

# The Corporate Ladder in S & E Industry – How Diverse?

## Authors:

Catherine Didion, National Academy of Engineering, Washington, DC  
Wei Jing, National Academy of Engineering, Washington, DC

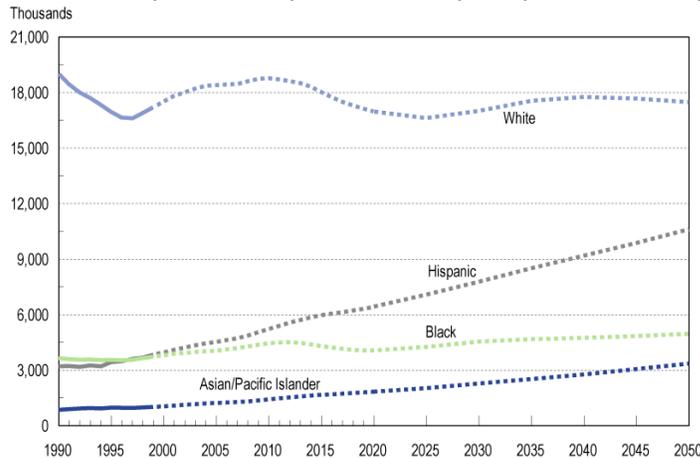
## Abstract

This paper will focus on the preliminary research gathered for the National Academy of Engineering and the Committee on Science, Engineering, and Public Policy of the National Academies for a project on “Capitalizing on the Diversity of the Science and Engineering Workforce in Industry”. The purpose of the project is to gather data on how to maximize the recruitment, retention, and advancement of women and minorities in industries that have a large scientific and engineering component. This paper represents the research gathered for this effort and presents a picture of the status of women and minorities in these industries as well as an initial indication of the gaps of knowledge and information that need to be addressed in order to further facilitate greater participation of women and minorities in industry.

## Introduction

An increasing concern in industry is the need for a more diverse workforce to enable more innovation, enhance company markets, and allow for better recruitment and retention from a wider pool of highly qualified individuals (European Commission 2005). The diversity of the United States population is on the rise, and by 2050, minorities<sup>1</sup> are expected to comprise 52% of the population (NSF 2006). Accordingly, the U.S. economy will need to rely on these populations as a major source for workers as well as a consumer base. The scientific and engineering (S&E) industry in which a high growth rate of workforce is expected to occur, in particular, will have to draw their workforce from these pools.

Figure 1. U.S. population 18-24 years old, by race/ethnicity: July 1990-99 and projections to 2050



\*Hispanics may be of any race. Data for American Indians/Alaskan Natives are not shown.

Source: National Science Foundation, “Women, Minorities, and Persons with Disabilities in Science and Engineering,” 2006

<sup>1</sup> The Federal government recognizes 5 racial categorizations (American Indian/Alaska Native, Asian, African American, Native Hawaiian/Other Pacific Islander, and White) and two ethnic categorizations (Hispanic/Latino and Not Hispanic/Latino).

However, both women and minorities are significantly underrepresented in the workforce, especially in S&E fields. For the country's S&E industry to maintain their technological edge, women and minorities must become a larger part of the S&E workforce.

### **National Academies' Effort on S & E Industrial Workforce**

The National Academy of Engineering and the Committee on Science, Engineering, and Public Policy of the National Academies created a committee on "Capitalizing on the Diversity of the Science and Engineering Workforce in Industry" which is conducting a study on how to maximize the recruitment, retention and advancement of women and underrepresented minorities in industries with large S&E components. Key questions that will be considered are what is the current representation of women and underrepresented minorities in industry and its present rate of change? Does it differ by sector? Is this representation sufficient relative to the overall workforce population of women and underrepresented minorities? What is the typical route of advancement in science and engineering firms? Do the routes of advancement for women and minorities differ from majority men? Have industry's efforts to recruit greater participation of women and minorities been effective? Do the critical points for advancement in technical careers differ from those of non-technical careers? What current challenges exist in recruitment, retention, and advancement of women and underrepresented minority scientists and engineers in industry? Do these challenges differ by S&E sector? How does the participation of women and minorities influence the competitiveness of individual firms in the marketplace? Are there examples illustrating this? How can industrial policies encourage the recruitment, retention and advancement of women and underrepresented minorities? What works and what does not work? Does one type of policy work better than another (e.g., "push" vs. "pull" strategies)? What are the best practices? Are they distinctive for women? For underrepresented minorities? For women of color?

