



2011

STEMMING THE TIDE:

WHY WOMEN LEAVE ENGINEERING

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“I have to get **OUTSIDE OF THE CUBICLE**.”

“ My work for many years at a US national laboratory has provided both the flexibility and scientific/educational environment I need. In turn I give my professional best while at work. It is a **WIN-WIN**.”



“ There is little to no **RESPECT** for women in male-dominated fields.”



“ My current workplace is very **WOMAN ENGINEER FRIENDLY**. Women get promoted and paid at the same rate as men.”

“ Being a blonde, blue-eyed female **DOESN'T HELP** when interviewing in a manufacturing/plant setting.”

“ Still getting asked if I can handle being in a mostly male work environment in interviews in 2009 - I've been an engineer for 9 years, obviously I can. I know when I'm asked that question, **I HAVE NO CHANCE AT THE JOB**. It is nice they brought me in for equal opportunity survey points but don't waste my time if you don't take females seriously.”

“ The lack of women in general, and the lack of women mentors makes it [engineering] a **LONELY** field for women to want to stay in.”

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EXECUTIVE SUMMARY

STEMMING THE TIDE: WHY WOMEN LEAVE ENGINEERING

Women comprise more than 20% of engineering school graduates, but only 11% of practicing engineers are women, despite decades of academic, federal, and employer interventions to address this gender gap. **Project on Women Engineers' Retention (POWER)** was designed to understand factors related to women engineers' career decisions. Over 3,700 women who had graduated with an engineering degree responded to our survey and indicated that the workplace climate was a strong factor in their decisions to not enter engineering after college or to leave the profession of engineering. Workplace climate also helped to explain current engineers' satisfaction and intention to stay in engineering.

KEY FINDINGS: Some women left the field, some never entered and many are currently engineers:**Those who left:**

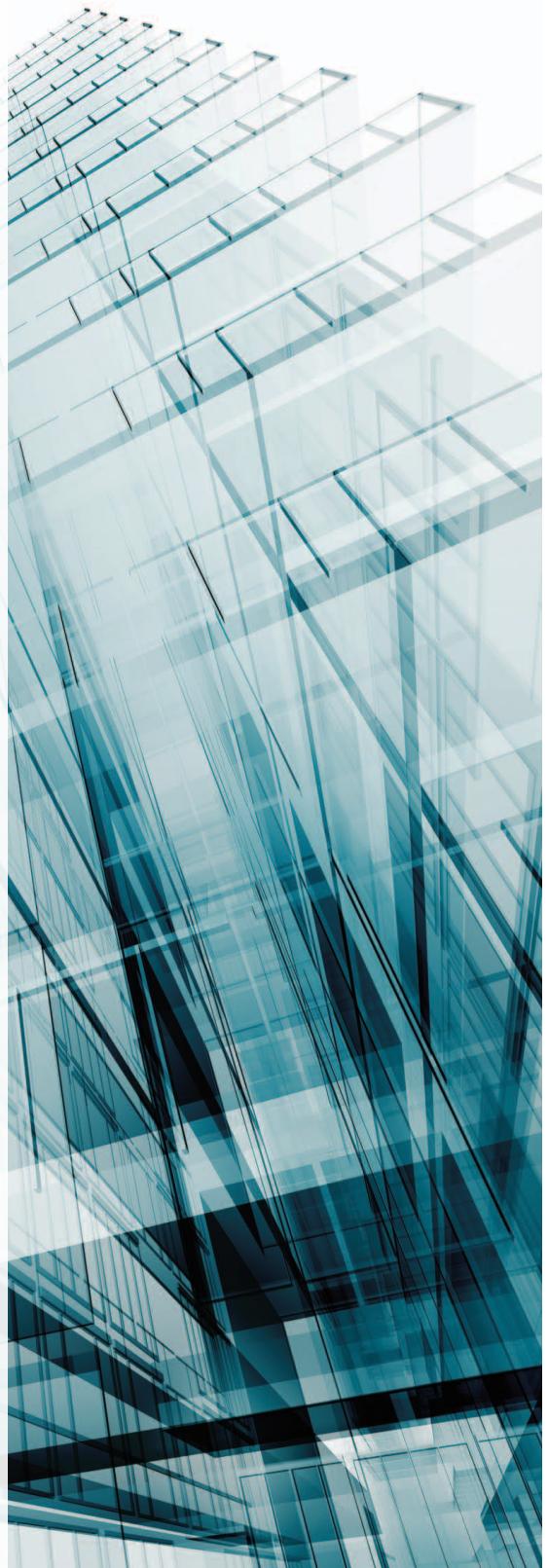
- Nearly half said they left because of working conditions, too much travel, lack of advancement or low salary.
- One-in-three women left because they did not like the workplace climate, their boss or the culture.
- One-in-four left to spend time with family.
- Those who left were not different from current engineers in their interests, confidence in their abilities, or the positive outcomes they expected from performing engineering related tasks.

Those who didn't enter engineering after graduation:

- A third said it was because of their perceptions of engineering as being inflexible or the engineering workplace culture as being non-supportive of women.
- Thirty percent said they did not pursue engineering after graduation because they were no longer interested in engineering or were interested in another field.
- Many said they are using the knowledge and skills gained in their education in a number of other fields.

Work decisions of women currently working in Engineering:

- Women's decisions to stay in engineering are best predicted by a combination of psychological factors and factors related to the organizational climate.
- Women's decisions to stay in engineering can be influenced by key supportive people in the organization, such as supervisors and co-workers. Current women engineers who worked in companies that valued and recognized their contributions and invested substantially in their training and professional development, expressed greatest levels of satisfaction with their jobs and careers.
- Women engineers who were treated in a condescending, patronizing manner, and were belittled and undermined by their supervisors and co-workers were most likely to want to leave their organizations.
- Women who considered leaving their companies were also very likely to consider leaving the field of engineering altogether.



STUDY METHODS:

In November 2009, we launched a national longitudinal study, funded by the National Science Foundation (NSF), to investigate women engineers' experiences in technical workplaces. To reach women who earned engineering undergraduate degrees, we partnered with 30 universities and recruited their female engineering alumnae through e-mail and postcards. Women recognized the importance of the study and responded enthusiastically to our survey. In fact, women from an additional 200 universities have participated after hearing of the study in the media and through colleagues. As of January 2011, over 3,700 women have completed the survey and more than three quarters have agreed to be re-contacted in future waves of the study.

THE PARTICIPANTS

The engineering alumnae who participated in the study consisted of 4 groups: those with an engineering undergraduate degree who never entered the engineering field, those who left the field more than 5 years ago, those who left the engineering field less than 5 years ago, and those who are currently working as engineers. We first report on what we learned from the first two groups of women who are no longer working in engineering. Then, to help understand potential reasons why women left the field, we compare current engineers with engineers who left less than 5 years ago on their perceptions of the supports and barriers in the workplace and their perceptions of managing multiple roles. We only contrasted the current engineers with those who left less than five years ago to provide similar time frames for comparison as well as to ensure that recollections were recent enough to be accurate.

“ At my last engineering job women were fed up with the culture: arrogant, inflexible, completely money-driven, sometimes unethical, intolerant of differences in values and priorities. I felt alienated, in spite of spending my whole career **TRYING TO ACT LIKE A MAN.**”

Women Who Left Engineering

Some alumnae never entered the engineering profession:

Fifteen percent (N=560) of our participants had completed the rigorous training required to earn a baccalaureate degree in engineering but chose not to enter the field of engineering.

- *What did they major in?* The three most frequently cited majors were: Industrial Engineering, Chemical Engineering and Mechanical Engineering. Nearly half of this group of engineers earned an additional degree, primarily master's degrees, although 11% had earned an additional BS degree.
- *Are they working?* YES. Although they did not enter engineering, 4 out-of-5 of them are working in another industry. Two thirds of the women are working in a managerial or executive position. The most frequently cited industries in which they work are: Information Technology, Education, and Government/Non-profit. A quarter of the women who did not enter the field reported that they were earning less than \$50,000, while another quarter reported earning between \$51,000 and \$100,000. Most of this group had a spouse who was also employed full time, reflected in the third of them reporting a family income greater than \$150,000.
- *Why did the women not enter an engineering career?* The top five reasons women reported for deciding not to enter engineering were: They were not interested in engineering, didn't like the engineering culture, had always planned to go into another field, did not find the career flexible enough, or wanted to start their own business. These reasons did not differ significantly across different age groups or years of graduation.

Some women left an engineering career more than five years ago:

- One-in-five of the participants (N=795) started in an engineering career but left the field more than five years ago.
- *What did they major in?* Similar to the women engineers who never entered the engineering field, the top three majors earned by this group of women engineers were: Industrial Engineering, Mechanical Engineering, and Chemical Engineering. Almost half had earned an additional degree, most often an MS or MBA.
- *Are they working?* YES. Two thirds are currently working, a third of them are earning over \$100,000, and 70% of these women are in management or executive level positions. More than two thirds reported a family income of over \$100,000. The top three industries in which these women are working in are: Education, Healthcare, and Consulting.
- *Why did they leave an engineering career?* A quarter of the women reported that they left the field to spend more time with their family. Other women reported that they lost interest in engineering or developed interest in another field, they did not like the engineering culture, they did not like engineering tasks, or they were not offered any opportunities for advancement.

Profile of Women Currently Working in Engineering and Those Who Left Less Than Five Years Ago

POTENTIAL REASONS FOR LEAVING:

The women who left engineering less than five years ago were compared to those who are still in an engineering career. Current engineers were the largest group in our study (N=2,099) while those who left less than five years ago were the smallest group (N= 291). We first compared the groups on various demographic and career-related variables.

- *Are current engineers less likely to be married or to be parents?* NO. The groups were not significantly different in race, marital status, or parental status. Both groups were about 80% White, with two thirds married, and 40% had children living at home with them. Both groups of women were relatively evenly distributed across the different age groups.
- *Are current engineers more likely to have majored in a particular area?* NO. The two groups of engineers, for the most part, did not differ by disciplinary area. The top three majors for both groups were Chemical, Mechanical, and Civil Engineering.
- *Did women leave engineering to stay home with children?* A third appear to have done so, but two thirds of the women who left are working full time in another field, and 78% of those are working in management or executive level positions. For those who are currently working, there were no significant differences between those who left and those who stayed in the average range of salary.

We next compared women currently working in engineering with those who left the field key psychological factors. It is possible that current engineers differed from women who left engineering with regard to their levels of self-confidence, expected outcomes from performing certain tasks, or underlying interests. We specifically examined confidence and expected outcomes in three critical areas that comprise a successful engineering career for women: performing engineering tasks, managing multiple work-life roles, and navigating the political landscape at work.

Are current engineers more likely than women who left engineering less than five years ago to:

- be confident of their abilities as an engineer or what they expect from performing engineering tasks? NO.
- be confident of their abilities to navigate the political climate or what they expect from managing these dynamics? NO.
- be confident of their abilities to manage multiple work-life role demands or what they expect from managing multiple roles? NO.
- have interests in engineering related activities? NO.

CURRENT ENGINEERS: MANAGING MULTIPLE ROLES

Are women's perceptions of managing multiple roles influenced by psychological variables, such as self-confidence, or by their supervisor or other workplace factors?

- The answer was both. The three most important contributors to a current engineer's experience of conflict between work and family roles was their lack of self-confidence in their ability to manage multiple roles, being overloaded by their current work role (including the fact that they were given too many tasks and had too much responsibility without commensurate resources), and working in an uncivil work environment that treated women in a condescending and patronizing manner.
- The use of a company's work-life benefit policies exacerbated the conflict that engineers experienced between their work-life roles.
- The greater the conflict experienced between work and non-work roles, the greater is the intention to leave the organization as well as the profession.

CURRENT ENGINEERS: PREDICTING SATISFACTION AND TURNOVER

We also examined women's perceptions of the work environment and whether those perceptions influenced satisfaction or retention. Women who left engineering differed significantly from current engineers on perceptions of the workplace climate, both in terms of supports and barriers they encountered. We examined workplace support at two levels: first, the extent to which their organizations supported their training and development, provided avenues for advancement, valued their contributions at work, and created a supportive climate for fulfilling multiple life role obligations. Second, support was assessed in terms of the extent to which the women engineers reported having a mentor, and received support from their supervisors and co-workers. We also examined two types of workplace related barriers that could impact their levels of satisfaction as well as thoughts of leaving: workplace climate factors were captured by the extent to which supervisors, senior managers, and co-workers undermined them and/or treated them in a condescending, patronizing, or discourteous manner. A second set of workplace barriers focused on the extent to which women engineers lacked clarity in their roles, experienced contradictory and conflicting work requests and requirements, and were overburdened with excessive work responsibilities without commensurate resources.

Are current engineers more likely than women who left engineering less than five years ago to:

- *experience different types of support?* YES. Current engineers were significantly more likely to perceive opportunities for training and development. Interestingly, the current engineers reported fewer work-life benefits available to them, but were significantly more likely to have used those benefits.
- *have a mentoring relationship?* NO. Only about a quarter of each group reported having a mentor and there were no differences in satisfaction with mentoring.
- *encounter supportive supervisors and co-workers?* YES.
- *encounter role related barriers in the work environment?* NO.
- *encounter organizational level barriers in the work environment?* YES. Current engineers were significantly less likely to perceive organizational barriers. Specifically, they were less likely to perceive either co-workers or supervisors as undermining them, perceived less sexism in the environment, and were less likely to view organizational time demands as a barrier.

Finally, we looked at what predicts current engineers' job and career satisfaction and their intention to leave their companies as well as the field of engineering.

- *Do workplace barriers affect current women engineers' satisfaction?* YES. The two barriers that most negatively influenced women's satisfaction levels were work-role uncertainty and a work environment that consistently undermined them.
- *Do workplace supports affect current women engineers' satisfaction?* YES. Different forms of support, such as training and development opportunities, supportive co-workers and supervisors, and companies that allowed employees time to balance their multiple life roles, were positively related to satisfaction.
- *Do climate factors influence intention to leave their job?* YES. Both workplace climate and personal factors influenced intention to leave. Being undermined by their supervisors, perceiving that the organization was not supportive of them, and that their managers were unwilling to accommodate their desire to balance multiple life roles, predicted their intention to leave their current organizations.
- *What predicts intention to leave engineering as a career?* Feeling a lack of confidence in their ability to perform engineering tasks and manage multiple roles combined with not being positive about the outcomes they expected from performing engineering tasks leads women engineers to consider quitting the engineering field altogether. The other two most significant contributors to women's intentions to quit engineering were excessive work responsibilities without commensurate resources and a lack of clarity regarding their work roles.
- *What predicts job and career satisfaction?* Perceiving that the organization is supportive and provides opportunities for advancement. Personal factors also were related to job and career satisfaction: women who reported high levels of self-confidence in navigating their organization's political landscape and juggling multiple life roles and who expected positive outcomes to result from their efforts to navigate the organizational climate at work, were most likely to express both job and career satisfaction.
- *Do psychological factors predict intention to stay better than work environment factors?* NO. Women's intention to stay in engineering as a field and in their current organization is best predicted by a combination of psychological variables related to confidence, expected outcomes, and interests, as well as supports and barriers encountered at work.

1: INTRODUCTION

Why Study Women Engineers?

The National Academy of Engineering has clearly shown that the US needs technological expertise to be competitive in the global market, and it is critical to train engineers to provide that expertise. However, research shows that women are much more likely to leave an engineering career, thus losing many of the engineers US colleges are training. Women are, in fact, underrepresented in the field of engineering at every level. Most of the research on effective interventions has successfully focused on increasing women's choice of engineering major. The result is that women are now nearly 20% of engineering graduates. However, only 11% of professional engineers are women (National Science Foundation, 2011), a statistic that has been stable for nearly 20 years. In fact, the proportion of women engineers has declined slightly in the past decade, suggesting that, while the pool of qualified women engineering graduates has increased, they are not staying in the field of engineering. Clearly, while our educational system is having some success at attracting and graduating women from engineering programs, women who earn engineering degrees are disproportionately choosing not to persist in engineering careers, and research has not systematically investigated what factors may contribute to their decisions.

Women's decisions not to persist may be due to their own concerns about managing the organizational climate, performing engineering tasks, or balancing work and family roles (Smith, 1993) or could be due to environmental barriers, such as facing a chilly organizational climate, particularly during parenting years (Society of Women Engineers, 2007). Women may also encounter organizational barriers when they reach a juncture to move into management from engineering roles. It is therefore, critical to understand the diversity of factors that lead some women to persist in engineering and others to leave it, as our educational system may have a role in better preparing women engineers for workforce challenges. In addition, the organizations that employ women engineers have a vital role in creating work environments that both attract and retain women engineers.

There are personal costs to choosing to leave a career for which one has trained long and hard for. There is also a societal cost to losing the potential of, or the investment in, a trained workforce, particularly at a time when there is a shortage of technological employees in the United States. In short, it is important to understand the factors that lead to women's choices to leave engineering so that educational and organizational institutions can intervene to shift those choices.

Background on Engineering Labor Force

U.S. leadership in technical innovation has been a vigorous force behind economic prosperity for at least the last 50 years. Recent concern about declining numbers of U.S. citizens choosing to enter technical careers and the increase in technological talent and jobs overseas led Congress to ask the National Academy of Sciences to analyze the U.S. technical talent pool and make policy recommendations to advance U.S. competitiveness in global research and development markets (Committee on Science, Engineering, and Public Policy, 2007). The report effectively argues for the increased importance of technology to the U.S. economy, demonstrates global trends in research and development that favor other countries, and highlights the need for concrete action to enhance U.S. competitiveness. However, while the report briefly notes that U.S. women and minorities are underrepresented in science and technology, it does not address the additional loss of women from technology careers, post-graduation, which represents a substantial loss of talent from the technical workforce.

