE VARIABLE, WITH DATA IMPUTATION

		TOTAL EFFECTS			DIRECT EFFECTS			INDIRECT EFFECTS		
HYPOTHESES/PROPOSITION	*PATH*	*Std. Est.*	*S.E.*	*Sig*	*Std. Est.*	*S.E.*	*Sig*	*Std. Est.*	*S.E.*	*Sig*
H1 (+)	NetResources--->SPIMICRO	-0.228	0.036	***	-0.228	0.036	***	...	...	...
	StrongTies--->NetResources	0.814	0.012	***	0.814	0.012	***	...	...	...
	Ext-IntTie--->NetResources	0.014	0.011	NS	0.014	0.011	NS	...	...	...
	NetConstraint--->NetResources	0.069	0.012	***	0.069	0.012	***	...	...	...
H2 (-)	NetConstraint--->SPIMICRO	0.076	0.019	***	0.091	0.02	***	-0.016	0.004	***
H3 (+)	StrongTies--->SPIMICRO	0.190	0.022	***	0.375	0.042	***	-0.185	0.03	***
H4 (-)	Ext-IntTie--->SPIMICRO	-0.116	0.016	***	-0.113	0.016	***	-0.003	0.003	NS
H5 (-),P1 ()	AfAmBl--->SPIMICRO	-0.010	0.015	NS	0.000	0.015	NS	-0.010	0.005	*
H6 (-)	AfAmBl--->NetResources	0.086	0.014	***	0.075	0.011	***	0.012	0.012	NS
H7 (+)	AfAmBl--->NetConstraint	0.003	0.014	NS	0.003	0.014	NS	...	...	...
H8 (+)	AfAmBl--->Ext-IntTie	-0.038	0.014	***	-0.038	0.014	***	...	...	...
H9 (+)	AfAmBl--->StrongTies	0.015	0.015	NS	0.015	0.015	NS	...	...	...
Controls	Gender--->SPIMACRO	-0.108	0.016	***	-0.108	0.016	***	...	...	...
	Math--->SPIMACRO	0.027	0.017	NS	0.027	0.017	NS	...	...	...
	BioChem--->SPIMACRO	-0.080	0.016	***	-0.080	0.016	***	...	...	...
	CivEng--->SPIMACRO	0.020	0.017	NS	0.020	0.017	NS	...	...	...
	AssistProf--->SPIMACRO	-0.327	0.016	***	-0.327	0.016	***	...	...	...
	AssoctProf--->SPIMACRO	-0.214	0.016	***	-0.214	0.016	***	...	...	...
	PubAvg--->SPIMACRO	0.107	0.016	***	0.107	0.016	***	...	...	...
	TeachGrntAvg--->SPIMACRO	0.045	0.015	***	0.045	0.015	***	...	...	...
	GrntAvg--->SPIMACRO	0.025	0.016	NS	0.025	0.016	NS	...	...	...
	SocPot--->SPIMACRO	0.306	0.015	***	0.306	0.015	***	...	...	...