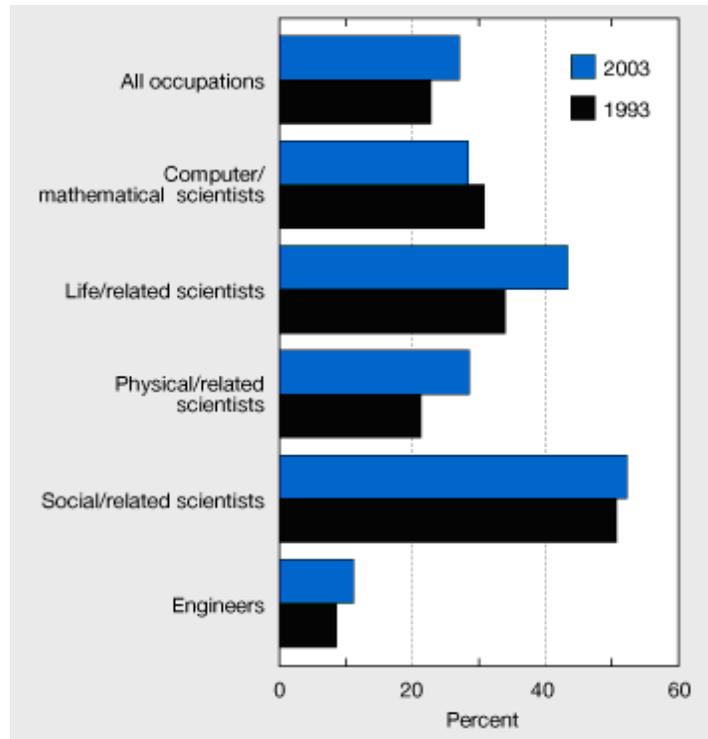
### **Review of Current Research**

Although women and minorities have increased their representation in many S&E sectors, their representation in industry is disproportionately lower than in the general population and the overall workforce. Variation does exist across different S&E sectors for both women and minorities, but all sectors have lower-than-expected representation. There has been a decline in computer science despite the expansion of the sector.

In 2003, the U.S. labor force consisted of approximately 69 million workers (Bureau of Labor Statistics 2003), of which an estimated 6-22% worked in S&E disciplines (NSF 2008). Women comprise nearly half (47%) of the total college-educated workforce but make up only 26% of the workforce in S&E disciplines (NSF 2008). In addition, industry employs 75% of men whose highest degrees are in S&E disciplines but only 62% of women (CPST 2007). Overall, women with bachelor's degrees in science and engineering are less likely than men to work in S&E occupations.

Between 1983 and 2003, the percentage of all U.S. jobs held by women rose from 44% to 47%. During this time, women's representation in S&E fields also increased from 16-19% to 23%-26% (CPST 2007). However, there are differences across disciplines. In 2003, women made up 52% of social scientists, 44% of life scientists, 29% of physical scientists, and 11% of engineers (NSF 2008). The percentage of women in engineering rose from 10% to 14%, while those in the life sciences increased from 23.5% to 38.2%. In contrast, the number of women in computer science increased from 30% in 1983 to 35% in 1991 but steadily declined to 27% in 2003 despite an increase in the total number of computer science jobs in the U.S. (CPST 2007).

Figure 2. Women as proportion of S&E workforce, by broad field of occupation: 1993 and 2003



Source: National Science Foundation, Division of Science Resources Statistics, Scientists and Engineers Statistical Data System (SESTAT), 1993 and 2003.

Underrepresented minorities<sup>2</sup> collectively make up 24% of the total US workforce (European Commission 2005)<sup>3</sup> but comprise only 10% of the S&E workforce (NSF 2008). 62% of minorities with S&E degrees are employed in industry compared to 71% of whites (CPST 2007). Those with bachelor's degrees in science and engineering have higher unemployment rates and are less likely to be employed in S&E occupations or continue schooling than whites with similar degrees (CPST 2007). Since 1980, participation in S&E occupations has nearly doubled for blacks (2.6% to 5.1%) and more than doubled for Hispanics (2.0% to 5.2%) (NSF 2008).

However, considerable variation exists in the rate of change across S&E disciplines and ethnic/racial groups. Between 1994 and 2004, African-American representation in S&E professions rose from 5.5% to 6.2% while their percentage in the overall workforce increased from 10.4% to 10.7% (CPST 2005). From 1980 to 2000, the number of African Americans in non-academic S&E professions more than doubled, from 2.6% to 6.9% (NSF 2008). However, in comparison to their overall representation in professional specialty occupations, the percentage of African-Americans in S&E professions decreased from 80% in 2001 to 69% in 2004 (CPST 2005).

