

WHAT MATTERS FOR SCIENCE LEADERSHIP

Is it what you know, who you
know, or who you are?

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Public Administration Research Symposium, March 11, 2011

Introduction

This paper seeks to understand the determinants of becoming a science leader in academia. Based on the literature, we develop alternative hypotheses for three different explanations of leadership: social connections, science ability or characteristic.

- The social construct recognizes the importance of the network of connections that individuals have;
- The ability construct identifies the expertise and skill of the individual;
- The characteristic construct concerns the individual trait of gender.

RESEARCH QUESTION: *How are social connections, scientific ability, and gender associated with attainment of science leadership positions in academia?*

Introduction

- Furthermore, we are interested comparing estimation results for three types of formal leadership positions within academic science:
 - Center research leadership;
 - University administrative leadership ; and
 - Discipline or field leadership
- An additional model will be estimated for ***total science leadership***, which accounts for the presence of at least one type.

Motivation

- The progressive development of science; greater complexity requires leadership.
 - Individual to a collaborative, team based enterprise;
 - Greater interaction across boundaries of universities;
 - Increasing range and diversity of actors.
- Leadership in science important topic:
 - Development of human capital;
 - Resource dependence;
 - Disciplinary guidance;
 - Visibility.
- Policy importance of gender and leadership in science where women are consistently underrepresented.

Hypotheses

Social Capital and Social Networks

- Social networks are entities that facilitate the creation of social capital (Burt 2000). Access to resources, information, opportunities Coleman (1988). Attainment of a leadership position requires information, resources and support.
- Larger networks could provide access to more resources and information (Burt 1992, Haythornthwaite 1996).
 - H1: Individuals with larger networks will be more likely to have a science leadership position.
- Networks that are less dense may mean that the ego receives a greater diversity of information and opportunities (Friedkin 1982, Lin 2001).
 - H2: Individuals that have denser collaboration networks will be less likely to have a science leadership position.

Hypotheses

- Egos that have a greater ratio of external to internal ties may have access to more information and resources outside the organization (in this case the university).
 - H3: Individuals with more external networks will be more likely to have a science leadership position.
- Strong ties imply greater emotional closeness (Lin 2001, Granovetter 1973) and higher levels of trust, which are likely to make people prone to sharing information and resources (Krackhardt 1992). A larger proportion of strong ties in networks provide resources that would be useful in attaining leadership positions.
 - H4: Individuals with stronger ties in their networks will be more likely to have a science leadership position.

Hypotheses

Science Ability

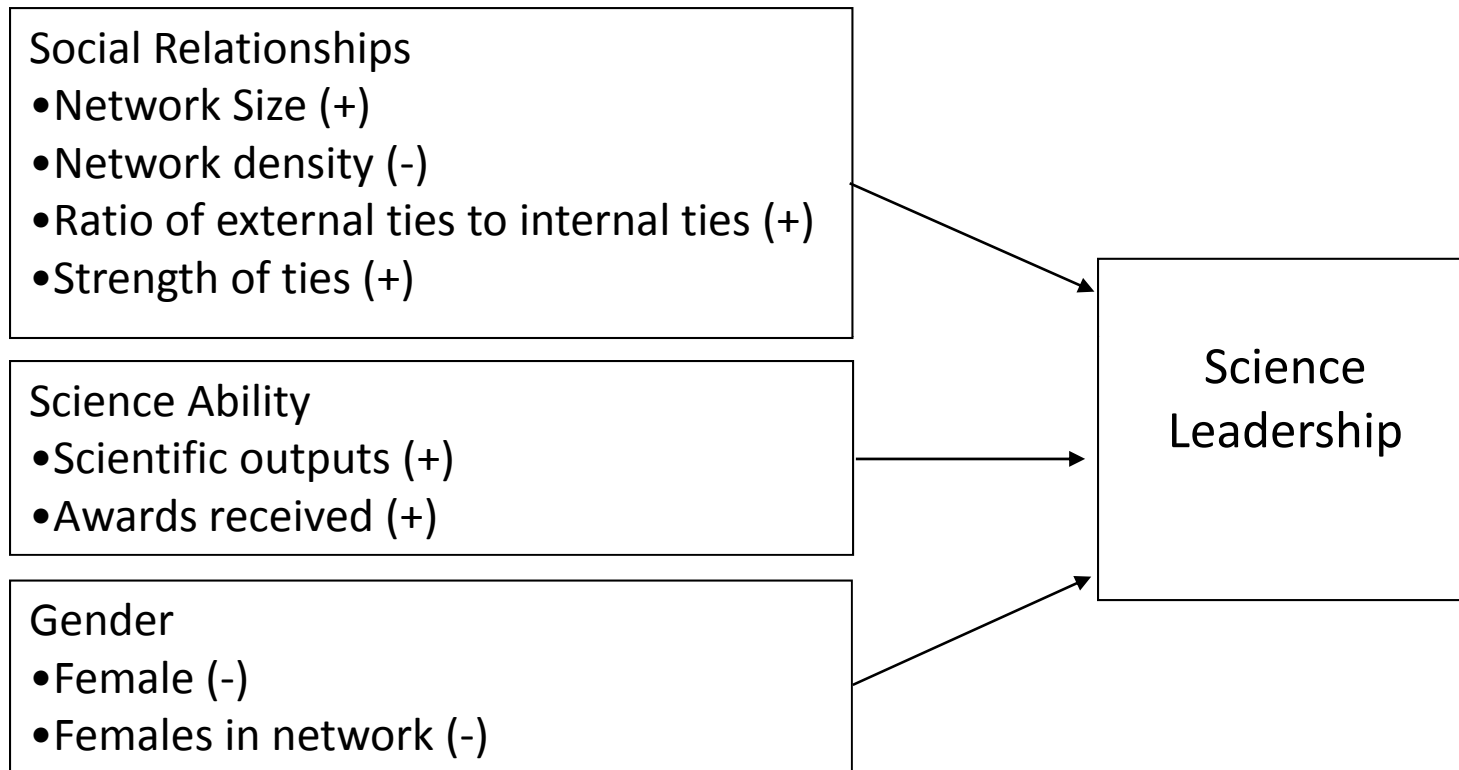
- Scientific ability is an important indicator of reputation, which is an important determinant of leadership attainment (Merton 1957, Crane 1965, Ben-David and Sullivan 1975, Hargens and Hagstrom 1982, Stern 2004, O’Learly 1999).
- Science leaders need to possess strong technical skills since they are charged with working with group members in solving research problems and advancing the development of scientific knowledge (Sapieza 2005, Jindal-Snape and Snape 2006, Shapin 2008).
 - H5: Individuals having a higher amount of awards will be more likely to have an academic science leadership position.
 - H6: Individuals that produce more science outputs will be more likely to have a science leadership position.