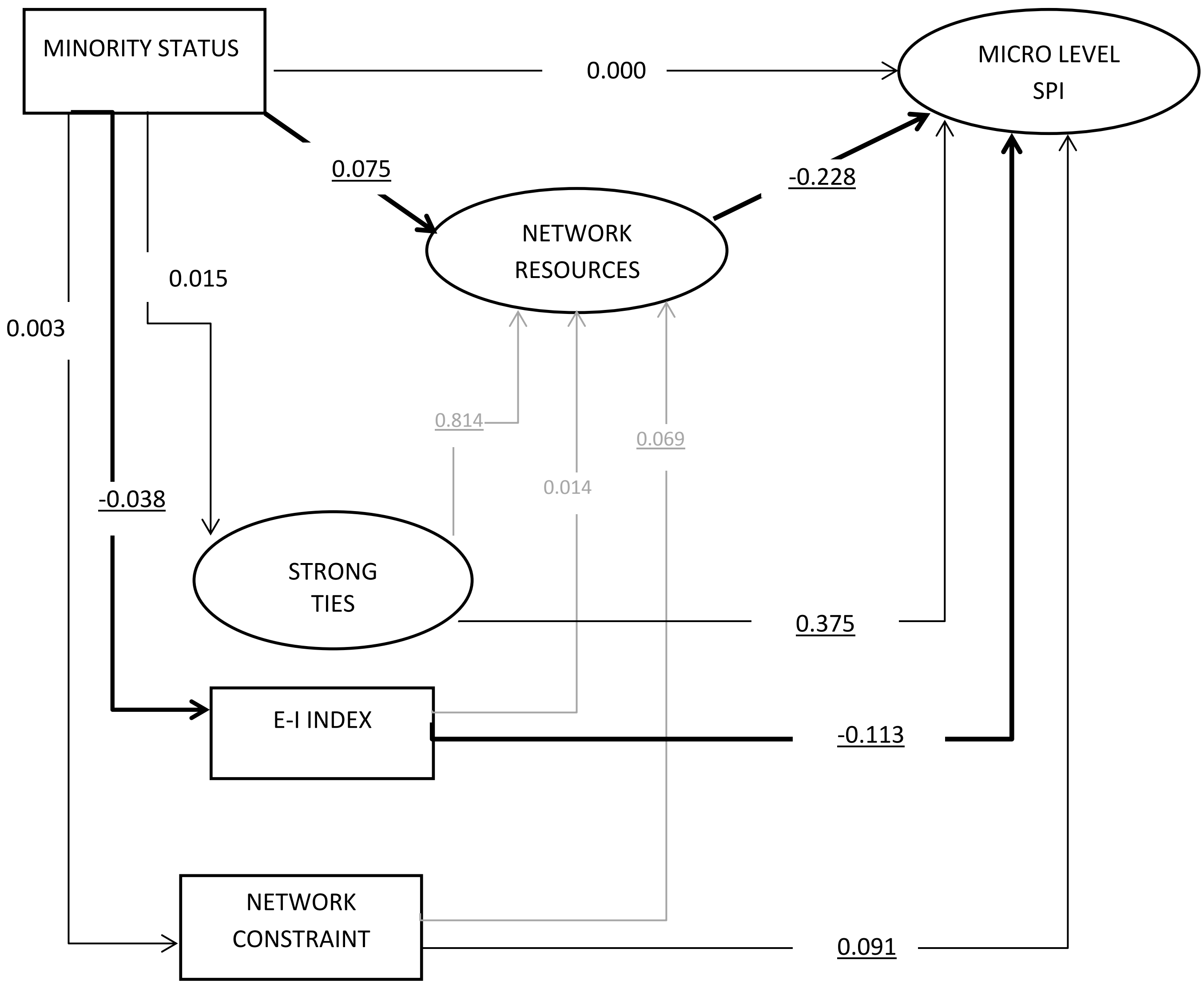
APPENDIX C (CONTINUED)

TABLE XXIX. MODEL 4: TOTAL, DIRECT AND INDIRECT EFFECTS ON MICRO LEVEL SPI USING CAREER DEVELOPMENT AND MENTORING NETWORK RESOURCES, WITH DATA IMPUTATION