As we note above, women are the most underrepresented in the engineering disciplines. The loss of women from the profession after they complete their undergraduate degree is particularly disheartening as well as costly to the educational system, society, and to women personally, given the large time, effort, and monetary investment in their education. As noted in a recent review of research on girls' persistence in science and engineering, little is known about what happens to women

once they enter the engineering workforce (National Science Foundation, 2006). However, a report recently released by the Society of Women Engineers (2007) suggests that they leave engineering careers in part because they encounter a chilly organizational climate when they reach childbearing age and desire to balance work and family roles.

Factors Related to Employee Turnover

For any individual, the decision to persist or change careers, jobs, or organizations is often precipitated by a variety of factors that influence the trajectory of the choice process. Hence it is important to capture both the more immediate predictors of that choice (such as withdrawal cognitions) as well as more distal predictors (such as attitudes towards their career and other barriers and supports) that lead to either persistence in a career or the decision to leave. By examining the antecedents of employee turnover, it is possible to gain a new understanding of some of the factors that influence individuals' decisions to stay or leave a given career field, job, or organization.

Employee turnover has been the subject of intense empirical and theoretical scrutiny for several decades and has generated an impressive body of knowledge about the withdrawal process (e.g., Griffith, Hom, & Gaertner, 2000; Lee, Mitchell, Holtom, McDaniel, & Hill, 1999; Mitchell, Holtom, Lee, Sablinsky, & Erez, 2001). Turnover decision research points out that employees engage in thinking about quitting which may or may not result in actual quitting; instead these thought processes (withdrawal cognitions) may trigger alternative forms of withdrawal such as plans to search for alternative job opportunities, general thoughts or considerations of quitting, and intentions to quit (Hanisch, 1995). Withdrawal cognitions also include the concept of psychological withdrawal, which refers to a deliberate re-direction of thought processes and personal plans away from one's current position. These cognitions are manifested in a broad, encompassing reduction of inputs to one's current role such as absenteeism, lateness, and inattention, or basic neglect of duties (Hanisch, 1995; Shaffer & Harrison, 1998). Employees who remain in the organization but are psychologically withdrawn may incur indirect costs to their organizations through reduced productivity and reduced staff morale. Further, psychological withdrawal may also be damaging to the employee in the form of diminished self-esteem, impaired

relationships at work and home, and interrupted careers.

Prevailing models of voluntary turnover and accumulated research evidence indicate that withdrawal cognitions are the immediate precursors to actual, voluntary turnover decisions (Griffeth et al., 2000; Hom & Kinicki, 2001; Maertz & Campion, 2004). Withdrawal cognitions, in turn, are usually precipitated by negative evaluations about one's job (i.e., lower job satisfaction) and lowered commitment to the organization. This is consistent with attitude theory (Ajzen & Fishbein, 1980) which posits that behavior is determined by the intention to perform the behavior and that this intention is, in turn, a function of the attitude toward the behavior. Research on voluntary turnover process has shown general support for this unfolding sequence of exit behavior: job dissatisfaction and lowered commitment progresses toward withdrawal cognitions, and withdrawal cognitions in turn, lead to turnover. Research on the relationship between turnover intentions and attitudinal variables such as job satisfaction and organizational commitment have found that both job satisfaction and commitment were negatively correlated with withdrawal cognitions (e.g., George & Jones, 1996; Hom & Kinicki, 2001; Rosin & Korabik, 1995), and withdrawal cognitions predicted turnover (e.g., Hom & Kinicki, 2001).

Despite differences in labor market behaviors by men and women, research on gender differences in voluntary turnover has been surprisingly limited. Furthermore, existing research has produced inconsistent findings. For example some studies indicate that women and people of color tend to leave their jobs at a higher rate than Caucasian males (e.g., Cox & Blake, 1991; Stuart, 1992) while other studies report the opposite effect: turnover for males is greater than that for females (e.g., Barrick, Mount, & Strauss, 1994; Blau & Lunz, 1998).

Given that withdrawal behavior progresses in these clearly identifiable stages, it is important to understand a broad range of barriers and supports that may lead to poor career commitment, psychological withdrawal, and intentions to quit the organization and the engineering profession. By understanding the process that leads to turnover from engineering careers, we will be better able to design appropriate interventions that facilitate women's decision to persist in engineering careers.

Women's Preparation to Enter STEM Fields

While we know little about the factors that predict the turnover of employed engineers, there has been research to predict initial vocational choices of engineering as a career within K-16 educational settings. This research has examined not only engineering as a career choice, but also the choices to take the advanced mathematics and science classes that are critical to engineering education at the baccalaureate level.

Research has suggested interventions that focus on increasing girls' participation that include promoting math/science interests (e.g., O'Brien, 1996), promoting the human-value characteristics of engineering (Eccles, 2007), increasing parental support for math and advanced classes (e.g., Burgard, 2000), promoting positive environments (e.g., Dooley, 2001), focusing on the outcome expectations of math and science (e.g., Edwardson, 1998; Nauta & Epperson, 2003) and increasing math/science and engineering self-efficacy (Mau, 2003). Colleges have also instituted systemic interventions, such as the Model Institutes for Excellence, a National Science Foundation program, that include mentoring, tutoring, targeted advising, and faculty development. And, indeed, there has been a small but measurable improvement in women's graduation rates in engineering over the last decade. For example, from 1995 to 2010, the percentage of women who have earned bachelor's degrees in engineering has increased from 17.3% to 20.1% (National Science Foundation, 2011), and the impact of recent educational intervention efforts will likely be seen in coming years.

Women who do choose engineering and persist through the educational system to achieve a technical degree have demonstrated interest in their field (Davey, 2001), expect positive outcomes from their participation (Shaefers, Epperson & Nauta, 1997), possess the math, science, and engineering self-efficacy sufficient to navigate required technical coursework (Lent et al, 2003), and value the occupational characteristics of technical jobs (Eccles, 2007). Thus, one would expect that women who earn engineering degrees would be likely to persist and be successful in their careers. However, women's representative numbers in engineering and the physical sciences decline significantly post-graduation and the occupational pipeline continues to narrow such that women are less and less represented over their career span (Preston, 2004; Society of Women Engineers, 2007).

Women Leave Engineering Careers More Than Other Fields

Preston (2004) reported that all engineers leave the field at a rate four times that of doctors, three and a half times that of lawyers and judges, and 15-30% more than nurses or college teachers. Specific to engineering, the Society of Women Engineers (SWE) recently reported that one in four women who enter engineering have left the profession after age 30, compared to one in ten male engineers (SWE, 2007). However, while these studies have documented that women have left the field of engineering, they have not focused on the psychological processes involved in making their decision to leave the profession. Their decision could be related to concerns with work/family balance or lack of advancement opportunities. It could be because they reach a juncture where they have to decide to enter a management career, or face the possibly limited opportunities that may come with an exclusively technical engineering role. It could be that they no longer enjoy the work of an engineer. It could be because they encounter a chilly organizational climate. There are many possibilities that have surfaced from anecdotal accounts but little research to offer some tangible evidence.

“ ...I got to a certain point in my engineering career when **I NO LONGER ADVANCED**. I felt I needed additional education to move forward, but no topics interested me as much as computer programming, so I changed my career to that. It was a good change. I have been more successful in the computer field than I was in the engineering field.”

– Caucasian Mechanical Engineering Graduate

OUR STUDY

The problem we set out to investigate was why women choose to leave engineering careers. Much of the research on career choices has been based on the Social Cognitive Career Theory (SCCT; Lent, Brown, & Hackett 2002). The SCCT model has been used to help explain the factors related to initial career choice, but has not yet been studied to explain career persistence decisions in the workplace. We extended this model to predict women's choices related to engineering persistence in the workplace by incorporating research related to career attitudes (career satisfaction and commitment), psychological withdrawal, and turnover intentions.

We hope that this research can help us develop interventions (educational, organizational, and/or personal) to possibly

STEM THE TIDE OF DEPARTURE AND INCREASE WOMEN'S PERSISTENCE IN ENGINEERING CAREERS.

The results from this study may be useful to employers who seek to attract and retain talented women engineers, and in doing so, realize their investment in their technical employees. Understanding the dynamics of women's technical career paths over their lifespan may also support development of interventions for women's university education, perhaps to better prepare future engineers for challenges they will face in the workplace.

2: PARTICIPANTS' PROFILE AND STUDY PROCEDURES

In November of 2009, we launched POWER (Project on Women Engineers' Retention), a national longitudinal study funded by the National Science Foundation, to investigate women engineers' experiences in technical workplaces. In collaboration with ENTECH (Empowering Nonprofits in Technology) at the University of Wisconsin-Milwaukee, we developed a website for POWER, which includes information about the study and a link to the survey. Data from the first phase of the longitudinal study have been collected and our report is based on the findings from this first wave of participants.

Who Are The Participants?

A total of 3,745 women who graduated with a bachelor's degree in engineering participated and completed the study. Of this, 560 (15%) women obtained a degree but never worked as an engineer, 1,086 (29%) women previously worked as an engineer but have left the field since (291 of these left less than five years ago), and 2,099 (56%) women are currently working in engineering.

WOMEN WHO GRADUATED BUT DID NOT ENTER ENGINEERING

This group of women earned a bachelor's in engineering but did not enter the field. This was the most racially and ethnically diverse group in the study. Women in this group include: 65% Caucasian, 18% Multi-racial, 9% Asian/Asian-American, 5% African American, 2% Latina, and less than 1% American Indian. Of those who reported their marital status, about half (46%) of the women were married, a third (29%) were not married, and a small percentage indicated that they were either not married but in a committed relationship (4%), divorced (3%), separated (<1%), or widowed (<1%).

WOMEN WHO LEFT ENGINEERING

The women in this group were separated into those who worked as engineers but left engineering more than five years ago and those who worked in engineering but left within the past five years.

Women Who Left Engineering Over Five Years Ago.

This group consisted of 795 women, with the majority self-identifying themselves as White (85%), 6% as Asian-American, 2% Latina, 2% Multi-racial, 4% African American, 1% other, and less than 1% identified themselves as American Indian. The majority of women in this group reported being married (80%), 11% of women were not married, 5% were divorced, 2% reported being in a committed relationship, 1% indicated they were separated from their spouse, and 1% reported being widowed.

Women Who Left Engineering Less Than Five Years Ago.

291 women fell in this group, with the majority self-identifying as White (79%), then Asian/Asian-American (8%), Latina (3%), African American (3%), American Indian (<1%), Multi-racial (5%), and other (2%). About two-thirds of women in this group are married (63%), 28% reported not being married, 5% indicated they were in a committed relationship, 3% were divorced, and less than 1% of the group were either separated or widowed.

CURRENT ENGINEERS

Women who are currently working in engineering represent the largest group in the study (2,099). As with the other groups, most of the women self-identified themselves as White (84%), 8% were Asian/Asian-American, 4% indicated multi-racial heritage, 2% African American, 2% Latina, and less than 1% as American Indian. About two-thirds of the women were married (62%), 22% reported not being married, 8% were in a committed relationship, 5% were divorced, 1% were separated, and <1% were widowed.

HOW WERE THE VARIABLES MEASURED?

The study included a demographics questionnaire and 26 different measures that assessed factors that would influence women's thoughts about leaving the field of engineering. The survey used well-established and validated measures designed to probe a variety of perceptions, attitudes, and behaviors that could potentially influence withdrawal and turnover intentions. The survey topics included: vocational interests, job and career satisfaction, work-family conflict, withdrawal intentions, commitment to the current organization and the engineering profession, availability of training and development opportunities, undermining behaviors in the work environment, and a variety of workplace support mechanisms and initiatives. When well-established measures were not available, we created new measures for this study that accurately captured women engineers' experiences. Specifically, we developed six new measures: three domain-specific self-efficacy and outcome expectations measures related to working and managing in the field of engineering. Prior to launching POWER, each newly developed scale was carefully validated through a pilot test on a separate pool of women engineers.

HOW WERE THE WOMEN SURVEYED?

To reach women who earned engineering undergraduate degrees, POWER partnered with over 30 universities to recruit their female engineering alumnae through email and postcards. Women interested in participating in this study were directed to the POWER website and a link to the online survey. Recognizing the importance of the study, women have not only responded enthusiastically by completing our survey, but also contacted the POWER team to express their interest in this project and shared their personal experiences. In fact, women from an additional 200 universities have participated in this study after hearing about POWER in the media and through colleagues. Over 3,700 women have completed the first phase and more than three quarters have agreed to be re-contacted to participate in future waves of the study.

PARTICIPATING UNIVERSITIES

1. California Polytechnic State University, SLO
2. California State Polytechnic University, Pomona
3. California State University, Northridge
4. Cornell University
5. Georgia Tech
6. Iowa State University
7. Marquette University
8. Michigan State University
9. MIT
10. North Carolina State University
11. Ohio State University
12. Penn State University
13. Purdue University
14. Rutgers University
15. San Jose State University
16. Southern Illinois University
17. Stanford University
18. University of California, San Diego
19. University of Florida
20. University of Illinois
21. University of Maryland
22. University of Michigan
23. University of Missouri-Kansas City
24. University of New Mexico
25. University of Texas, El Paso
26. University of Washington
27. University of Wisconsin-Madison
28. University of Wisconsin-Milwaukee
29. University of Wisconsin-Platteville
30. Virginia Tech

3: WOMEN WHO NEVER ENTERED THE FIELD OF ENGINEERING AFTER EARNING THEIR UNDERGRADUATE DEGREE IN ENGINEERING

“ You have to be a bit **TOUGHER** when you are around the guys, you feel you have to do better than them to be accepted”

– Caucasian Operations & Research Engineering Graduate

“ I do not know why other women leave engineering. I got an engineering degree because I was very good at math & sciences and wanted a technical & **CHALLENGING** degree.”

– Caucasian Electrical Engineering Graduate

“ I interviewed with a company where there were **NO WOMEN** working there, besides secretaries, **NO MINORITIES** and no one in the young adult age group.”

– African American Chemical Engineering Graduate

WHO ARE THE WOMEN WHO NEVER ENTERED THE ENGINEERING FIELD?

Fifteen percent of engineering alumnae who participated in the POWER study were women who never entered an engineering field after receiving a degree in engineering. Of the women who never entered ($n= 560$), the majority ($n=267$, 48%) graduated between the years 2000-2010.

More than half of the POWER participants (65%) who have never entered an engineering field were White. The second largest group was of participants who identified with more than one race (18%). The age of the women in the Non-Entrants group ranged from 22-66 years old. Nearly half (46%) of the women were married and 29% reported never being married. Most of the women reported having a spouse that is employed full-time. Most of the women who have never entered an engineering field are not parents (61%) and the majority of them (98%) did not care for dependents.

Figure 1 Percentage of Women Who Never Entered Engineering Based on Graduation Year

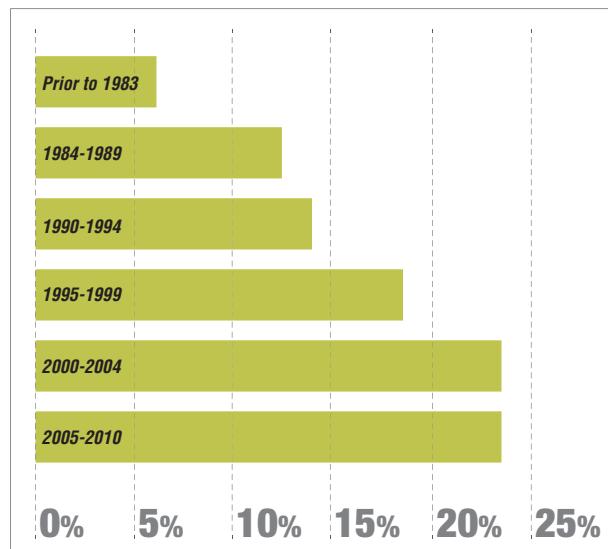
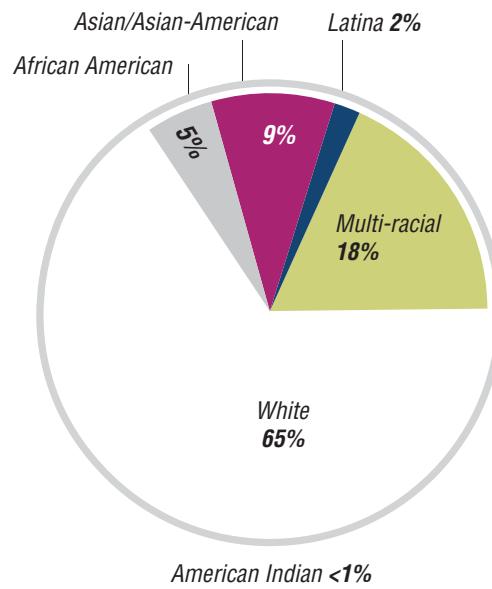


Figure 2 Racial/Ethnic Background of Women Who Never Entered Engineering



Note: All figures are rounded to the closest percentage point

Most women (64%) who have never entered an engineering field reported working at least 40 hours per week in a current non-engineering position.

Individual salary ranged from less than \$50,000 to more than \$151,000. Twenty-six percent of women who never entered the engineering field reported earning less than \$50,000 and 25% make \$51,000 - \$100,000.