Hypotheses

Females

- Structural exclusion from leadership positions due to lack of social capital necessary for advancement and attainment of power (McPherson and Smith-Lovin 2001, Ruef et al 2003).
- Fewer weak ties making connections across different types of networks located within and outside of the organization difficult (Burt 2002).
 - H7: Individuals that have more women in their collaboration networks will be less likely to have a science leadership position.
 - H8: Being a woman is negatively associated with the likelihood of having a science leadership position.

Conceptual Model



Data

- A 2007 National Science Foundation funded online survey administered by the University of Illinois at Chicago, the Georgia Institute of Technology, and the University of Georgia. This was a national survey conducted among scientists and engineers at 150 Carnegie-designated Research I (i.e Research Extensive) universities.
- 1,774 completed surveys were received, final sample size used for analysis was 1,598.
- The overall response rate of the survey, calculated using the RR2 method of the American Association for Public Opinion Research (AAPOR) was 45.8%. The weighted response rate was 43.0% (AAPOR 2009).
- Network data was collected using a series of *name generator* and *name interpreter* questions. Individuals were also asked about their research activities. Detailed demographic data was gathered as well.

Data: Measures

DEPENDENT VARIABLES [discrete 0/1]

- Discipline Leadership** (officer holder at professional association)
- Center Leadership** (director or co-director of lab or research center/institute)
- Administrative Leadership** (dean, department head, chair)
- Total Science Leadership** (holding at least one of the 3 types)

INDEPENDENT VARIABLES

- Science ability** (amount of grants, publications, awards)
- Social relationships** (network structure, network size, strength of ties, number of women in network)
- Gender** (male or female)

CONTROLS

- Minority, science field, age, and age squared

METHOD

- Logistic regression analysis** was used to predict the likelihood of leadership. Sample weights were used and listwise deletion of observations due to missing values resulted in a sample size of 1,317 used in the estimations.

Findings

DETERMINANT	TOTAL LEADERSHIP	DISCIPLINE LEADERSHIP	CENTER LEADERSHIP	ADMINISTRATIVE LEADERSHIP
Science Ability (grants, pubs, awards)	(+,+,+)	(+,+,+)	(+,+,+)	+ <i>only grants</i>
Density of Network	-	-	+	-
Ext to Int Ties	-	<i>Not sig</i>	-	-
Strength of Ties	+	+	+	-
Size of Network	+	+	+	-
Total Women In Network	-	-	-	<i>Not sig</i>
Female	+	+	-	-

Relationship of Hypotheses to Findings

- Social Networks: H1, H2, and H4 are supported. H3 is not supported.
 - However, having denser networks increases the likelihood of having a center leadership position.
 - Furthermore, having larger networks and close ties decreases the likelihood of having an administrative leadership position.
- Science Ability: H5 and H6 are supported
 - However, for administrative leadership it is only more grants that increases the likelihood of having a leadership position.
- Gender: H7 is supported, but H8 is not supported
 - However, the number of women in the network is not significant for predicting the likelihood for having an administrative leadership position.
 - Furthermore, being a woman is only positively and significantly related to predicting the likelihood of having a discipline leadership position.

Conclusions

- Having more science output significantly increases the likelihood of having a formal science leadership position. This reinforces the value that is placed on building reputation based on skill in the science culture.
- However, when predicting the likelihood of leadership, this norm does not overshadow the impact of individual traits and aspects of social relationships.
- Furthermore, when conceptualizing science leadership in different types (discipline, administrative, and center) according to distinct functions in the academic science settings, the impact of determinants vary. This means that the story of the path to leadership in scientific organizations is not exactly clear cut and necessitates a more microscopic analysis. This also sheds light on how leadership can be multidimensional in a single context.
- Policies geared towards improving the status of women in science via leadership positions should consider how this visibility may be concentrated (and lacking) among certain types of leadership positions, thus perpetuating disparities.

Thank You!

Questions