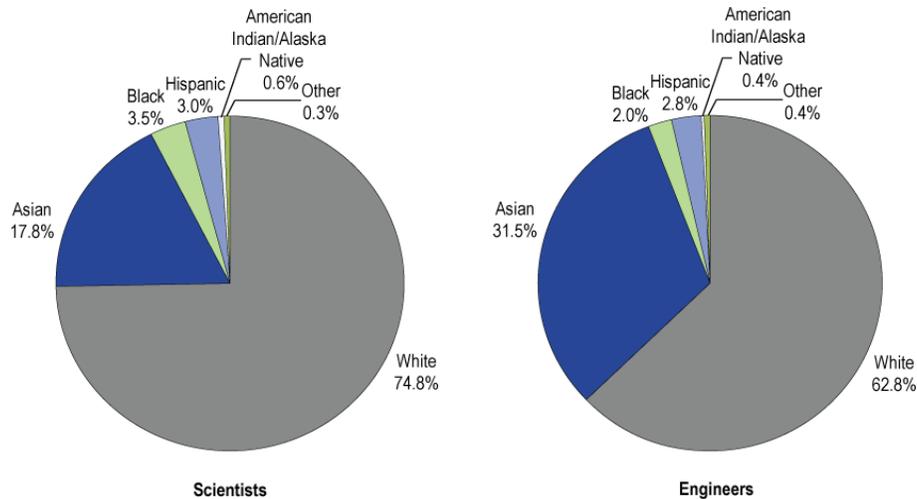
Hispanics comprised 12.9% of the total workforce in 2004, an increase from 8.8% in 1994. Their representation in the S&E workforce also increased from 3.7% to 5.3% during this time (CPST 2005). However, from 1980 to 2000, nonacademic S&E professions experienced a minimal increase in Hispanic representation, from 2% to 3.2% (NSF 2008). In total, Hispanic participation in S&E disciplines improved at roughly the same rate as in the overall workforce, a

<sup>2</sup> African-Americans, Hispanics, and American Indians/Native Alaskans

<sup>3</sup> Data does not include American Indians

positive rate of change of 46% in S&E professions and 43% in the overall workforce (CPST 2005). There is no comparable data on Native Americans in either the S&E or overall workforce as their representation has historically been too low to merit inclusion in statistical analyses of workforce demographics.

Figure 3. Employed doctoral scientists and engineers, by race/ethnicity and occupation: 2006



Source: National Science Foundation, “Women, Minorities, and Persons with Disabilities in Science and Engineering,” 2006.

### Routes of Advancement in S&E Industry

The National Academies intend to look into the different career tracks, route of advancement in science and engineering firms and the effectiveness of industry’s strategies and efforts on recruiting greater participation of women and minorities

There is no one route to the top of the corporate ladder in S&E industry, and it is unknown whether advancement points for technical careers differ from non-technical careers. However, routes of advancement for men and women differ in terms of access to mentoring and networking opportunities. Despite efforts by S&E companies to recruit greater numbers of women and minorities, these groups remain significantly underrepresented.

Advancement routes for all technical workers appear the same. However, regardless of the typical route to the top, advancing in S&E firms largely depends on networking. Most individuals feel networking has a more important role than merit in career advancement (Catalyst 2001, CAWMSET 2000). Proper mentoring also plays a significant role in advancement within a company (CAWMSET 2000). Consequently, women and minorities have had difficulty advancing due to a lack of mentoring and networking opportunities. Problems women and underrepresented minorities face in advancing in industry include numerous barriers limiting access to these opportunities. The continued low representation of women and minorities in S&E industries indicates more work is needed to recruit these individuals and create a better environment for their advancement.

### Current Challenges

Unfortunately, obstacles exist for companies looking to retain a diverse staff. One of the best mechanisms for the corporate advancement of women has been to leave the company and find a

better job with another corporation. For example, women of color who left their companies since 1998 found, on average, their salaries were \$20,000 higher after three years than women who stayed at the same company (Catalyst 2002).

Current challenges existing in recruitment, retention and advancement for women and minorities in industry include a lack of mentoring, difficulty managing a work/life balance, and negative stereotypes regarding ability to perform in the workplace. There is no data suggesting these challenges differ by sector or type of position, but data do show smaller corporations often have more difficulty overcoming these challenges because they lack the necessary resources to help their workforce.

Although no data are available regarding differences in the types of challenges in different S&E sectors, numerous barriers affect the recruitment, retention and advancement of women and underrepresented minorities across all areas of industry. Women of color are particularly vulnerable in S&E industries because they suffer from the “double bind” of both gender and racial/ethnic discrimination (CAWMSET 2000, Giscombe & Mattis 2002).