Thirty percent of participants in this group reported a family total income of more than \$151,000, 15% earned \$101,000 - \$150,000, 14% earned between \$51,000 - \$100,000, and 10% earned less than 50,000.

The highest percentage of women in the Non-Entrants group (40%) reported having an executive management status position. Other women in the group (23%) reported either having a manager status position or an individual contributor position (37%).

WHAT IS THE EDUCATIONAL BACKGROUND OF WOMEN WHO NEVER ENTERED ENGINEERING?

The top five major areas of study reported by more than half of the Non-Entrants included the following: Industrial Engineering (22%), Chemical Engineering (13%), Mechanical Engineering (13%), Electrical Engineering (10%), and Bioengineering (9%).

Nearly half (46%) of the Non-Entrants had an additional degree. Of the women who received an additional degree, 18% earned a M.S., 12% earned a M.B.A., 11% earned a B.S., and 4% earned a PhD.

Figure 3 Individual and Family Income based on the Percentage of Women Who Never Entered Engineering

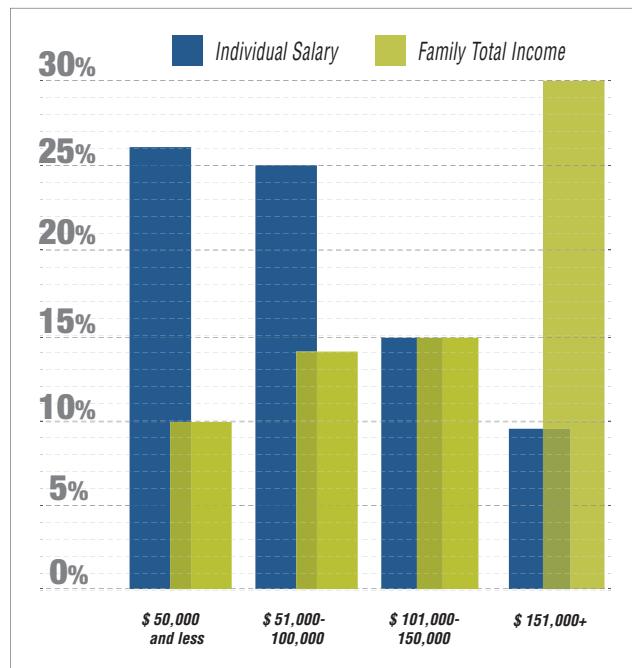
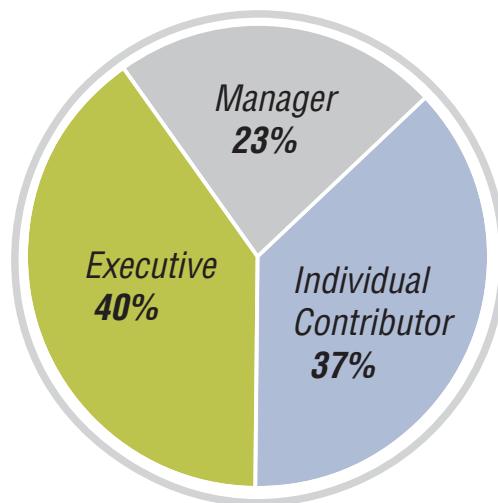


Figure 4 Organizational Rank of Women Who Never Entered Engineering



“At the time I graduated no one was hiring except for the computer consulting companies who also paid very well compared to engineering and valued our problem solving skills. By the time I worked ... for 5 years, **I HAD SURPASSED** my father’s salary who had worked in engineering for over 40 years.” – Caucasian Aerospace Engineering Graduate

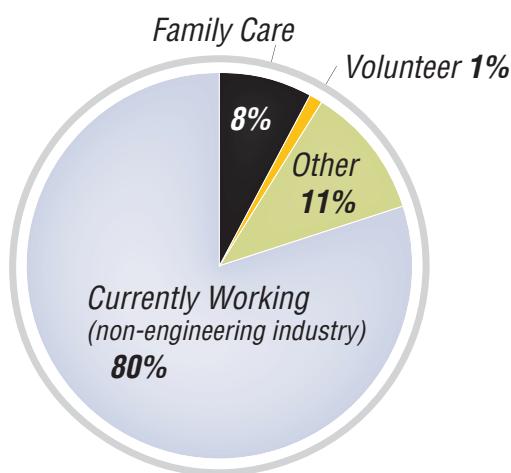
WHAT ARE THESE WOMEN DOING NOW?

Table 1: Primary Activities of Women Who Never Entered Engineering (for Different Years of Graduation)

Primary Activity	Before 1983	1984-1989	1990-1994	1995-1999	2000-2004	2005-2010	Total
Currently working (in non-engineering industry)	29	59	67	100	107	86	448
Family care	2	10	10	5	12	5	44
Retired	2	1	0	0	0	0	3
Volunteer	0	0	1	0	0	3	4
Other	0	2	2	3	15	39	61

Total Responses = 560

Figure 5 Primary Activities of Women Who Never Entered Engineering



“I chose to study engineering and to pursue a Master’s in Engineering even though I knew that I did not want to practice as a “traditional” engineer. My first-class education allowed me to pursue **EXTRAORDINARY OPPORTUNITIES** as a strategy consultant.”

– Caucasian/Latina Chemical Engineering Graduate

WHY DID WOMEN WITH AN ENGINEERING DEGREE NEVER ENTER THE ENGINEERING FIELD?

Table 2: Reasons Why Women Never Entered Engineering for Different Years of Graduation

Reason For Not Entering	Before 1983	1984-1989	1990-1994	1995-1999	2000-2004	2005-2010	Total
couldn't find position	1	11	3	8	13	14	50
management not appealing	0	2	3	3	7	5	20
too difficult	2	3	4	5	4	8	26
low salary	1	2	8	17	11	8	47
no advancement	1	3	6	11	9	10	40
not flexible enough	2	2	6	7	14	14	45
never planned to enter	4	16	11	20	32	24	107
wanted to start own business	7	14	16	21	29	36	123
didn't like culture	4	13	18	28	27	29	119
not interested in engineering	9	25	24	34	46	32	170

Total Responses = 747 (Note: women could choose more than one reason)

“ **ENGINEERING SCHOOL WAS PURE HELL** for me - my personality inspired much sexist behavior from my male classmates and my T.A.s... At some point, after many interviews, I decided that I wouldn’t want to spend the majority of my waking hours with the type of people interviewing me.” – Caucasian Mechanical Engineering Graduate

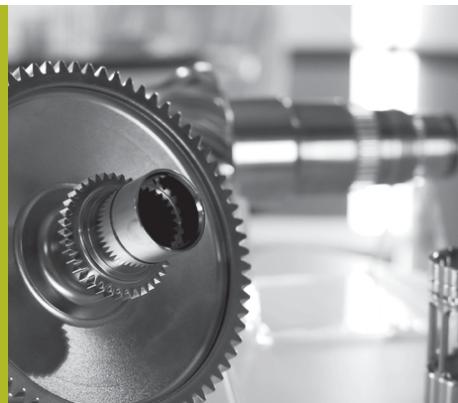
KEY FINDINGS:

80% are working full time in another field

Organizational climate was a factor in not entering engineering
- lack of flexibility, didn't like the culture, management not appealing

Lack of interest cited as a reason not to enter engineering

20% never planned to enter and pursued other post-graduate degrees



4: WOMEN WHO LEFT THE ENGINEERING FIELD OVER FIVE YEARS AGO

“ In my experience, women leave engineering for **FAMILY REASONS**. I left engineering when I had my first child. I decided to stay home with my children...we moved to an area with very few engineering jobs. So I decided to go back to school and become a math teacher.”

– Caucasian Electrical Engineering Graduate

“ There isn’t a strong network of females in engineering. You either need to learn to be “one of the guys” or **BLAZE THE TRAIL YOURSELF**, which is very difficult. I deviated from engineering... but work now in construction, where I am the only female executive officer.”

– Caucasian Agricultural Engineering Graduate

“ [There is no] opportunity for advancement in a male-dominated field- the culture of engineering is male-centric with **HIGH EXPECTATIONS** for travel and little personal time.”

– Caucasian Chemical Engineering Graduate

WHO ARE THE WOMEN WHO LEFT OVER FIVE YEARS AGO?

Twenty-one percent of engineering alumnae who participated in the POWER study were women who entered an engineering field after receiving a degree in engineering but left the field more than five years ago. Of the women who did not persist in engineering and left more than five years ago ($n=795$), the largest group ($n=243$, 31%) graduated prior to 1983.

The majority of this group of women engineers (85%) was White and reported being married (79%) with 11% reporting never being married. Most of the women reported having a spouse that is employed full-time. Most of the women who have left the engineering field over five years ago are parents (62%).

Figure 1 Percentage of Women Who Left the Engineering Field More Than Five Years Ago Based on Graduation Year

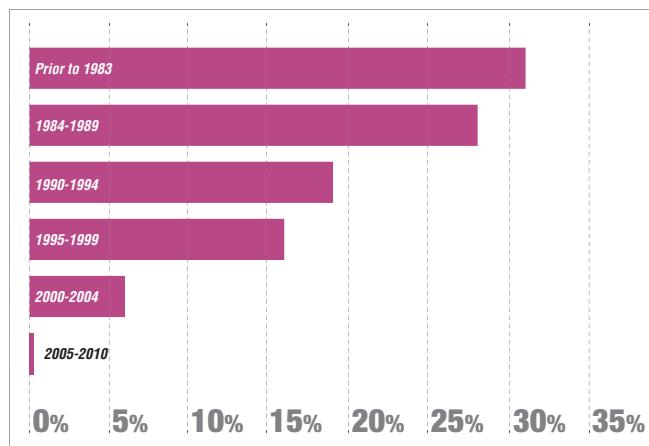
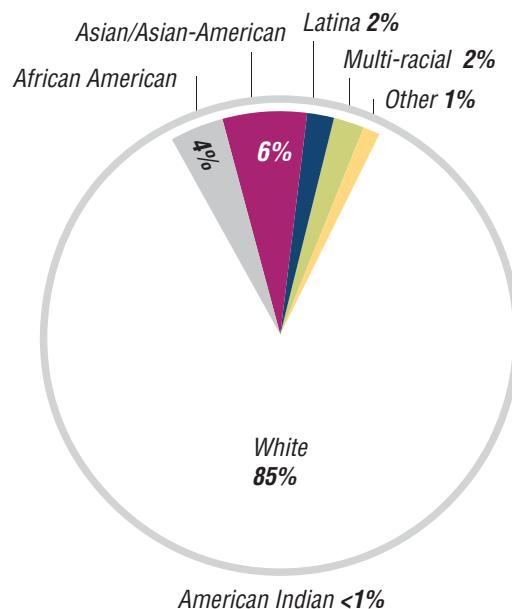


Figure 2 Racial/Ethnic Background of Women Who Left Engineering Over Five Years Ago



Note: All figures are rounded to the closest percentage point

Almost half (45%) of the women who left the engineering field over five years ago reported working at least 40 hours per week in a current non-engineering position.

Individual salary ranged from less than \$50,000 to more than \$151,000. Twenty-two percent of women in this group reported earning between \$101,000 -150,000 and 13% earn more than \$151,000.

Forty-one percent of women in this group reported earning a family total income of more than \$151,000.

More than half of the women in this group reported being in an executive management position, 15% were in a managerial position, and 30% reported being individual contributors.

WHAT IS THE EDUCATIONAL BACKGROUND OF WOMEN ENGINEERS WHO LEFT ENGINEERING OVER FIVE YEARS AGO?

The top five major areas of study reported by this group included the following: Industrial Engineering (22%), Mechanical Engineering (18%), Chemical Engineering (15%), Electrical Engineering (15%), and Civil Engineering (8%).

Almost half (41%) of this group earned an additional degree: 25% earned a M.S., 14% earned a MBA, 9% earned a B.S., and 4% earned a M.A., and 2 % earned a PhD.

Figure 3 Individual and Family Income Based on the Percentage of Women Who Left Over Five Years Ago

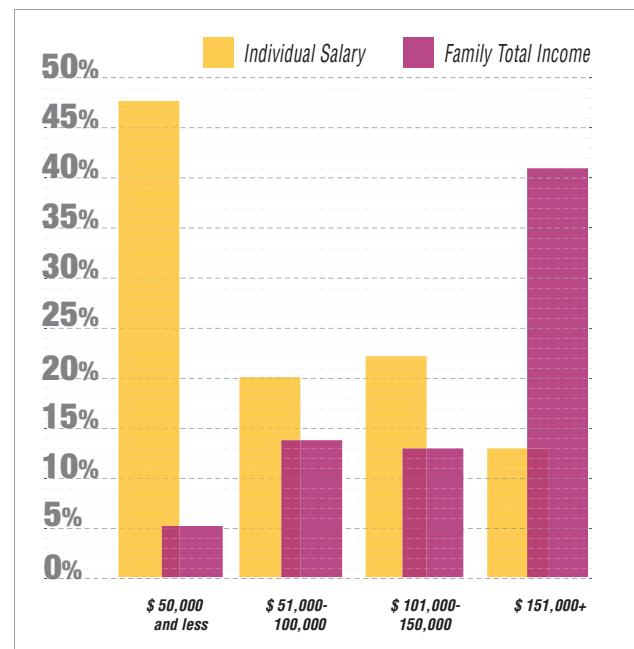
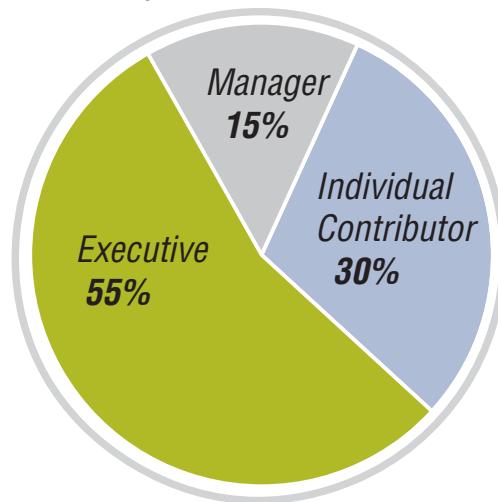


Figure 4: Organizational Rank of Women Who Left Engineering Over Five Years Ago



“I feel that most engineering jobs are **VERY DISAPPOINTING**, at least as compared to the high expectations I had going in to engineering school. School programs are advertised as “build cool stuff!”, and then you get a job and are put in a cubicle and go to boring meetings and are part of a team making a bracket...” – Caucasian Mechanical Engineering Graduate

WHAT ARE THESE WOMEN DOING NOW?

Primary Activities of Women Who Left Engineering Over Five Years Ago (For Different Years of Graduation)

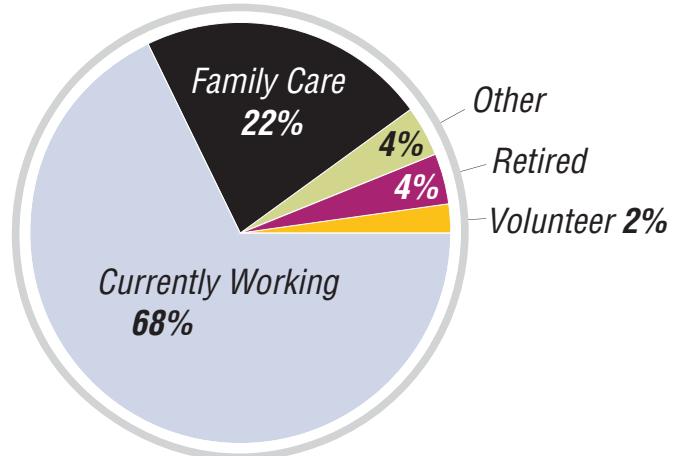
What are they currently doing?	Before 1983	1984-1989	1990-1994	1995-1999	2000-2004	2005-2010	Total
currently working (in non-engineering industry)	154	150	101	92	36	2	535
Family care	32	60	42	27	7	3	171
Retired	26	3	0	1	0	0	30
Volunteer	12	3	2	1	0	0	18
Other	18	7	3	7	1	0	36

Total Responses = 790

“TO ADVANCE, seems as though you must be willing and able to work 50+ hours/week; and often be on-call 24/7.”

– Caucasian Chemical Engineering Graduate

Figure 5 Primary Activities of Women Engineers Who Left Engineering Over 5 years Ago



WHAT WERE THE REASONS FOR LEAVING ENGINEERING?

Reasons Why Women Left Engineering (For Different Years of Graduation)

Reason Left	Before 1983	1984-1989	1990-1994	1995-1999	2000-2004	2005-2010	Total
too difficult	3	2	0	1	0	0	6
couldn't find position	4	0	6	5	1	0	16
started own business	8	3	7	2	1	0	21
Didn't like co-workers	4	0	6	7	6	1	24
too much travel	15	3	12	12	2	0	44
low salary	10	4	15	14	3	2	48
too many hours	27	6	18	11	6	0	68
conflict with family	38	8	16	7	1	0	70
poor working conditions	21	1	23	20	8	1	74
Didn't like boss	26	2	22	23	9	2	84
Didn't like culture	24	3	27	18	12	1	85
Didn't like daily tasks	28	5	26	40	15	1	115
no advancement	45	8	41	38	8	2	142
lost interest	32	6	40	41	13	2	134
wanted more time with family	76	13	58	30	7	1	185

Total Responses = 1116 (Note: women could choose more than one reason)

“ [I left because I wanted] more **OPPORTUNITY FOR ADVANCEMENT** in non-engineering positions”

– Caucasian Mechanical Engineering Graduate

KEY FINDINGS

More than two-thirds are working in another field, half of those are in executive positions

Nearly half of women left a career in engineering because of working conditions
- too much travel, lack of advancement, or low salary.