		TOTAL EFFECTS			DIRECT EFFECTS			INDIRECT EFFECTS		
HYPOTHESES/PROPOSITION	***PATH***	***Std. Est.***	***S.E.***	***Sig***	***Std. Est.***	***S.E.***	***Sig***	***Std. Est.***	***S.E.***	***Sig***
H1 (+)	CareerNetResources--->SPIMICRO	-0.218	0.042	***	-0.218	0.042	***	...	...	...
H1 (+)	MentNetResources--->SPIMICRO	-0.265	0.048	***	-0.265	0.048	***	...	...	...
	StrongTies--->CareerNetResources	0.828	0.008	***	0.828	0.008	***	...	...	...
	StrongTies--->MentNetResources	0.861	0.007	***	0.861	0.007	***	...	...	...
	Ext-IntTie--->CareerNetResources	0.115	0.012	***	0.115	0.012	***	...	...	...
	Ext-IntTie--->MentNetResources	-0.015	0.011	NS	-0.015	0.011	NS	...	...	...
	NetConstraint---CareerNetResourc	0.094	0.014	***	0.094	0.014	***	...	...	...
	NetConstraint--->MentNetResourc	0.124	0.012	***	0.124	0.012	***	...	...	...
H2 (-)	NetConstraint--->SPIMICRO	0.069	0.019	***	0.123	0.023	***	-0.053	0.010	***
H3 (-)	Ext-IntTie--->SPIMICRO	-0.118	0.016	***	-0.097	0.018	***	-0.021	0.007	***
H3 (+)	StrongTies--->SPIMICRO	0.181	0.022	***	0.589	0.070	***	-0.408	0.059	***
H4 (-),P1	AfAmBl--->SPIMICRO	-0.010	0.015	NS	0.015	0.016	NS	-0.024	0.008	***
H5 (-)	AfAmBl--->CareerNetResources	0.063	0.015	***	0.056	0.013	***	0.008	0.012	NS
H5 (-)	AfAmBl--->MentNetResources	0.087	0.014	***	0.074	0.011	***	0.013	0.013	NS
H6 (+)	AfAmBl--->NetConstraint	0.003	0.014	NS	0.003	0.014	NS	...	...	...
H7 (-)	AfAmBl--->Ext-IntTie	-0.038	0.014	***	-0.038	0.014	***	...	...	...
H8 (+)	AfAmBl--->StrongTies	0.014	0.016	NS	0.014	0.016	NS	...	...	...
Controls	Gender--->SPIMACRO	-0.109	0.016	***	-0.109	0.016	***	...	...	...
	Math--->SPIMACRO	0.026	0.017	NS	0.026	0.017	NS	...	...	...
	BioChem--->SPIMACRO	-0.079	0.016	***	-0.079	0.016	***	...	...	...
	CivEng--->SPIMACRO	0.022	0.017	NS	0.022	0.017	NS	...	...	...
	AssistProf--->SPIMACRO	-0.330	0.016	***	-0.330	0.016	***	...	...	...
	AssoctProf--->SPIMACRO	-0.215	0.016	***	-0.215	0.016	***	...	...	...
	PubAvg--->SPIMACRO	0.109	0.017	***	0.109	0.017	***	...	...	...
	TeachGrntAvg--->SPIMACRO	0.045	0.015	***	0.045	0.015	***	...	...	...
	GrntAvg--->SPIMACRO	0.025	0.016	NS	0.025	0.016	NS	...	...	...
	SocPot--->SPIMACRO	0.307	0.015	***	0.307	0.015	***	...	...	...

APPENDIX C (CONTINUED)