Barriers for women and minorities in industry include:

- **A lack of information on potential careers** (CAWMSET 2000, Catalyst 1999). While this can affect *all* students pursuing S&E degrees, data suggest it can be more of a factor for women and underrepresented minorities.
- **A lack of role models** (Catalyst 2005, CAWMSET 2000, Catalyst 1999), often leading to the perception that certain career paths are not open to certain groups (ASHA 2007).
- **Negative stereotypes** (CAWMSET 2000, Barres 2006) regarding the overall ability of women and minorities in science as well as their capability to serve as effective managers. Data show minorities who are placed in management positions have lower numbers of subordinates than whites (regardless of gender).
- **A lack of flexibility in work/life balance**, which disproportionately affects more women than men. It not only includes child-rearing issues but also care for elders and extended family and can also be a factor for men of certain cultures (CAWMSET 2000, page18), including newly immigrated Hispanics and Asians (Catalyst 2003, Bayer 2006). Additionally, children and other dependents have a negative association with women’s salaries (NSF 2008).
- **A lack of access to networking opportunities and mentoring** (CAWMSET 2000, Catalyst 2002, ASHA 2007, The Families and Work Institute et al, Bayer 2006). Many workers feel people advance more based on who they know rather than on merit. Women and minorities in general feel they are shut out of many informal networking opportunities within their companies due to their gender or race/ethnicity (CAWMSET 2000). In fact, data show the number of mentors an individual has correlates to the rate of his or her promotion (U.S. Department of Labor 2002).
- **Cultural differences**, which can lead to misunderstandings between co-workers of different ethnicities and misinterpretations of certain behaviors. For example, Asian culture encourages humility and respect for authority, which can conflict with corporate notions of self-promotion and self-assertion (Catalyst 2003).

Many of these barriers not only prevent individuals from entering the S&E industry but also affect their participation in other areas of the S&E workforce (CAWMSET 2000). This, in turn, can have a negative effect on the recruitment of underrepresented groups.

### **Impact of Lack of Representation in S&E Industry**

Two-thirds of CEOs in S&E fields believe underrepresentation of women and minorities is a problem in their industry (Bayer 2006). However, when it comes to their own companies, a little over half surveyed believe underrepresentation is not a problem (Bayer 2006). Although many companies now have programs in place to try to overcome these issues, they often fail to address the hostile corporate working environment for women and minorities (Giscombe & Mattis 2002). In addition, smaller companies do not have the resources for formal diversity programs (Catalyst 2003).

When looking into the influence of involving more women and minorities in S&E companies, we found that companies employing more women in management positions tend to perform better, but few data are available on the effects of minorities in these positions. Industrial sectors largely benefit from the participation of women through diversity in innovation and experience a competitive edge in the marketplace.

Women and minorities' lack of participation in industry has deep implications for the country's preparedness, competitiveness, economic well-being, and quality of life (NCWIT 2006, COSEPUP 2007). Women bring different life experiences and perspectives to the innovation process, and diversity in innovation leads to the design of products and services that benefit a broader range of people. Three quarters of CEOs believe having a diverse workforce is beneficial to their companies (Bayer 2006), and data show companies with more women corporate officers perform significantly better financially (Catalyst 2006, Catalyst 2002). Companies with more women on their corporate boards out-perform others with fewer in Return on Equity, Return on Sales, and Return on Investment by a margin of 42%-66% (Catalyst 2007).

### **Strategies to Encourage Workforce Diversity**

There are a number of strategies companies can and do pursue to increase opportunities for women and minorities. These include more work-life flexibility, better access to networking, and increased mentoring opportunities. Currently, there is no comprehensive examination of whether certain practices work better than others.

Many company policies can increase the participation of women and minorities in S&E industry. However, attitudinal barriers in corporate culture cannot be addressed completely unless diversity programs target behavioral changes in management (Giscombe & Mattis 2002). The following strategies have been found to encourage women and minorities' participation in S&E industry (Catalyst 2002, The Families and Work Institute et al, Catalyst 2003):

- Creating flexible work-life environments.
- Creating structured mentoring programs.
- Creating opportunities for women to network.
- Providing flexibility in career paths.
- Providing support for personal responsibilities.
- Connecting to professional women's and minority associations.
- Providing effective executive and management training programs.

- Creating transparent talent identification programs.
- Providing tools and resources to support career planning and development.

In addition to these strategies, corporations should consistently communicate a commitment to diversity and take time to assess their own corporate culture, including periodic review of management activities to determine whether diversity aims are being met (Catalyst 2002). These strategies will go a long way in recruiting, retaining, and advancing underrepresented groups.