Thirty percent left engineering because of organizational climate

A quarter left a career in engineering because they wanted more time with family



5: CURRENT AND FORMER WOMEN ENGINEERS: WHO ARE THEY AND WHAT ARE THEY DOING?

“Women leave engineering due to lack of job satisfaction, lack of reliable female role models, inflexible work schedules, workplace discrimination, **WHITE MIDWESTERN MEN** syndrome, and glass ceiling issues.”

– Latina Civil Engineering Graduate

“The pressure is intense, and with no viable part-time alternatives, a woman [engineer] is **FORCED TO CHOOSE** between work and family.”

– Caucasian Civil Engineering Graduate

“...being a female minority, it was **DIFFICULT** to work with white men who were much older than me and did not share a similar background.”

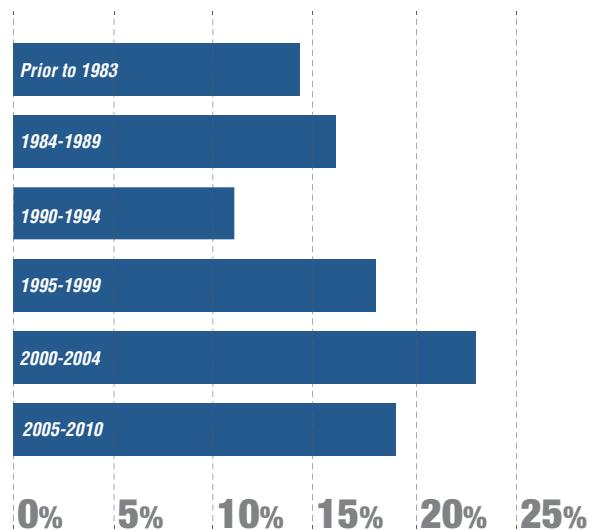
– Asian American Chemical Engineering Graduate

PROFILE OF WOMEN ENGINEERS

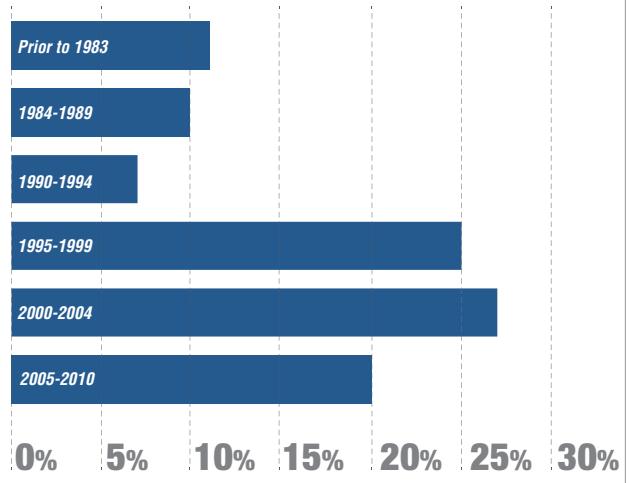
The study was designed to understand why women engineers leave the field of engineering. For those who are currently working in engineering, we sought to gauge/assess their intentions to leave the field and to explain factors related to their satisfaction with their job and with an engineering career. We first report on two groups of women in this chapter; those who are currently working as engineers and those who left recently, less than five years ago. We chose 5 years as a cutoff for our comparison point to provide similar time frames for comparison as well as to ensure that recollections were recent enough to be accurate. Thus, the women who left engineering less than five years ago were compared to those who are still in an engineering career. Current engineers were the largest group in our study ($N=2,099$) while those who left less than five years ago were the smallest group ($N= 291$). As can be seen from the other chapters in this report, the women who had left engineering less than five years ago were overall the smallest group in our sample. We do not know why this might be the case. This group was distributed across age and cohort levels similar to the other groups, and we can assume that they received the email invitation to take part in the survey at the same rate as the other women in the study. It may be that their decision to leave engineering left an emotional legacy that they did not want to revisit by participating in the survey. This is a hypothesis, however, and we really do not know why their representation is the smallest. However, this group of participants was large enough to allow us to make some comparisons with women who are currently working in engineering.

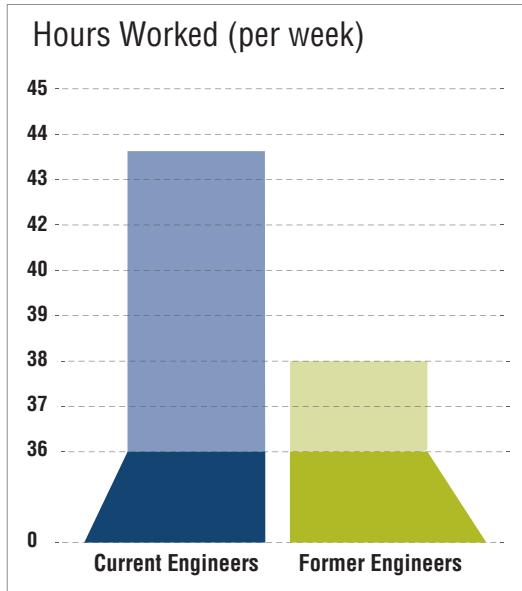
We first compared the two groups on various background factors.

Graduation Year of Current Women Engineers

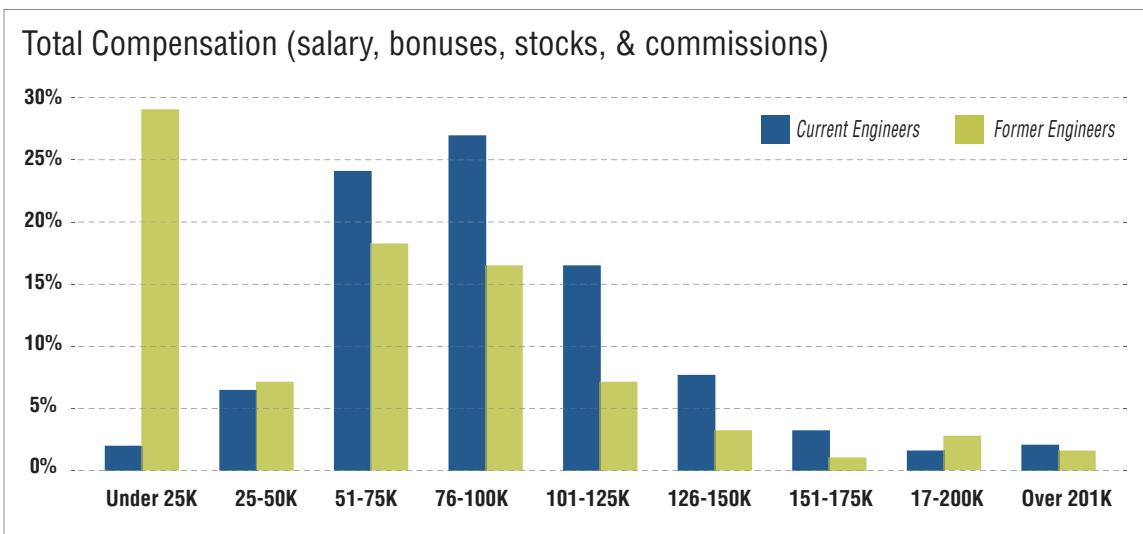


Graduation Year of Women Who Left Engineering in The Past 5 Years

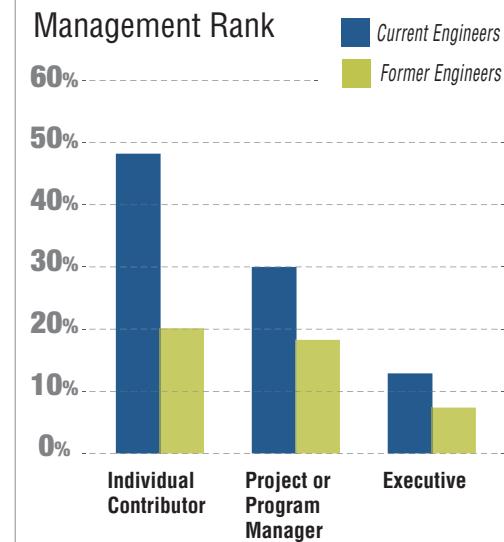




Most of the women who are currently working in engineering work 43.5 hours a week, had been with their organization for 8 years, and reported earning salaries ranging from \$76,000 to \$125,000. This group of women was very diverse in terms of their undergraduate engineering majors with most of them representing chemical, mechanical, and civil engineering fields.



About half of them are individual contributors in their organization while one-third are in project management positions. The least common positions occupied by these engineers were in executive roles (15%). Consistent with the percentage of individual contributors, about half of the engineers were not in a supervisory role. For those in management positions, a majority of engineers in this group supervised between 1 to 5 individuals. Most worked in groups that were predominantly male with a smaller number (18%) reporting working in gender balanced groups.

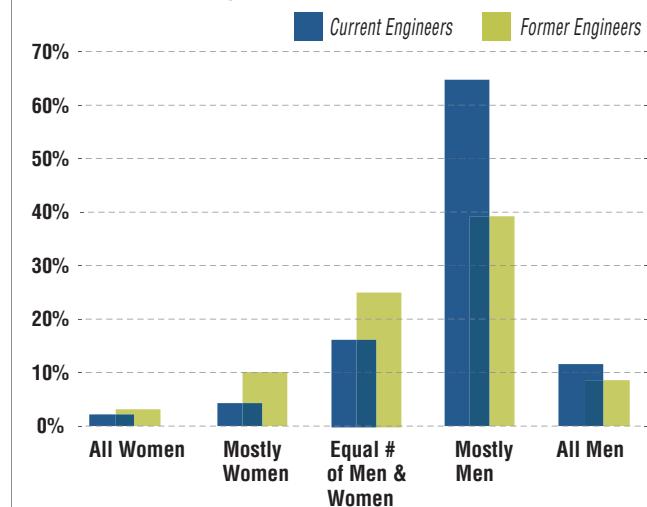


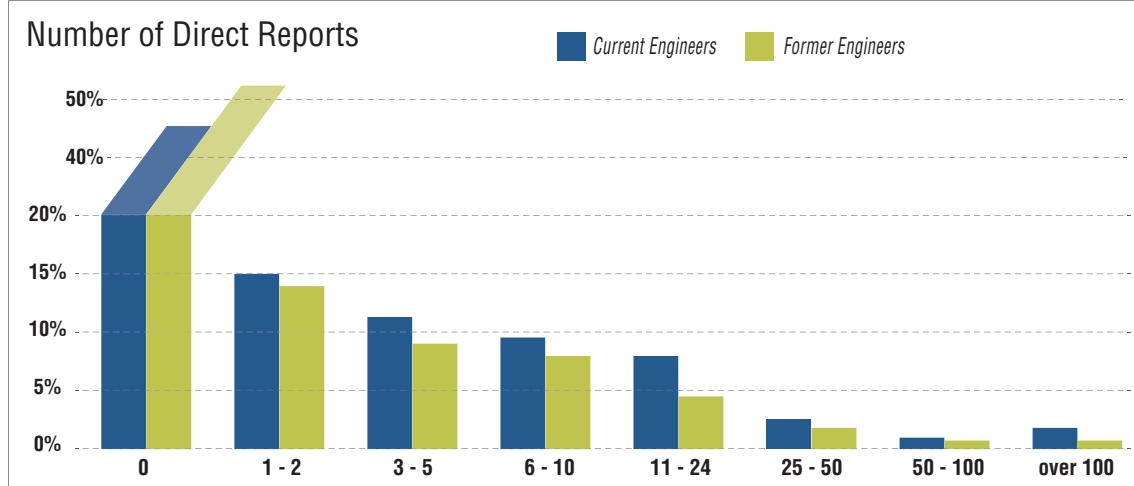
“It is hard to justify the long hours to go nowhere.”

– Caucasian Industrial Engineering Graduate

There were no significant differences between women who are currently working in engineering and those who left engineering less than five years ago in terms of the hours worked (38 hours/week), length of tenure with their company (5.5 years), average range of salary reported (between \$51,000 and \$75,000), and both groups were likewise most likely to have graduated with chemical, mechanical, and civil engineering degrees. Similar to women who are currently working in engineering, women who left engineering were equally in non-management (22%) and project management roles (21%). The least common positions occupied by these engineers were executive roles (10%). Similar to women who are currently in engineering, the majority of women who left less than 5 years ago were not in a supervisory role.

Gender Make-up of Co-workers

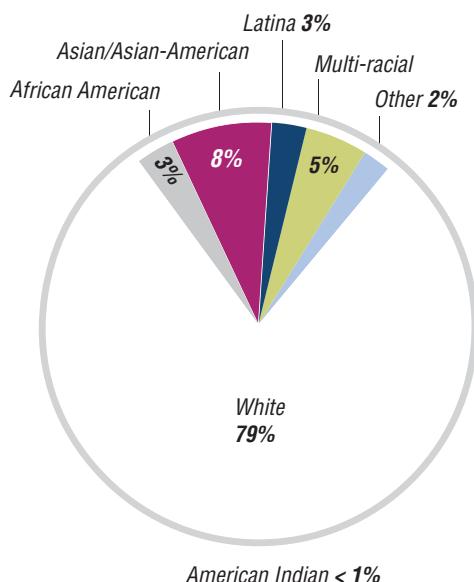




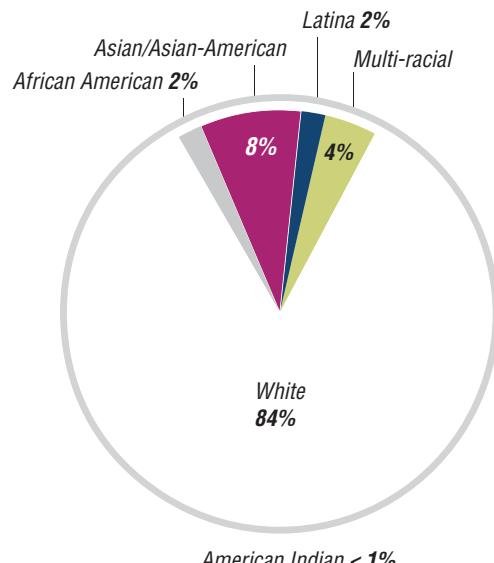
For those in management positions, the majority indicated that they had 1 to 5 direct reports and were most likely to work in groups that were predominantly male; however, a larger number who left engineering (25%) reported working in gender balanced groups.

Current women engineers in our sample were no less likely to be married or to be parents as their counterparts who left engineering less than five years ago. Neither did the two groups of women differ in terms of their race which was predominantly Caucasian, although many (5% for those who left and 4% for current engineers) reported multi-racial heritage as well. Both groups of women were relatively evenly distributed across the different cohort (or graduation groups).

Racial Ethnic Background of Former Engineers



Racial Ethnic Background of Current Engineers

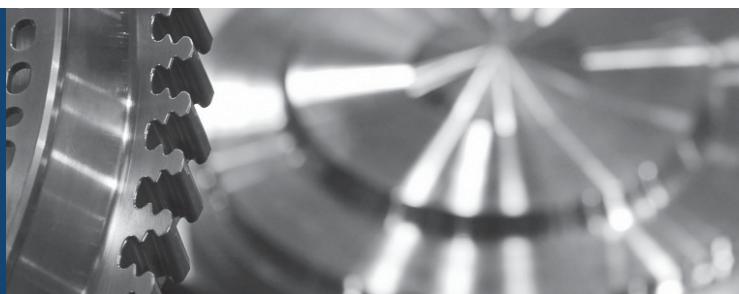


“ Most of management is a male-dominated culture (male conversation topics, long hours, demanding lifestyle, career-focused expectations). ... Women usually choose to leave **WITHOUT FIGHTING THE UPHILL BATTLE** to make improvements. It is a self-sustaining cycle!”

– Asian American Operations Research and Engineering Graduate

KEY FINDING

Current and former engineers do not differ in marital or parental status, engineering major, salary level, or number of direct reports.



“ Worked in a department for 4 years - in that time, 3 people out of 50 got promotions - all men. Then only the women and elders got laid off. Senior VP couldn't even handle saying hello to females in the hallway. His **AWKWARD OLD SCHOOL TENDENCIES** made him unable to consider females as equals. This was at a company with 90% female employees throughout the company; just a lack of females in the engineering group.”

– Caucasian Industrial Engineering Graduate

6: WOMEN CURRENTLY WORKING IN ENGINEERING: HOW ARE THEY FARING IN THEIR JOBS AND CAREERS?

“ We are often executing other’s orders and decisions, and the **OPPORTUNITIES FOR ADVANCEMENT** within the organization, to be a leader or impact business decision making, are slim.”

– African American Mechanical Engineering Graduate

“ Engineering firms aren’t respectful of the work/home boundary. At the firm I worked for, engineers were **EXPECTED TO** take work home, work late, or travel, often with little warning.”

– Caucasian Civil Engineering Graduate

“ There’s still a bit of an “**BOYS CLUB**” mentality around, even with younger engineers and non-engineer women. Some older male engineers certainly think that females shouldn’t be engineers, or that it’s “cute” when they are, like it’s an amusing phase she’s going through, instead of a career...”