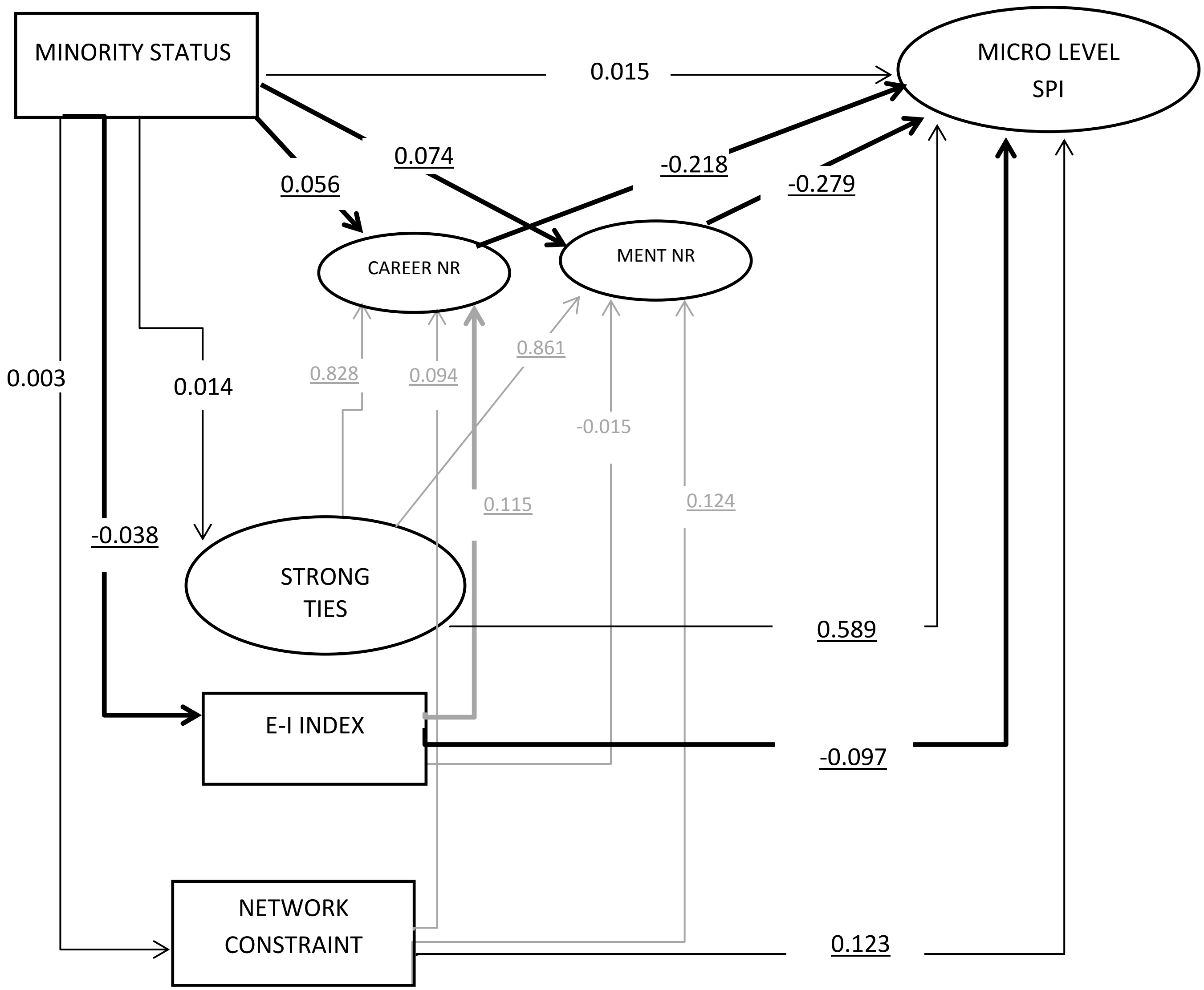
FIGURE 6A. MODEL 3: ESTIMATED PATHS WITH ALL NETWORK RESOURCES IN SINGLE VARIABLE PREDICTING MICRO LEVEL SPI, WITH DATA IMPUTATION



Goodness of Fit Indices: Chi-sq 25039.328 Sig p<.01, RMSEA 0.096, CFI 0.641, PGFI 0.662, PNFI 0.588

APPENDIX C (CONTINUED)

FIGURE 6B. MODEL 4: ESTIMATED PATHS WITH GROUPED NETWORK RESOURCES PREDICTING MICRO LEVEL SPI, WITH DATA IMPUTATION



Goodness of Fit Indices: Chi-sq 23250.311 Sig p<.01, RMSEA 0.092, CFI 0.667, PGFI 0.677, PNFI 0.606

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