## **Discussion and Conclusion**

In an effort to collect current data on the representation of women and minorities in industry, the National Academies have been working with several corporations with extensive scientific and engineering workforces including Genentech, IBM, and SAIC to focus on what types of data would be most useful in answering the research questions posed earlier in this paper.

It is recognized that new data would be advantageous to the National Academies' effort and therefore a survey is planned to collect data from corporations representing various sectors of the S & E industries. The Conference Board, given their expertise and extensive experience in this arena, has provided input into the survey that will be utilized to gather information to inform this effort from scientific and engineering corporations regarding their diversity practices.

The aggregated survey results will be compiled and released at a convocation that is being planned in Washington, DC for the summer of 2010. It is anticipated that the primary audiences invited to participate in the convocation include 1) industrial employers in the scientific and engineering sectors; 2) federal agencies, particularly laboratories, that engage in public-private collaborations with industrial partners; 3) Congressional committees that focus on workforce training; and 4) professional science and engineering societies with a substantial percentage of industrial members. Secondary audiences would include trade associations that address workforce issues and institutions of higher education that train students in relevant scientific and engineering disciplines, and the public at large.

It is anticipated that this project, including the survey and the convocation that follows, should offer some insight into the current practices of the S & E industry to recruit, retain, and advance a more diverse workforce. Such knowledge would be beneficial to other corporations and to our nation as a whole.

## **Bibliography**

Alliance for Board Diversity, "Women and Minorities On Fortune 100 Boards," May 2007.

American Speech-Language-Hearing Association (ASHA), "Minority Student Recruitment, Retention and Career Transition Practices: A Review of the Literature," 2007.

Bayer Facts of Science Education XII: "CEOs on STEM Diversity: The Need, the Seed, the Feed, 2006.

Ben A. Barres, "Does Gender Matter?" *Nature*, vol. 442, 2006.

Bureau of Labor Statistics, Current Population Survey 2003 data.

Catalyst, “2005 Census of Women Board of Directors of the *Fortune* 500: Ten Years Later: Limited Progress, Challenges Exist” 2006.

Catalyst, “Advancing Asian Women in the Workplace: What Managers Need To Know,” 2003.

Catalyst, “Advancing Latinas in the Workplace: What Managers Need To Know,” 2003.

Catalyst, *Bit By Bit: Catalyst’s Guide to Advancing Women in High Tech Companies*, 2003.

Catalyst, “Leadership Careers in High Tech: Wired for Success,” 2001.

Catalyst, “The Bottom Line: Corporate Performance and Women’s Representation on Boards,” 2007.

Catalyst, “Women of Color in Corporate Management: Three Years Later,” 2002.

Catalyst, “Women Scientists in Industry: A Winning Formula for Companies,” 1999.

Commission on Professionals in Science & Technology (CPST), “Professional Women and Minorities: A Total Human Resources Compendium,” 2007.

Commission on Professionals in Science and Technology (CPST), “Sisyphus Revisited: Participation by Minorities in STEM Occupations, 1994-2004,” 2005.

Commission on Professions in Science and Technology (CPST), “Women in Science and Technology: the Sisyphean Challenge of Change,” 2003.

Committee on Science, Engineering, and Public Policy (COSEPUP), “Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future,” 2007.

Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development (CAWMSET), “Land of Plenty: Diversity as America’s Competitive Edge in Science, Engineering, and Technology,” 2000.

European Commission, “The Business Case for Diversity, Good Practice in the Workplace,” 2005.

Giscombe, Katherine, Mattis, Mary C, “Leveling the playing field for women of color in corporate management: Is the business case enough?” *Journal of Business Ethics*, Vol. 37, 103-119, 2002.

National Center for Women & Information Technology (NCWIT), “Information Technology: How the Power of IT and the Power of Women Will Power the Future,” 2006.

National Science Foundation (NSF), *Science & Engineering Indicators 2008*, Chapter 3: Science and Engineering Labor Force.

National Science Foundation (NSF), “Women, Minorities, and Persons with Disabilities in Science and Engineering,” 2006.

The Families and Work Institute, Alfred P. Sloan Foundation, the Institute for a Competitive Workforce, and the TWIGA Foundation, “When Work Works: Making Work “Work” – New Ideas from the Winners of the Alfred P. Sloan Awards for Business Excellence in Workplace Flexibility.”

U.S. Department of Labor Women’s Bureau, “Women in High-tech Jobs,” *Facts on Working Women*, No. 02-01, 2002.