– Caucasian Civil Engineering Graduate

Career success can be defined in many ways. One of the most common ways of assessing career success is by looking at tangible signs such as total compensation, number of promotions, rank attained and other similar objective indicators of success. Others have considered more subjective criteria such as satisfaction with one's job and career and have used these as a benchmark for career success. In the POWER study, we defined career success in terms of subjective criteria such as satisfaction with one's job and career, and objective criteria such as total compensation (including salary, bonuses, stock options etc.), number of direct reports, and number of recent promotions.

“As a Latina, I felt engineering OPENED MANY DOORS for me to work internationally. I spent some time in Europe and Central America due to my work with prototype designs and my ability to speak Spanish.”

– Latina Chemical Engineering Graduate

Understanding what comprises career success is important because research has linked individual's career success to important organizational and individual outcomes such as organizational commitment, lack of intention to leave the company or the career, and performance. More importantly, by examining the different elements that contribute to career success, we can begin to shed light on how successful women engineers are in the workplaces. To date, there's been no research that has uncovered the different dimensions of career success for women engineers and what factors influence it.

In this chapter, we examine factors related to the subjective experience of career success: i.e., job and career and satisfaction of current engineers. At the end of this chapter, we briefly compare women who are currently working in engineering with those who left the field on some of the salient factors related to satisfaction.

In the POWER study, career satisfaction was measured by asking the participants to report their levels of satisfaction with variety of factors such as pay, progress toward career goals, advancement, and development of new skills. Job satisfaction was captured by women's overall feelings toward their jobs.

The women who are currently working in engineering expressed above average levels of satisfaction with their jobs and careers. Most of them reported that their last promotion was within the past 5 years. As noted in the previous section, 15% are in senior executive positions and a third in project management positions and 25% had both line and staff responsibilities (16% had only staff responsibilities; 27% had only line responsibilities, and 9% did not disclose). Typically, all these dimensions that comprise career success are strongly related to one another and we found the same to be true for current women engineers. Specifically, women who reported higher levels of satisfaction with their jobs and careers also tended to be in more senior executive roles, with greater number of direct reports, and earning higher salaries than those who were relatively less satisfied with their jobs and careers. Women engineers who were satisfied with their jobs and careers also indicated that they were satisfied with the number of hours they worked per week.

WHAT DRIVES THE SUBJECTIVE EXPERIENCE OF CAREER SUCCESS?

In this study, we integrated several different strands of research and looked at a variety of personal and organizational factors that have the potential to explain the subjective experience of career success as reflected in women's career and job satisfaction. Specifically, we examined the effects of women's self-confidence with regard to performing engineering tasks, navigating the political landscape, and managing multiple life roles, as well as the outcomes women expected from performing these activities.

Workplace support is a key component of the overall work environment. It is manifested in the multiple types and layers of support that employees experience at various levels in their workplaces. At a very broad level, workplace support is reflected in the extent to which a company values the contributions of its employees and shows care and concern toward their employees' wellbeing. One can also infer the supportiveness of a company by looking at the provision of training and development opportunities and clear and tangible avenues for advancement. Workplace support can also be gauged by looking at the interpersonal nature of relationships with one's supervisor and co-workers.

In this study, we examined employees' perceptions of workplace support at two levels that can impact their levels of satisfaction. First, the participants reported on the extent to which their organizations supported their training and development, provided avenues for promotion, valued and recognized their contributions at work, and created a supportive climate for fulfilling multiple life role obligations. Second, we examined the extent to which the women engineers received support from their supervisors and co-workers.

We also examined two sets of workplace related barriers that could lower an engineer's satisfaction with her job and/or career. The first set of factors tapped into the perceptions of incivility in the workplace that was captured by the extent to which supervisors, senior managers, and co-workers treated women in a condescending, patronizing, or discourteous manner. We also directly assessed the extent to which supervisors and co-workers engaged in undermining behaviors at work such as insulting women, talking badly about them behind their backs, belittling them or their ideas, making them feel incompetent, and/or talking down to them. The second set of factors believed to lower satisfaction focused on more role-level barriers such as the extent to which women engineers lacked clarity in their roles, experienced contradictory and conflicting work requests and requirements, and felt overburdened with excessive work responsibilities without commensurate resources.

“ It was hard without having FEMALE MENTORS in the field. It would have helped to have someone to talk with about issues. Male mentors are helpful with career advice from a male perspective, but it does not feel like they truly understand the burdens that women face, especially in such a male-dominated field as engineering.”

– Asian American Chemical Engineering Graduate

DO PERSONAL FACTORS PREDICT WOMEN ENGINEERS' CAREER AND JOB SATISFACTION?

We examined factors related to women engineers' satisfaction with their current job and with the career of engineering in general. It is important to examine both, because while a woman might be dissatisfied with her current job, she may be satisfied with the profession of engineering. Arriving at conclusions about a woman engineer's job satisfaction would therefore, only capture part of the factors that influence her overall satisfaction of being an engineer in an engineering profession.

Therefore, the answer to the above question is yes, personal factors, such as levels of self-confidence in various areas,

do make a difference in engineers' satisfaction with their careers and jobs. Current women engineers who possessed a great deal of self-confidence in their abilities to navigate their organization's political landscape and juggle multiple life roles were most likely to express satisfaction with their careers as well as their jobs. Further, engineers who expected positive outcomes to result from their efforts to navigate the organizational climate at work were also most likely to express satisfaction with their jobs and careers. Interestingly, the more women engineers expected positive results from their efforts to balance multiple life roles, the less satisfied they were with their jobs and careers. It may be that expecting to balance multiple life roles leads to less satisfaction in just one of those roles.

KEY FINDING:

Women who were self-confident in their abilities to navigate their organization's political landscape and juggle multiple life roles reported being highly satisfied with their jobs as well as their careers.

DO BARRIERS AT WORK PREDICT WOMEN ENGINEERS' CAREER AND JOB SATISFACTION?

Women who are currently working in engineering have to face and contend with a variety of barriers that dampen their satisfaction with their jobs and careers. One of the biggest barriers that current engineers faced at work was the lack of clarity in the goals, objectives, and responsibilities in their work roles and these role-related barriers were related to a diminished sense of satisfaction with their jobs and careers. Research has shown that lack of clarity regarding job roles and expectations can create tension and stress for employees and negatively affect their satisfaction (Schaubroeck, Ganster, Sime, & Ditman, 1993). Current engineers who reported being given excessive workload without commensurate resources also experienced low levels of satisfaction with their jobs (but not their careers). Surprisingly, women who faced conflicting and often incompatible work requests from their supervisors and co-workers did not report lower levels of career satisfaction, presumably because they either expected this and knew how to deal with it, or because they viewed it as a work challenge that extended their learning.

In addition to the work-role related barriers, current women engineers who reported working in an environment that belittled and treated women in a condescending, patronizing manner, and were systematically undermined by their supervisors and co-workers felt least satisfied with their jobs. We found current engineers' career satisfaction was

most diminished when they experienced these uncivil and undermining behaviors from their supervisors rather than their co-workers.

In essence, of the different types of workplace barriers that we examined, the two that most negatively influenced women's satisfaction levels were work-role uncertainty and a work environment that consistently undermined them.

KEY FINDINGS:

Women who reported facing excessive workload felt least satisfied with their jobs. Women who were systematically undermined by their supervisors and co-workers, felt least satisfied with their jobs. Being undermined by their work supervisors also lowered women engineer's overall satisfaction with their careers.

DOES SUPPORT AT WORK PREDICT WOMEN ENGINEERS' CAREER AND JOB SATISFACTION?

Women also reported that there were several supportive elements in their workplace that influenced how satisfied they felt with their jobs and careers. For women who were currently working in engineering, four different types of support made a difference to their satisfaction at work: first, the most satisfied women worked for companies that provided them with tangible training and development opportunities by assigning them to projects that helped them develop and strengthen new skills, giving them challenging assignments, and investing in their formal training and development. Second, women engineers who perceived that their co-workers and supervisors were supportive of them felt most satisfied with their jobs. Third, women engineers who worked for companies that valued and recognized their contributions and cared about their well-being were most satisfied with their jobs. Finally, the results revealed that women engineers who worked in companies that regularly expected their employees to work more than 50 hours a week, to take work home at night and/or weekends, and regularly put their jobs before their families – especially to be considered favorably by top management – were least satisfied with their jobs.

Women engineers who reported to be the most satisfied with the careers worked in companies that not only valued and recognized their contributions but also invested substantially in their training and professional development. These women also received substantial support from their family and friends which elevated their levels of career satisfaction.

In sum, support at work matters in shaping current women engineers feelings of satisfaction with their jobs and careers. Specifically, tangible support in terms of training and development opportunities, supportive co-workers and supervisors, and companies that allow employees time to balance their multiple life roles, all make for satisfied employees.

CONCLUSION:

Current women engineers' career success was shaped by both positive and negative experiences at work. Positive experiences were captured by the type and amount of support received at work and negative experiences were reflected in the role-related pressures and undermining behaviors encountered at work.

A variety of personal and organizational factors lie behind current women engineers' career success. For example, current women engineers who expressed high levels of satisfaction with their careers were likely to have received ample opportunities for training and development, felt supported by their supervisors, co-workers, and their organizations and perceived avenues for further advancement within the company. These women had clear, identifiable set of task goals, responsibilities, and expectations to work with; they also felt confident in their abilities to navigate the political landscape in their companies and manage multiple life role responsibilities. Furthermore, successful women engineers reported working in companies that supported their efforts to balance their work-life responsibilities.

“ [I am] Still getting asked if I can handle being in a mostly male work environment in interviews in 2009 - I've been an engineer for 9 years, obviously I can. I know when I'm asked that question, I HAVE NO CHANCE AT THE JOB. It is nice they brought me in for equal opportunity survey points but don't waste my time if you don't take females seriously.”

– Caucasian Industrial Engineering Graduate

“ ...what ultimately led me to B-school and a non-engineering job was the **LACK OF A VIABLE CAREER PATH** (i.e. advancement) within the engineering organizations where I worked. In addition to that, most engineering organizations have promotion / leadership funnels that are very, very narrow.”

– African American Mechanical Engineering Graduate

There is a different side to this picture as well – one that highlights the challenges and negative experiences at work that have exercised a strong influence on shaping these women’s perceptions of subjective career success. Prominent among these factors was the experience of incivility at work that was reflected in the extent to which the supervisors, senior managers, and co-workers generally treated women in a condescending, patronizing, or discourteous manner and specifically undermined their efforts at being successful at work. This finding is in line with other recent reports that describe how women in STEM careers often face barriers to their career success in the form of hostility, bias, and lack of respect. (e.g., Hewlett et al., 2008; AAUW, 2010).

KEY FINDINGS:

The most satisfied women engineers were those who received support from supervisors and co-workers, ample opportunities for training and development and saw clear paths for advancement in the company.

The least satisfied women engineers were those who experienced excessive workloads and whose efforts by being successful were systematically undermined by their supervisors and co-workers.

Comparison of Women Engineers Currently Working in Engineering with Women Engineers Who Left Less Than Five Years Ago

DID THE TWO GROUPS OF WOMEN ENGINEERS DIFFER ON PERSONAL FACTORS?

We found that women currently working in engineering did not differ from women engineers who left less than 5 years ago on any of the personal factors related to self-confidence and their expectations from performing engineering tasks, balancing multiple roles, or navigating political climate at work. They also did not differ in their interests.

KEY FINDING:

Women currently working in engineering did not differ from women who left engineering in the past five years on the types of interests, levels of self-confidence, and outcomes they expected from performing in certain tasks.

DID PERSONAL FACTORS INFLUENCE JOB AND CAREER SATISFACTION OF WOMEN WHO LEFT ENGINEERING WITHIN THE PAST FIVE YEARS?

For women who had left engineering within the past five years, those who were self-confident in performing engineering tasks and expected positive results to emerge from these efforts felt most satisfied with their careers. Even though they were no longer working in engineering, women who expected positive outcomes from successfully performing their engineering tasks felt a great deal of satisfaction with their jobs. For this group of women, what mattered most for their job satisfaction was also the extent to which they felt confident about navigating the political climate in their organizations and managing multiple life-roles. The greater their confidence, the more satisfied they felt with their jobs. However, the more these women expected from balancing multiple life roles and managing the organizational dynamics, the less satisfied they felt with their jobs. It is possible that while women were highly self-confident of their abilities to successfully pursue these various tasks, they didn’t expect a lot of positive outcomes to emerge from these efforts which reflected in their dampened levels of job and career satisfaction.

DID THE TWO GROUPS DIFFER IN THEIR PERCEPTIONS OF ORGANIZATIONAL BARRIERS AND SUPPORTS?

We found that current engineers were significantly more likely than women who left engineering to perceive opportunities for training and development that would help them advance to the next level. Interestingly, the current engineers reported fewer work-life benefits available to them, but were significantly more likely to have used those benefits. Current engineers were significantly more likely to report both supervisor and co-worker support, and that the climate was supportive of their need to balance work and non-work roles. The two groups did not differ in having a mentor; however, only

“ I have left because I don’t like working longer than 12 HOUR DAYS and have been made to feel like a lazy employee unless I put in 14 hours a day plus time on weekends.

...Before leaving every night my supervisor would consult with every single male under his management before me. He would always wait to talk to me and the status of my work last, thus many times he would never get around to me until 10 pm, thus resulting in me not being able to leave the office until 11 pm... on a daily basis.”

– Multi-racial Civil Engineering Graduate

about a quarter of each group reported having a mentor. We found that women who left engineering reported experiencing more undermining behaviors from their supervisors, more incivility in their workplaces (being talked over, patronized, or talked about behind their backs), and indicated that the organizational time demands, to work long hours, on weekends and evenings, were excessive.

KEY FINDING:

Current engineers and engineers who left less than five years ago did differ both in perceptions of supports and barriers. Supervisors and co-workers were viewed as more supportive of current engineers, and as undermining of engineers who had left.

DID WORK BARRIERS PREDICT CAREER AND JOB SATISFACTION OF WOMEN WHO LEFT ENGINEERING WITHIN THE PAST 5 YEARS?

Yes, they did. As compared to their colleagues who are currently working in engineering, women who left engineering within the past five years reported a very similar set of work and role hindrances that diminished their levels of job and career satisfaction. This group of women who experienced undermining behaviors from their supervisors were least satisfied with their careers. Lack of clarity in one’s job roles and expectations coupled with excessive workload (and few resources) also made them feel dissatisfied with their jobs and careers.

DID SUPPORT AT WORK PREDICT CAREER AND JOB SATISFACTION OF WOMEN WHO LEFT ENGINEERING WITHIN THE PAST FIVE YEARS?

Yes, it did. As compared to their colleagues who are currently working in engineering, women who left engineering in the last five years reported similar supportive elements that made them feel satisfied with their jobs. Most notably, women who worked for companies that valued their contributions and received substantial training and development opportunities were most satisfied with their jobs.

7: WOMEN CURRENTLY WORKING IN ENGINEERING: HOW ARE THEY MANAGING THEIR MULTIPLE LIFE ROLES?

“There is a lot of pressure to get things done and **LITTLE SYMPATHY** for personal issues at work.”

– Caucasian Mechanical Engineering Graduate

“Larger companies like mine technically offer part-time work, telecommuting, etc., but individual managers **DON'T ALWAYS APPROVE** of these options or only offer them occasionally instead of as a permanent schedule option.”

– Caucasian Mechanical Engineering Graduate

“...once I **STARTED MY FAMILY**, my employer gave me the opportunity to take unpaid leave and work part time in order to meet the demands of my home. Because of the flexibility my employer has provided me, it has engendered a tremendous amount of loyalty to the organization that might not otherwise exist.”

– Asian Electrical Engineering Graduate

Work and family roles are intimately and inextricably connected in most people's lives. What happens in one's job and career affects one's personal and family life. For example, a good (or a bad) day at work may affect one's mood when interacting with family and friends after work. The things that happen in one's personal life – the friendships and family responsibilities – also affect one's job or career. For example, a spouse's (or a partner's) career may prevent one from accepting a relocation offer. Given the multiple, competing, and often simultaneous demands and pressures that employees face, friction between their work-family roles is inevitable. Indeed, some reports estimate that 95% of American workers experience work-family conflict (Williams & Boushey, 2010).

Work-family conflict poses a significant source of stress in the lives of many employees and has been known to affect a variety of important personal and organizational outcomes such as employee well-being, physical health, loyalty, performance, job satisfaction, absenteeism, turnover intentions, and withdrawal from the organization and the profession. There is a compelling need to understand work-family conflict among engineers because the profession is already facing a shortage of talented engineers (2010). Indeed, a survey of male and female scientists revealed that women who experienced high levels of work-family conflict were less likely to be retained by their employers compared to their male colleagues (National Science Board, S & E Indicators, 2004). However, despite decades of research on work-family conflict among different professional groups of employees, there is inadequate understanding of dynamics of work-family conflict among engineers. It is therefore imperative to take steps toward filling an important gap in our understanding.

Although being engaged in multiple roles has well-documented salutary effects on people's lives in terms of improved wellbeing, greater creativity, and social support, in this chapter, we describe the women engineers' experience of work-family conflict, the different personal and organizational factors that provoke and alleviate it. Indeed, this is the first study of its kind to exclusively focus on engineers as a distinct class of professional employees and not in the same category as scientists and engineers.

In this study, we adopted a broad definition of non-work roles to include any kind of care-giving responsibilities, involvement in personal relationships, or engagement in other non-work activities. We defined work-home conflict as the extent to which work and home responsibilities interfere with one another, i.e., the extent to which employees experience mutually incompatible demands and pressures

from one's work (or home) role such that it interferes with effective participation in the home (or work) role. Work can interfere with the fulfillment of one's home-related obligations (work-to-family conflict/interference) or vice versa, family/home responsibilities can interfere with the fulfillment of work tasks (family-to-work conflict/interference). In addition to looking at both directions of work-family conflict mentioned above, this study also examined at two forms of work-family conflict. Work-family conflict can be instigated when excessive time demands in one role do not allow one to fulfill the responsibilities associated with the other role, (time-based conflict) or when the strain and pressures associated with a particular role make it difficult for the individuals to participate in the other role (strain-based conflict). In this study, we aggregated the responses to time and strain-based demands and looked at the combined effects of both forms of conflict.

“I feel that I have been very LUCKY to find a company that supports balance between work & family through its flexible schedule and leave policies and the corporate culture, which was a strong benefit both before and after I had a child.”

– Caucasian Civil Engineering Graduate

DO PERSONAL FACTORS PREDICT WOMEN ENGINEERS' WORK-FAMILY CONFLICT?

Yes, they do and some factors more than the others. Predictably, women with childcare responsibilities experienced greater interference between their work and non-work roles than those without such responsibilities; for this group, the extent to which their home life interfered with their work role was greater than the other way around. Only 2% of our sample reported providing care for dependents other than their children. There were no differences in work-family conflict by race. Compared to baby-boomers or Generation X-ers, millennial women reported lowest levels of interference originating from their non-work responsibilities that adversely affected their participation in the work role.

Given that women are engaged in multiple life roles, the question that arises is how confident are they in managing these multiple roles and how their expectations of managing these roles affect their experience of work-family conflict. We examined the extent to which women's self-confidence in performing engineering tasks, managing multiple roles, and navigating the organizational dynamics made a difference in their experience of work-family conflict. The greater their self-confidence in managing multiple roles, the less friction they experienced between their work and non-work roles. Unexpectedly, women with high levels of confidence in performing engineering tasks and navigating political landscape reported high levels of work interfering with their family role. One possible explanation for this counterintuitive finding could be that high levels of self-confidence in accomplishing different tasks may serve to attract more work their way which would prevent them from fully participating in their family role. Indeed, our results on work-role overload and self-confidence support this line of reasoning.

Surprisingly, women who expected positive outcomes from managing multiple roles did not see a commensurate decrease in levels of work-family conflict. Instead, the more that they expected from balancing their multiple roles, the more work-family conflict they experienced. Perhaps, the anticipated benefits of managing multiple roles are not enough to outweigh the reality of juggling multiple, competing demands. However, the perceived benefits of successfully navigating the organizational landscape were associated with lower levels of work interference with family.

Overall, self-confidence in managing multiple roles emerged as one of the most salient factors that explained the experience of work-family conflict among this group of women engineers. Engineers with the highest levels of self-confidence in managing multiple roles were likely to experience lowest levels of work-family conflict. Interestingly, these self-confidence beliefs were not always aligned with the anticipated benefits from performing this balancing act; women who anticipated positive outcomes to result from balancing their multiple roles did not experience lower levels of work-family conflict.

KEY FINDING:

Women engineers who are confident about managing multiple life roles experience low levels of work-family conflict.

DO BARRIERS AT WORK EXACERBATE WOMEN ENGINEERS' WORK-FAMILY CONFLICT?

There are certain barriers that women engineers experience at work that are associated with heightened levels of work-family conflict. Prominent among these barriers is women's experience of excessive workload without commensurate resources. Such role overload heightened the friction between engineers' work and non-work roles. In addition, experiencing conflicting and sometimes incompatible work demands also contributed to the friction between work and non-work roles. Research has shown that role pressures that involve extensive time commitments or produce excessive strain exacerbate the degree of work-family conflict. We also found that women engineers who reported working in environments where women were treated in a patronizing, condescending, and rude manner by the supervisors, senior managers, and other colleagues indicated that their work role prevented them from effectively fulfilling their non-work commitments, thereby exacerbating the experience of work-family conflict.

Overall, role related stresses and pressures emerged as one of the biggest influences on women engineers' experience of work-family conflict. In addition, encountering an uncivil work environment contributed to heightened levels of stress between work and non-work roles as well.

KEY FINDING:

Women engineers who handled excessive and conflicting work-role demands, and worked in environments where women were treated in a condescending manner, experienced considerable work-family conflict.

DOES SUPPORT AT WORK REDUCE THE OCCURRENCE OF WOMEN ENGINEERS' WORK-FAMILY CONFLICT?

The answer is – it depends. Certain supportive aspects of one's work environment enable women engineers to better fulfill their work and non-work role responsibilities thereby reducing the occurrence of work-family conflict, whereas, there were certain support structures that produced just the opposite, unintended effect. What helps to reduce the occurrence of work-to-family conflict? Because our purpose was to understand what reduces work-family conflict, we considered a variety of work-family initiatives at the organizational level as well as individual support mechanisms that could reduce this important stressor in the lives of the engineers.

Work-family initiatives have been traditionally defined as deliberate organizational changes—in policies, practices, or the target culture—to reduce work-family conflict and/or support employees' lives outside of work (Kelly et al., 2008). We examined whether formal work-life policies (such as part-time work, job-sharing, paid and unpaid leaves of absence, and flexible work arrangements) provided to employees helps to reduce work-family conflict. Research has shown that it is not the mere availability of work-family initiatives, but their actual use that makes a difference in the occurrence of work-family conflict. Hence, we also examined the extent to which engineers used different work-life policies affected their experience of work-family conflict. We also tapped into engineers' perceptions of how supportive their organizational culture was toward their need for work-family balance. Specifically, we examined the extent to which supervisors and managers are accommodating and responsive to employees' non-work responsibilities and the extent to which the organization imposes time demands and constraints that make fulfillment of non-work obligations difficult. Finally, we also assessed the whether the extent to which the organization valued and recognized the engineers' contributions to the company and cared about their well-being, lowered the occurrence of work-family conflict. At the individual level, we assessed whether having a mentor and receiving support from supervisors, colleagues, and friends and family can offset the occurrence of conflict.

Our results revealed three key supports that reduced the occurrence of one form of work-family conflict – specifically, the extent to which work interfered with family life. First, the extent to which the organization valued and recognized the engineers' contributions to the company and cared about their well-being did indeed lower the extent to which their work tasks interfered with their involvement in non-work

roles. Second, women engineers who reported working for organizations that were characterized by family supportive work cultures tended to experience less friction between their work responsibilities and family commitments. Specifically, the more responsive and accommodating the managers were to engineers' non-work concerns, the less conflict they experienced. Further, the less the organization imposed excessive time demands, especially demands that required face-time and weekend and evening work, the less conflict these women experienced in fulfilling their non-work responsibilities. Neither having a mentor nor having supportive colleagues, supervisor, friends and family, made any difference to the degree to which work role interfered with the non-work role.

A different set of findings emerged when we examined the question – what reduces the extent to which family responsibilities interfere with work participation? Whereas none of the individual sources of support made a difference to work-to-family conflict, we found that women who could rely on and elicit support from family and friends were least likely to report that their non-work responsibilities interfered with their involvement at work. However, that was the only thing that reduced family-to-work interference. Contrary to expectations, none of the work-family initiatives – whether in the form of availability and/or use of work-life policies or the supportiveness of organizational culture – reduced the extent to which non-work commitments interfered with fulfillment of work responsibilities. In fact, the actual use of work-life benefit policies substantially increased the level of family-to-work conflict. There have been similar results reported among other groups of professional employees (cf., Kelly et al., 2008). It is possible that women who use work-life benefit policies have extensive family demands to begin with and they experience high levels of family-to-work conflict regardless of what the company offers. It is also possible that the organizations do not provide a variety of different work-life benefit policies to choose from, and the one (or few) option(s) that the engineers report being available to them, may not be the one that helps to meet their needs. For example, several companies offer childcare and eldercare referral services, but if the engineer seeks a telecommuting arrangement, or a job-sharing option, having referral services may do nothing to lessen the conflict she faces between her non-work and work roles.

We also found that women engineers who worked in organizations with family supportive cultures did not experience reduced levels of family-to-work conflict. In fact, they experienced heightened conflict between their non-work

and work roles. This finding needs to be considered in light of the excessive levels of work overload that women engineers face. Indeed, the results further revealed that despite a family supportive work culture, women engineers who reported being overloaded at work experienced the highest level of conflict between their non-work and family roles. It is possible that a family supportive work culture may be of limited help unless accompanied by some real tangible changes to one's workload. It is also possible that since women shoulder the bulk of care-giving and household responsibilities, having a supportive work culture doesn't do much to reduce the actual source of conflict – i.e., non-work responsibilities.

In sum, a variety of organizational supports help to reduce the degree to which work responsibilities interfere with the fulfillment of family commitments. These and other organizational supports did not have the intended effect of reducing the extent to which family responsibilities interfered with work role participation. Instead, family responsive policies and culture exacerbated the extent to which family responsibilities hampered work role participation.

KEY FINDING:

Women engineers experienced low levels of work-to-family conflict when they worked for organizations that were supportive of, and accommodating toward, their employees' concerns for work-life balance.

Women engineers experienced high levels of family-to-work conflict when they reported working for organizations with family-friendly cultures and used some of the work-life benefits provided to them.

CONCLUSION:

Given that the women engineers are combining paid work while shouldering non-work responsibilities, it was important to understand the factors that influence the degree of conflict they face in managing these multiple roles and obligations. Women engineers' work-family conflict was shaped by both personal and organizational factors.

For example, self-confidence made a difference to the extent to which women experienced work-family conflict, but more importantly, not all confidence beliefs were associated with lower conflict. Women engineers who were highly confident of their abilities in managing multiple roles, experienced lower levels of work-family conflict. However, when their high levels of self-confidence were directed toward performing their engineering tasks and/or managing the organizational dynamics, they felt a great deal of conflict.

Two prominent work stressors exacerbated the level of work-family conflict reported by the women engineers. First, excessive and conflicting work-role demands were associated with heightened conflict. And second, engineers who worked in environments characterized by general incivility directed toward women were more likely to experience high levels of work-family conflict.

Our results also revealed that women engineers experienced lower degree of work interference with family when they worked in organizations that not only cared about the general well-being of their employees, but were also responsive and accommodating toward their employees' need to balance work and non-work roles. However, work-family initiatives and a family-friendly work culture did not have the intended dampening effect on women engineers' family-to-work conflict, and in fact, served to exacerbate it. Since the women engineers in our sample reported facing excessive workload, presumably all these work-life supports are meaningful in reducing family-to-work interference only when accompanied by some real tangible changes to the work role. Overall, the results suggest that alleviating the stresses experienced from managing multiple life roles may not be simply a matter of providing and/or encouraging employees to use certain work-life initiatives, or making the organization more responsive to employees' need for work-life balance. A variety of factors need to be in place for engineers to successfully manage their multiple role obligations.

“ I am lucky to work for an organization that has **FLEXIBLE LEAVE** policies, in that I can take an hour off here or there if need be to deal with family issues.”

– Caucasian Mechanical Engineering Graduate

8: WOMEN CURRENTLY WORKING IN ENGINEERING: HOW STRONG IS THEIR BOND TO THE ENGINEERING PROFESSION AND TO THEIR ORGANIZATIONS?

“ My current workplace is very **WOMAN ENGINEER FRIENDLY**. Women get promoted and paid at the same rate as men. There are a lot of women in our group, it must be about 20%. The work atmosphere is very fair and the men who work here are not sexist for the most part.”

– Caucasian Mechanical Engineering Graduate

“ I **LOVE MY JOB** and feel successful at it but I can pin that on one factor: I've had great mentorship. My mentors have been older men who were encouraging and motivating and have been stubborn advocates on my behalf -- and they absolutely didn't care that I was female.”

– Caucasian Chemical Engineering Graduate

“ I was fortunate to work with senior male engineering officers who gave me fantastic opportunities and provided outstanding **SUPPORT.**”

– Caucasian Civil Engineering Graduate

Women engineers who work in the engineering field do so because they feel passionate about the work they do and are committed to the profession. In attempting to understand why women leave the field of engineering, we examined the extent to which they feel committed to the profession and what factors account for their intentions to leave the profession.

We know little about what influences career commitment among women engineers. While previous surveys have assessed the rate of women engineers' departure from the field, there has been no study to date that systematically probed the extent to which women engineers are committed to staying in the field and the reasons why they may contemplate leaving the field.

In the POWER study, we looked at two forms of commitment: commitment to the organization and commitment to the profession. A woman might be committed to the profession but not to her current organization. Lack of commitment to the engineering profession might lead women to leave the field of engineering completely, while lack of organizational commitment might lead them to look for a new engineering job, but with a different company. Likewise, we looked at two forms of intentions to leave: intentions to leave the organization and intentions to leave the profession. In this study, we examine the interplay between these two forms of commitment and intentions to leave the organization and/or profession.

Consistent with commonly accepted definitions of commitment, we defined employee commitment to the organization as the emotional attachment to, identification with, and involvement in the organization. Similarly, commitment to the engineering profession was captured by the extent to which women felt attached to, and identified with, and involved in the engineering profession.

In our study, women who were currently working in engineering reported higher than average levels of commitment to the organization as well as to the engineering profession.

WHAT EXPLAINS COMMITMENT TO THE COMPANY AND THE PROFESSION?

We focused on understanding the level of commitment only for women who were currently working in engineering; there is no way to ascertain this with our data, but it might be expected that women who left engineering had a low level of commitment to the field.

DO PERSONAL FACTORS PREDICT CURRENT ENGINEERS' COMMITMENT TO THE ORGANIZATION AND THE ENGINEERING PROFESSION?

Yes, they do. Women who feel confident about managing their multiple life roles and the political climate at work express the highest commitment toward their organizations as well as to the engineering profession. Women's self-confidence in performing engineering made the biggest difference to the bond they felt toward the engineering profession and their company. Further, engineers who expected positive outcomes to accrue from performing their engineering roles felt the greatest level of commitment. But the same wasn't true about their expectations regarding balancing multiple life roles. Those women who expected most out of juggling their multiple life roles exhibited the least amount of commitment, both toward their company as well as toward the larger profession.

In sum, self-confidence in performing relevant tasks accompanied by expectations for positive outcomes, exercises a potent influence in strengthening these engineers' bonds toward the engineering field as well as their companies.

KEY FINDING:

Women with highest levels of self-confidence and positive expectations felt most committed to their organizations and the engineering profession.

“In those rare cases where I felt I was not being treated appropriately, I have been able to go to HR and management and talk through the situations and always **FELT I WAS BEING TAKEN SERIOUSLY AND SUPPORTED.”**

– Caucasian Mechanical Engineering Graduate

DO BARRIERS AT WORK PREDICT ONE'S COMMITMENT TO THE ORGANIZATION AND ENGINEERING PROFESSION?

Yes, there are certain barriers that women engineers face at work that hurt their attachment to the company as well as the profession. Once again, lack of certainty in the engineers' work role objectives, responsibilities, and expectations emerged as a powerful deterrent to the commitment and attachment they expressed toward their organization as well as to the profession. Excessive work overload without adequate resources also left the engineers feeling less committed to the engineering profession as a whole. In addition, the extent to which engineers experienced friction and conflict in managing their work and non-work roles did influence their level of attachment toward their organization or their profession. The greater the friction experienced in juggling these responsibilities, the less strong the bonds of attachment toward the company and the profession.

Commitment to the organization was also largely shaped by how the participants were treated by their supervisors and co-workers. Most notably, engineers who worked in environments in which the supervisors, co-workers, and other senior managers treated women in a condescending, patronizing, and discourteous manner, felt less committed to their organization. Further, undermining behaviors instigated by co-workers weakened one's commitment to the organization. Women engineers were least likely to feel attached to their companies when their co-workers belittled and insulted them, made them feel incompetent, talked about them behind their backs, put them down when they questioned work procedures, and undermined women engineers in their efforts to be successful on the job.

“MEN IN SUPERVISORY positions do not take their women subordinates out to lunch, or invite them to attend professional meetings and conferences with them...”

– Caucasian Civil Engineering Graduate

Overall, women engineers who contend with significant role-related barriers experience the most tenuous bonds with their organizations as well as the engineering profession as a whole. This is not surprising for the simple reason that if employees do not know what is expected of them, they may be working on the wrong things. Prolonged

exposure to role uncertainty has been found to be stressful since it deprives employees of valuable cognitive resources that could be used for effectively fulfilling their responsibilities. However, what is unique about the finding that role uncertainty erodes one's attachment to the profession is this: what women engineers experience on a daily basis at work, profoundly alters their feelings to the engineering profession as a whole. These feelings are not contained to the workplace and instead spillover to weaken their commitment to the profession. Compounding these role related pressures, engineers who were undermined at work by their co-workers and treated in an uncivil manner felt least attached to their organization.

KEY FINDING:

Women who were tasked with jobs without clear expectations, responsibilities and objectives felt least committed to their organizations and the engineering profession as a whole.

Women who were undermined by their co-workers and reported working in cultures characterized by condescending, patronizing treatment of women, expressed least commitment to their organizations.

DOES SUPPORT AT WORK STRENGTHEN ONE'S COMMITMENT TO THE ORGANIZATION AND ENGINEERING PROFESSION?

Yes, it does to a large extent. The type of support that makes the most difference to women engineers' commitment to the organization as well as to the profession is the extent to which the organization makes a substantial investment in their professional development by providing them with challenging assignments and training opportunities to strengthen and develop new skills. Commitment toward the profession as a whole was also profoundly influenced by the availability of fair, regular, and performance based promotion opportunities. In addition, engineers expressed greatest levels of commitment to the profession when they found themselves working for companies that did not impose excessive time demands on them by way of insistence on face-time, and working weekends and nights.

Employees' attachment toward their companies was also shaped by the manner in which the company and their co-workers treated them in general. Engineers who worked for companies that valued and recognized their contributions and expressed care about their general well-being reaped

the rewards in terms of these engineers' loyalty and commitment. Similarly, women who worked with colleagues who were supportive of them, felt much more committed and attached toward their companies than those who did not have a similar support structure.

In sum, the extent to which engineers experience a variety of supportive actions, behaviors, systems, policies, and even symbolic gestures in their work environment makes a difference to the strength of their ties to their organization as well as the profession. Once again, the results revealed that what happens at work on a daily basis does spillover to affect one's feelings toward the profession as a whole. This conclusion is underscored by our finding that a high level of commitment toward one's organization is accompanied by a correspondingly high level of commitment toward the engineering profession.

KEY FINDINGS:

Women were more likely to be committed to the field of engineering if they received opportunities for training and development, opportunities for advancement, and believed that time demands were reasonable.

Women were more likely to be committed to their engineering job when their supervisors and co-workers were supportive of them.

DO JOB ATTITUDES INFLUENCE ONE'S COMMITMENT TO THE ORGANIZATION AND THE ENGINEERING PROFESSION?

Yes, they do. Not surprisingly, satisfaction with one's job made a huge difference to how strongly attached and committed engineers' felt toward their organizations and the engineering profession. Overall satisfaction with one's career as well as commitment to one's current organization also strengthened the bonds with the engineering profession.

WHAT ARE THE BEHAVIORAL SYMPTOMS OF ONE'S COMMITMENT TO THE ORGANIZATION AND THE ENGINEERING PROFESSION?

Not surprisingly, women who expressed a very strong attachment and commitment toward their organization and profession were least likely to search for alternative jobs, follow up on job leads, and harbor intentions to leave the company and the profession. They were also less likely to disengage from their work or otherwise scale back their level of work involvement.

In essence, there are a variety of personal and organizational factors that work in concert to strengthen women's bond to the engineering profession and their organizations.

CONCLUSION:

Women currently working in engineering expressed a strong commitment to their organizations as well as to the profession. A variety of personal and organizational factors affected the strength of those ties. Women with high levels of self-confidence, who were given clear, identifiable set of task goals, responsibilities, and expectations to work with, expressed strong commitment toward their companies and the engineering profession. Working with supportive supervisors and colleagues also helped to strengthen these engineers' bonds to the companies and the field. Organizations that valued and supported their employees and made substantial investments in training and developing their women engineers were likely to experience high levels of employee loyalty in return.

Loyalty to the organization was also shaped by how poorly women were treated. Women engineers who were belittled, made fun of, and undermined by their co-workers expressed low levels of attachment to their companies. Finally, incivility in the workplace, characterized by condescending and patronizing treatment of women, diminished the sense of loyalty that these engineers felt toward their companies.

“I have spent many of my professional years in management positions, which have allowed me broader exposure to work with women from other disciplines. Because of that, I have been able to find female co-workers for support.

...I personally think engineering is a **SATISFYING** and **CHALLENGING**

profession. I believe that my male co-workers treat women with respect and support them equal to their male co-workers.”

– Caucasian Industrial Engineering Graduate

9: WHAT EXPLAINS WOMEN ENGINEERS' DESIRE TO LEAVE THE COMPANY AND THE PROFESSION?

“ From my experience, women have left engineering because they are **PUSHED** to move into management. The female engineers I've known have had great technical skills as well as solid leadership abilities.”

– Caucasian Electrical Engineering Graduate

“ There are **NOT ENOUGH** opportunities for promotion. It's easier to get promoted and accepted outside of engineering fields.”

– Asian American Electrical Engineering Graduate

“ In leaving the technically focused roles, I believe it's because advancement and money are not there. You can **ONLY GO SO FAR** before you have to shift gears to more business type roles.”

– Caucasian Mechanical Engineering Graduate

While there has been a considerable amount of anecdotal evidence on women engineers' departure from engineering, there's been no research that assessed the extent to which women currently working in engineering desire to leave the profession, and what provokes that desire to leave a profession for which they have trained so hard and long.

The POWER study examined a number of personal and organizational factors that have been theoretically (and empirically) linked to departure intentions among other groups of professionals but have never been studied among professional engineers. So what predicts current women engineers' intentions to leave the field of engineering?

DO PERSONAL FACTORS PREDICT CURRENT ENGINEERS' DESIRE TO LEAVE THE ENGINEERING PROFESSION?

Our study revealed that, yes, personal factors did make a difference in predicting current engineers' desire to leave the profession. We found that women who were highly confident of their engineering abilities as well as their ability to juggle multiple life roles were least likely to want to leave engineering. In addition, self-confident women who also expected positive results to come their way from successfully performing their engineering tasks were least likely to want to quit engineering. But surprisingly, women who expected positive outcomes from their efforts to manage the organizational climate as well balance multiple life roles, expressed a stronger intention to leave the profession. One of the reasons for this finding was because these women also tended to experience lowest levels of satisfaction with their jobs, which could have eventually influenced their desire to leave the profession. So a variety of personal factors influence women's intentions to quit engineering – these factors were primarily related to their levels of self-confidence in performing engineering tasks and managing multiple roles combined with what they expected to result from such efforts.

KEY FINDING:

Women who were highly confident of their engineering abilities as well as their ability to juggle multiple life roles were least likely to want to leave engineering. But women who expected positive outcomes from their efforts to manage the organizational climate as well balance multiple life roles, had a stronger intention to leave the profession.

WHAT TYPE OF AN INTEREST PROFILE DRIVES ONE'S INTENTION TO QUIT THE ENGINEERING PROFESSION?

We found that women engineers who were enterprising and expressed an interest in social dimensions of work were more likely to want to leave engineering. Not surprisingly, women who were more interested in detail-oriented, hands-on activities were least likely to want to leave engineering. These themes also echoed in the comments offered by the participants that described what factors precipitated their desire to leave engineering.

DO BARRIERS AT WORK PREDICT ONE'S INTENTION TO LEAVE THE ENGINEERING PROFESSION?

Yes, there are certain barriers that women engineers face at work that lead them to consider leaving the engineering profession altogether. We found that one of the biggest contributors to women's decision to leave the field is the lack of information and clarity regarding their work goals, objectives, and responsibilities. Research has shown that clear job roles tend to empower employees with feelings of competency because they understand what is required of them to fulfill their responsibilities. Lack of clarity regarding job roles and expectations can create tension and stress for employees and affect their attitudes toward their organizations. This is the first study to reveal that such role uncertainty can also strongly influence one's desire to leave the profession. In addition, work overload in terms of the sheer mismatch between the tasks demanded and the resources available, also influenced women's intention to quit engineering. In essence, of the different types of workplace barriers that we examined, the two most significant contributors to women's intentions to quit engineering were excessive work responsibilities without commensurate resources and a lack of clarity regarding their work roles.

KEY FINDING:

Women are more likely to consider leaving the engineering field if they experience excessive workload and if they perceive a lack of clarity regarding their work goals, objectives, and responsibilities.

“ When I first began my engineering career, I was often the only female in the organization other than secretaries. Now, I have many female co-workers. I think the increase in women in the organization has **IMPROVED COMMUNICATIONS** and working relationships.” – Caucasian Chemical Engineering Graduate

DOES SUPPORT AT WORK DAMPEN ONE’S INTENTION TO LEAVE ENGINEERING?

Yes, it does to an extent – but it is the tangible forms of support that matter the most. We looked at support at two different levels: organizational level support was captured through the availability of training and development opportunities, the extent to which the organization cared for and valued the women’s contributions, and the availability of fair, performance-based promotion systems. We also examined the extent to which the organization’s culture and work-life policies supported and valued employees’ integration of work and family lives. At the individual level, support was assessed in terms of the extent to which the employees perceived that their supervisors and co-workers are easy to talk to and are willing to listen, go out of their way to help them, and can be relied on when things get tough at work. We also assessed whether presence of a mentor would make a difference in the engineer’s intention to quit the profession. Of all these different types of support, three things stood out: first, the extent to which the companies provided tangible training and development opportunities such as assigning them to projects that helped them develop and strengthen new skills, giving them challenging assignments, and investing in their formal training and development, was related to a lower intention to quit engineering. Second, the degree to which the women engineers perceived their co-workers as supportive of them made a difference to their desire to leave engineering. The more supportive one’s co-workers lower the desire to leave the profession. Finally, the results revealed that the symbolic nature of a company’s culture toward work-family issues did not have an impact on the intention to leave engineering, neither did the provision or use of work-life benefit policies; instead one’s desire to leave engineering was influenced by the extent to which the organizational time demands and expectations consistently prioritized work responsibilities over family obligations. In other words, women engineers who worked in companies that regularly expected their employees to work more than 50 hours a week, to take work home

at night and/or weekends, and regularly put their jobs before their families – especially to be considered favorably by top management – were most likely to express a desire to leave engineering.

In sum, support at work matters in dissuading women engineers from contemplating quitting their profession. Specifically, having support at work, in terms of training and development opportunities, supportive co-workers, and working companies that allow employees time to balance their multiple life roles, dampens the desire to leave engineering.

KEY FINDING:

Women who had supportive co-workers and reported that their companies provided them with training and development opportunities were less likely to consider leaving engineering.

DO JOB ATTITUDES INFLUENCE INTENTIONS TO LEAVE THE ENGINEERING PROFESSION?

Yes, they do. Surprisingly, satisfaction with one’s career did not make a difference to one’s intention to leave engineering, but satisfaction with one’s job had a huge impact. This suggests that what happens in one’s immediate job transcends and spills over to affect how one feels about the profession as a whole. Not surprisingly, the extent to which women felt committed to the engineering profession was strongly reflected in their intention to stay on in engineering.

KEY FINDING:

The more women were satisfied with their current jobs the less likely they were to consider leaving the engineering profession.

WHAT ARE THE BEHAVIORAL SYMPTOMS OF ONE'S DESIRE TO LEAVE THE ENGINEERING PROFESSION?

This is one of the only studies of its kind to probe the behavioral symptoms of one's intention to leave the engineering profession and we found some interesting patterns. Women who were seriously contemplating leaving the profession were likely to actively pursue searching for alternative jobs or following up on job leads. They were also likely to scale back their level of involvement at work by not working late or overtime, leaving work early or, avoiding taking a business trip. These engineers were also very actively considering leaving their current organization.

In essence, it is not just one factor, in and of itself, that makes the difference in provoking women to contemplate leaving the engineering profession. It is a complex array of personal and organizational factors that work in concert to fray the ties that bind them to the profession.

WHAT, IF ANY, IS THE RELATIONSHIP BETWEEN ONE'S DESIRE TO LEAVE THE COMPANY AND ONE'S DESIRE TO LEAVE THE PROFESSION?

The answer to this question has tremendous implications for not only women engineers, but also for companies that employ them and educational institutions that train and educate them. Our study points out that women's intentions to leave their organizations are very closely linked to their desire to leave the profession altogether.

WHAT EXPLAINS CURRENT ENGINEERS' DESIRE TO LEAVE THE COMPANY?

We also looked at the same factors that explain women engineer's intention to leave the profession and examined whether these also influenced women's intention to leave their companies. Our results revealed a similar make-up of factors that influenced the two types of intention to withdraw but with important differences.

DO PERSONAL FACTORS PREDICT CURRENT ENGINEERS' DESIRE TO LEAVE THEIR ORGANIZATION?

Yes, they do. Similar to what we found for intentions to leave the profession, women engineers' desire to leave their companies was heavily influenced by their levels of self-confidence but with an important difference. Women's self-confidence in balancing multiple life roles and navigating the organizational political landscape primarily influenced their desire to stay or leave the company. Women who were

highly confident of their performance in these arenas were least likely to want to leave their organizations. Surprisingly, women's self-confidence in performing engineering tasks didn't matter much in influencing their desire to leave the company while it mattered significantly more for influencing their intention to leave the profession. In addition, women who expected positive results to accrue from successfully performing engineering tasks were least likely to want to think about quitting their companies as well as the engineering profession. However, those women who expected more positive outcomes to result from their efforts to fulfill multiple role obligations expressed greater intention to leave the company, again, due to their lowered levels of job satisfaction.

In essence, women engineers' self-confidence is vital to helping them fend off intentions to leave the company, and it seems for the most part, they expect positive outcomes to result from their various efforts, except when it comes to managing multiple roles. At that time, it seems that the more the engineers expect positive outcomes from balancing their life roles, the less satisfied they are with their jobs, and the less satisfied they are with their jobs, the more they want to quit the company, and the profession.

“I have encountered situations where a client does not want to work with me because I am a woman or I was mistaken for a secretary or someone is surprised that I am an engineer (**“ISN'T THAT CUTE”**). I think that as women we need to know that this is going to happen and learn how to prepare for it.”

– Caucasian Agricultural Engineering Graduate

KEY FINDING:

Women who were highly confident of their engineering abilities were most likely to want to stay with their companies. But women who expected positive outcomes from their efforts to balance multiple life roles appeared to consider leaving their organization.

WHAT TYPE OF AN INTEREST PROFILE DRIVES ONE'S INTENTION TO QUIT THE COMPANY?

We found that women engineers who possessed enterprising interests were more likely to want to leave their current organizations. In contrast, women engineers who characterized their interests as conventional (i.e., interested in activities that require a lot of attention to detail and structure), were least likely to want to quit. This pattern was similar to what we found for intentions to quit the profession.

“Women in our organization are usually not assigned the heavy weight projects. Instead we are often assigned typically

SECRETARIAL WORK

charts, reports, presentations, etc.”

– Asian Industrial Engineering Graduate

DO BARRIERS AT WORK PREDICT ONE'S INTENTION TO LEAVE THE ORGANIZATION?

Yes, they do but somewhat different types of work barriers influence whether one wants to leave the company or the profession. Similar to our finding about what influences engineers' desire to leave the profession, we found that excessive workload and unclear job goals, expectations, and responsibilities prompted women to consider leaving their companies. However, we found additional barriers at play here. In addition to the work-role related barriers, women engineers were most likely to harbor strong intentions to leave their companies when they reported working in organizations that treated women in a condescending, patronizing manner at work and when they were systematically undermined by their supervisors by being put down when they questioned the work procedures, talked behind their backs, and made to feel incompetent. Although this may not come as a surprising finding to some, what is particularly revealing about this result is that, for the first time, we have an understanding of the actual types of undermining behaviors directed at women engineers and how these play out by affecting their desire to stay on in the company.

KEY FINDING:

Women engineers are more likely to consider leaving their companies if they experience excessive workload, unclear roles, and report that their supervisor undermines their efforts at being successful at work.

DOES SUPPORT AT WORK DAMPEN ONE'S INTENTION TO LEAVE THE ORGANIZATION?

Yes to some extent. The types of supportive elements that made a positive difference to women's intentions not to leave the company are similar to what we found for their intentions not to leave the profession. For example, in both the cases, an organization's investment in professional training and development opportunities dampened their desire to leave the company as did working for companies that did not excessively emphasize long hours, face-time, and working weekends and evenings. What was different in terms of predicting intentions to leave the company was the strong influence of opportunities for promotion within the company. Women who believed they had good opportunities for promotion and that those promotion decisions were based on ability and fair criteria were less likely to want to think about leaving. Further, unlike the limited types of support that influenced departure from the profession, we found a full spectrum of supportive behaviors that were related to women engineers not wanting to leave their companies. Specifically, working with supportive co-workers and supervisors lessened their desire to leave the company. Further, the extent to which the organization valued and recognized the engineers' contributions to the company and cared about their well-being made a substantial difference to the desire to leave the company. The more supportive and appreciative an organization was toward a woman engineer's contributions, the less likely she wanted to think about leave the company. Once again, the extent to which the companies provided different work-life benefit policies and then extent to which the women used it, did not make a difference to their withdrawal intentions.

Overall, our results revealed that a variety of supportive actions, behaviors, systems, policies, and even symbolic gestures needed to be in place for women not to consider leaving their jobs.

KEY FINDING:

Women engineers who had supportive co-workers and supervisors were least likely to consider leaving their organizations.

Women engineers were less likely to consider leaving engineering when the companies invested in their training and development, provided them with opportunities for advancement, and valued their contributions to the organization.

DO JOB ATTITUDES INFLUENCE INTENTIONS TO LEAVE THE ORGANIZATION?

Yes, they do. Moreover, the same types of job attitudes influenced intentions to leave the organization as they influenced intentions to leave the profession. Specifically, satisfaction with one's job had a huge impact on influencing the extent to which one considered leaving the company. The more satisfied the engineers were with their jobs, the less likely they were to think about leaving. Not surprisingly, the extent to which women felt a sense of attachment and commitment to the company was strongly reflected in their intention to stay with the company.

KEY FINDING:

The more women were satisfied with their current jobs the less likely they were to consider leaving their organizations.

WHAT ARE THE BEHAVIORAL SYMPTOMS OF ONE'S DESIRE TO LEAVE THE ORGANIZATION?

Exactly the same set of behaviors influenced women's intentions to leave the organization as what we found for women contemplating leaving the engineering profession. That is, women who were thinking about leaving their companies were more likely to actively pursue searching for alternative jobs or following up on job leads. They were also likely to scale back their level of involvement at work by not working late or overtime, leaving work early or, avoiding taking a business trip. What was different was that in addition to actively looking for other jobs and scaling back their current involvement, women's expectations for finding an acceptable alternative job shaped their desire to leave the company.

DOES THE INTENTION TO LEAVE THE ORGANIZATION AFFECT WOMEN'S INTENTION TO LEAVE THE ENGINEERING PROFESSION?

Yes, it does, and in a huge manner. This was a surprising finding: women who intend to leave their companies are also seriously thinking of leaving the profession altogether. It seems that getting disenchanted in one's job provokes not just a desire to leave the company for a different engineering company but to leave the profession completely. Things that happen at work on a daily basis, the opportunities offered or denied, the extent to which employees are supported or undermined – all exercise a profound influence on women engineer's intentions to remain in the profession. One often does not hear about doctors thinking of leaving the medical

profession altogether if their work environment is not supportive and/or if they face consistent barriers at work, but women engineers are certainly doing that.

CONCLUSION:

Women engineers' intention to leave their organizations and the engineering profession was shaped by myriad factors – both at the individual and organizational level. For the most part, highly self-confident women engineers were not likely to want to leave their organizations or the engineering field. What triggered their thoughts about leaving had a great deal to do with their work environment. Both the positive and negative experiences encountered in the work environment prompted women not only to contemplate leaving their organizations but also the engineering field altogether. One common work factor that emerged to influence engineers' intentions to leave the company and the profession was excessive workload and unclear work roles. Clearly, these situations are stressful enough for these engineers to contemplate withdrawing from not only their current organizations but the engineering field as well.

In addition, women engineers' who were belittled, made to feel incompetent, and otherwise undermined by their supervisors, thought about leaving their organizations. Our results point out that supervisory undermining behaviors may take a toll on organizational retention plans.

What dissuaded women engineers from wanting to leave their organizations and the engineering profession was their experience of working in organizations that recognized and valued their contributions, invested in their training and professional development, and provided them with opportunities for advancement. Having supportive colleagues and supervisors at work also went a long way in lowering their desire to leave.

Our results point out that women's intentions to leave their organizations are very closely linked to their desire to leave the profession altogether, even though there are some differences in the triggers for these two types of withdrawal intentions. Because these two forms of withdrawal intentions are so closely tied together, what happens in one's immediate work environment, may inevitably affect one's attachment to the field.

10: SUMMARY AND RECOMMENDATIONS

Roughly 40% of the women engineers who responded to this study have left the field of engineering. Many who are currently working in engineering have expressed intentions to leave the engineering field. Why do women engineers leave (or want to leave)? What can we do stem the tide? The findings from the national Project on Women Engineers' Retention (POWER) have practical implications both for organizations that employ women engineers and educational institutions that educate and train them. Our recommendations are drawn from the key themes that emerged from our findings that revealed what's working well and what needs to be done differently.

Recommendations for Organizations

CREATE CLEAR, VISIBLE, AND TRANSPARENT PATHS TOWARD ADVANCEMENT

Women who saw clear paths and opportunities to advancement in the company reported feeling more satisfied and committed with little or no intentions to leave engineering or their current companies. Past research has shown that women and minorities often leave organizations out of frustration of not finding clear, tangible paths for advancement (Cox & Nkomo, 1991). In our study, women engineers who left engineering echoed similar sentiments. The women who were currently working in engineering expressed that lack of promotion opportunities influenced them to think about quitting their jobs and/or the field together. The takeaway message to organizations is clear – companies can do a better job of retaining and optimally utilizing the talents of their women engineers if they provide clear, visible, and transparent paths to advancement by articulating the criteria for promotion, implementing fair, performance-based systems for promotion, and offering multiple opportunities for mobility.

INVEST IN PROVIDING SUBSTANTIAL TRAINING AND PROFESSIONAL DEVELOPMENT

One of the key themes that emerged from the findings was the impact of training and development opportunities on a wide variety of outcomes that are relevant to the organization. For example, women who worked in companies that provided them with challenging assignments that helped them to develop and/or strengthen new skills and substantially invested in their formal training and development were more satisfied with their jobs and careers, more committed to the field and their companies, and also less likely to want to leave their companies and the engineering field. Women who had already left engineering reported that lack of training and development was instrumental in their decision to leave – they had simply reached a dead-end – and without further training and development opportunities, they felt compelled to leave. Companies that invest in tailored and specific training and development programs can reap rich payoffs with regard to productivity and profitability gains, reduced costs, improved quality, and faster rates of innovation.

The results from our study add another perspective by suggesting that lack of investment in training and development can hurt the company by incurring turnover costs. The engineering profession, and the larger society, do also directly and indirectly, bear these costs. Organizations interested in retaining their women engineers need to offer targeted

training programs aimed at strengthening not only technical skills but also developing overall leadership skills such as strategic planning and performance management skills. Lack of adequate or timely training and development may impose a structural barrier to their advancement and take these engineers out of the running for promotion to positions with greater authority, influence, and advancement.

COMMUNICATE CLEAR WORK GOALS AND RELEVANCE OF INDIVIDUAL TASKS TO THE BIG PICTURE

One of the key impediments that women engineers reported encountering in the workplace was excessive workload, unclear and sometimes conflicting information on work goals, expectations, and responsibilities. Clearly, these work role-related pressures took a profound toll on all facets of women engineers' work life – from the satisfaction and commitment they felt toward their jobs and engineering profession to the level of interference they experienced between their work and non-work roles – prompting them to consider leaving their organization and the engineering profession. Of all the different types of structural barriers that have been documented to have had an effect on women engineers' mobility, persistence, and attrition, role-related structural barriers have received negligible attention.

There are multiple strategies that can ease, if not eliminate, such role-related stresses. For starters, taking simple steps in terms of defining and clarifying what is expected of the employees – what needs to be done, how and when it needs to be done – can help the employees be more effective in using their talents for accomplishing their work goals. Work roles are dynamic and they are embedded in dynamic organizational environments. It is therefore, important to continually engage in this process of role clarification and redefinition, reducing or eliminating where possible, conflicting demands, expectations, and role disruptions. Setting clear work boundaries is important, and just as important is laying out how the tasks and roles are connected to the broader organizational mission.

Organizations also need to take active steps to reduce excessive work-role overload by infusing new resources or reallocating existing ones to streamline work procedures. Sometimes, it is a question of too much to do in too little time, without necessary resources. For those situations, it might be imperative to reprioritize the tasks that need to be completed, set more realistic timelines, and/or add more employees to complete the tasks (sometimes even increasing administrative support can go a long way in easing the workload). Continually training and developing employees

might not only result in immediate efficiency gains, but can also lead to enhanced creativity and innovation at work. All these measures call for a systematic examination of workflow and work processes, but it may be worth the time, money, and effort.

In short, setting clear boundaries around work role goals, prioritizing important duties, allocating necessary resources, and communicating the relevance of tasks can aid in streamlining work roles and earn strong loyalty and satisfaction from women engineers.

IT'S THE WORKPLACE CLIMATE!

Workplace climate issues, both positive and negative, had a pervasive influence on a variety of outcomes such as commitment, satisfaction, and withdrawal behaviors, and intentions. This finding is consistent with past research on women in STEM fields. Women engineers encountered a variety of supports and barriers in the workplace that were from structural, cultural, and behavioral in nature. Our study highlighted a number of climate-related aspects related to women's decision to stay in an engineering position; these are summarized below.

CREATE AN ORGANIZATIONAL CULTURE THAT VALUES EMPLOYEES' CONTRIBUTIONS

The extent to which an organization valued their women engineers' contributions and cared about their well-being influenced an array of attitudes and behaviors; women engineers who worked in such supportive organizations reciprocated their organization's efforts by expressing greater satisfaction and commitment toward their jobs and careers, and few intentions to leave the organization or the field. Such positive organizational cultures empower employees and help them flourish. Organizations can establish employee recognition programs that welcome and reward positive contributions. These programs can also provide the women engineers with platforms for reaching across functional and horizontal lines in the company, helping them foster meaningful connections with their colleagues, and possibly senior managers, in other areas of the company.

ROOT OUT UNCIVIL AND UNDERMINING BEHAVIORS IN THE WORKPLACE; CREATE A CULTURE THAT RESPECTS ALL

Incivility and social undermining in the workplace is on the rise as seen in recent research studies (Duffy, Ganster, & Pagon, 2002; Miner-Rubino & Cortina, 2007; Pearson & Porath, 2009) and it is taking a toll on the employees and the organizations

in which they work. Unfortunately, many organizations are ignorant or unaware of the prevalence and/or magnitude of this problem. While past research on women in STEM careers has highlighted the presence and effects of bias and hostility in the workplace, this is the first empirical study that set out to document the effects of two major forms of negative behaviors in the workplace – incivility and undermining behaviors –on a variety of organizationally relevant attitudes, behaviors, and cognitions. As our study points out, the cost of incivility and undermining behaviors can be seen in terms of reduced satisfaction and commitment, and increased disengagement at work, and increased desire to leave the organization as well as the profession. We also found a very strong relationship between incivility and undermining behaviors, perhaps not surprising, but one with disturbing implications. The confluence of uncivil and undermining behaviors can pose a hostile and seemingly insurmountable barrier to women's persistence and progress in engineering.

Organizations need to have a zero-tolerance for any form of incivility and undermining in the workplace. From creating a "hotline" to reporting such incidents, appointing an ombudsperson to address and resolve these issues, and providing systematic training throughout the organization that teaches, for example, conflict resolution, negotiation, and listening skills, there are several ways that an organization can show that such behavior is not tolerated within the company. While everyone could benefit from training, supervisors in particular need to be trained to recognize and address signs of incivility and undermining and to address it even when the instigators are powerful individuals within the company. Many organizations have succeeded in creating cultures that are intolerant of sexual harassment. The same needs to be extended to cover other types of hostile and unacceptable behavior in the workplace. Creating a workplace that is hospitable, welcoming, and respectful of all individuals is vital if the organizations want to retain the talents of not only their women engineers, but all its employees.

CREATE A SUPPORTIVE NETWORK AT WORK: SUPPORTIVE COLLEAGUES, SUPERVISORS, AND MENTORS MAKE A DIFFERENCE

In past studies on women in STEM careers, isolation and exclusion from informal communication and support networks have been identified as some of the key factors that stall women's mobility and take a toll on their career and job satisfaction (Mattis, 2005; Hewlett et al; 2008; NAE 2002, SWE, 2009). The findings from our research corroborate these results; the need to create support networks for women engineers cannot be overemphasized. However,

while these may involve deeper, and system level changes, our findings particularly suggest that implementing changes at the more micro-level can also make a huge difference to the satisfaction, commitment, and withdrawal levels of women engineers. In particular, women engineers reported an array of positive attitudes and behaviors when they worked with supervisors and colleagues who could be relied on when things got tough at work, when they were easy to talk to and actually listened to their problems at work, and when they went out of their way to make things easier at work for them.

CREATE OPPORTUNITIES FOR FORMAL AND INFORMAL MENTORING

The importance of having role models and mentors to one's professional growth and progress cannot be overemphasized. Women in STEM careers are particularly at a disadvantage because of the absence of such sources of support from other senior members (Mattis, 2005; NAE, 2002; SWE, 2009). Many women engineers in our research – including those who left and those still working in engineering – did not have a mentor. For the women who were still working in engineering, and did have a mentor, we found higher levels of job and career satisfaction and lower intentions to leave the engineering field or the company. Lack of mentors and role models take a toll not only on women engineers but also hurt the companies that employ them. Organizations need to consider implementing not only formal-mentoring programs, but also provide workplace forums for informal mentoring and coaching relationship to develop. Mentoring is especially critical in the first few years of the employee's tenure and should be seen as an extension of the engineer's on-boarding process (NAE, 2002). A network of supportive colleagues, senior managers (within and outside the chain of authority), coaches, and mentors would not only help women engineers get a better fit with their work groups and the organizations but also help them build their organizational knowledge that is vital for advancement.

OFFER WORK-LIFE INITIATIVES THAT ARE EMBEDDED IN FAMILY SUPPORTIVE CULTURES

A recent survey conducted by the American Association for the Advancement of Science (AAAS, 2010) found that of the 1,300 men and women scientists that were surveyed, 61% women reported that balancing work and family was a prominent barrier for them. Other studies of women in STEM fields revealed similar findings (SWE, 2007).

In the POWER study, the experience of work-family balance influenced engineers' satisfaction, commitment, and

withdrawal intentions. Women engineers who experienced work-family conflict were less satisfied with their jobs and their careers, less committed to their organization and the profession, more disengaged from work, and more likely to contemplate leaving their organization as well as the profession. Work-family conflict was also positively related to the general experience of incivility in the workplace as well specific incidents of undermining instigated by supervisors and co-workers.

Organizations with family-supportive cultures that did not impose excessive time commitments at work and were characterized by empathetic managers who understood their employees' work-family concerns benefitted from having satisfied and committed employees who were less likely to want to leave. These employees also experienced lower work-family conflict on the whole, although there were asymmetric effects for the two types of conflict. Further, women engineers who worked for organizations that provided work-life initiatives (such as job-sharing or flexible work time) reported lower levels of work interference with family and greater intention to stay with their current organization and in the profession than those who did not work for such organizations. The use of work-life initiatives was associated with high levels of family-to-work conflict suggesting a possible mismatch between the benefits used and the specific personal/family needs of the person.

What these findings suggest is that for companies to realize optimum results from their work-life initiatives, they need to do two things: first, understand the work-life (as opposed to mere work-family) needs of their employees and accordingly, offer specific, tailored initiatives to meet those needs. The work-life policies included in this study broadly covered dependent care and flexible work arrangements. Organizations should be proactive and periodically revisit these initiatives and determine whether the initiatives are still working as intended, or they need to be changed to better address their employees' concerns. Such an effort will help organizations avoid the familiar work-family backlash (Young, 1999) that may be experienced by employees who may feel left out by the scope of these benefits. The bottom-line is that, not only one-size doesn't fit all, but even if it does, the fit changes over time and needs to be readjusted.

Second, work-life benefits are not likely to be used effectively unless they are embedded in organizational cultures that truly recognize and support employees' need for work-life balance. A family responsive work culture, in and of itself, is limited in what it can accomplish unless accompanied by tangible, tailored policies that do not penalize people for using them. The use of work-life initiatives may be accompanied

by unintended consequences such as less favorable performance reviews, reduced opportunities for promotion, and other career penalties (Judiesch & Lyness, 1999) unless these policies are embedded in cultures that recognize, legitimize, and respect their employees' family and personal lives. Organizations can begin to change their work-life cultures by conveying that it is the job performance that truly matters and not mere face time, by training their supervisors to appropriately address their subordinates' work-life concerns, by providing work-life support groups, and redesigning work processes that may be more compatible with employees' non-work lives (Greenhaus, Callanan, & Godshalk, 2010). Changing the work-life culture in an organization can be a slow and painstaking process, but the costs of not doing so are higher.

In sum, the study revealed that while organization's systems, policies, and actions mattered a great deal, the *micro-climates* at work, characterized by supervisors and colleagues who supported or undermined, also exercised a profound influence on women engineers' satisfaction, commitment, and ultimately, their desire to leave the company and/or the profession. Women engineers will be more likely to fully invest their talents in companies where they see they are being treated with fairness and respect, where their contributions are recognized and valued, their professional skills developed and enhanced, and their work-life balance needs respected and addressed. Keeping women in engineering will require a multi-pronged approach that includes improving interpersonal and organizational climate along with tangible changes to work role, promotion, and opportunity structures within the company.

Recommendations for Colleges of Engineering

Sixteen percent of the participants in this study graduated with a bachelor's degree in engineering but never entered the field. Many of these women used their training and knowledge to succeed in other fields. However, about half said that they did not enter engineering because of their perceptions of the work environment. Thus, the findings from this study also have implications for educational institutions that train and educate women engineers. Given the patterns of findings, we offer three key recommendations to engineering universities and programs.

STRENGTHEN UNIVERSITY-INDUSTRY PARTNERSHIPS BY ALIGNING CURRICULUM WITH ORGANIZATIONAL EXPERIENCES

First, it is imperative that women engineering students are provided with networking opportunities with current engineering executives in order to get a realistic preview of engineering tasks and workplace cultures. This could be accomplished by designing internships, externships, and co-op programs that expose them to engineering workplaces. Such experiences could be instrumental in not only helping female engineering students get an up close and personal view of what to expect after they graduate, but could also set the foundation for important mentoring and role-modeling relationships.

CREATE CLIMATES THAT HAVE ZERO TOLERANCE FOR INCIVILITY

Similar to our recommendation that organizations need to develop policies that create a culture of civility, educational institutions need to have zero tolerance for rude or hostile behavior. Participants in our study provided a number of examples of classroom climates that were unwelcoming or hostile. Unfortunately, their examples included both faculty and fellow students' comments and behaviors in and out of the classroom. Universities need to convey to faculty that it is their responsibility to create the expectations that sexist behaviors and comments in classroom as well as outside the classroom (e.g., labs, outside groups, student organizations) will not be tolerated.

TEACH STUDENTS CAREER MANAGEMENT SKILLS

We strongly encourage engineering programs to consider incorporating career management courses that focus on workplace skills and behaviors for all students, and not just for women. For example, courses that focus on helping students learn how to work as part of a team, how to manage projects, how to communicate effectively, how to negotiate, and how to manage conflict and interpersonal differences, will help prepare students to pursue successful careers in engineering.

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