STEMMING THE TIDE REVISITED: PUSH-PULL FACTORS THAT SHAPE ENGINEERS' ENGAGEMENT

Nadya A. Fouad, Ph.D and Romila Singh, Ph.D.
University of Wisconsin-Milwaukee

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WHERE DISCOVERIES BEGIN

UNIVERSITY of WISCONSIN
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Our Research Team 2008-2015
Nadya Fouad and Romila Singh

- Mary Fitzpatrick
- Jane Liu
- Melissa Rico
- Michelle Parisot
- Catia Figueiredo
- Wen-hsin Chang
- Kevin Cappaert
- Min Wan
- Gary Young
- Tansu Mutlu

Agenda

- Why?
  - "STEMming the tide"
  - "Engage"-ing the Engineers
- How?
  - Research Studies
- What?
  - Summary and recommendations
  - Best Organizational Practices

WHY?

Women in Engineering: Current Status

- Women comprised more than 20% of engineering school graduates for past two decades (18% in 2012).
- Concern about underrepresentation for 3 decades
- Many efforts at Undergraduate, then K-12 levels to address STEM Education
- $ 3.4 billion in federal funds for STEM Education in FY 2010
- BUT 11% of practicing engineers are women- consistent for over 30 years

STRONG FEMALE LEAD

1.6K SHARES

WHY ARE WOMEN LEAVING SCIENCE, ENGINEERING, AND TECH JOBS?

WOMEN WORKING IN STEM FIELDS ARE 45% MORE LIKELY THAN MEN TO LEAVE WITHIN THE YEAR, AND IT'S NOT FOR LACK OF ENTHUSIASM.

BY JANE PORTER

Recent research from the Center for Talent Innovation shows U.S. women working in science, engineering, and tech fields are 45% more likely than their male peers to leave the industry within the year.

It's not for lack of enthusiasm or passion. Of those women surveyed, 80% say they love their work, yet many still report barriers to getting to the top.

"Microsoft reported earlier this month that its staff ***was only 29% women***.
At Google, ***the figure was 30%.***
For Facebook, the percentage of women was 31%,
but just 15% in technical jobs."

--Diversity Reports (Aug. 2014)

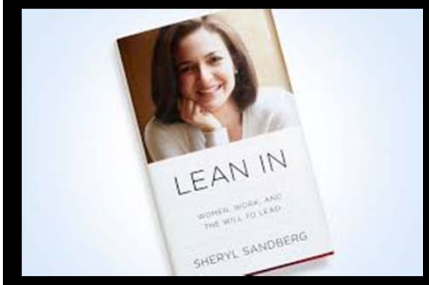
The Lack of Women in STEM Is a National Security Issue

It's important to show young women that non-STEM interests can still lead them to STEM fields.

Attracting more women to study science, technology, engineering and math isn't just an aspirational goal for education leaders and the business community – it's a "national security prerogative," according to the chief operating officer of the National Geospatial-Intelligence Agency.

Women in Engineering: Current Status

- Engineering profession has the highest turnover compared to other skilled professions: accounting, law, medicine, and higher education.
- Return on Investment (ROI) on STEM careers is not optimally realized
- Loss of engineers=loss to organizations, loss to society, loss to the U.S.s competitive edge, loss to innovation, loss to individual



"[We] hold ourselves back in ways both big and small, by lacking self-confidence, by not raising our hands, and by pulling back when we should be leaning in."

— Sheryl Sandberg, *Lean In: Women, Work, and the Will to Lead*

Are we asking the right question?

Fix Women?

Fix the work environment?

HOW?

Project on Women Engineers' Retention (POWER): Study Site and Method

- 3-year, NSF-funded longitudinal study
- Formally partnered with top 30 universities with the highest number of women engineering graduates (list from ASEE, 2008).
- Reached out to female engineering alumnae through email and postcards
- Women from an additional 200 colleges participated in the survey after hearing of this study through colleagues

Study Site and Method

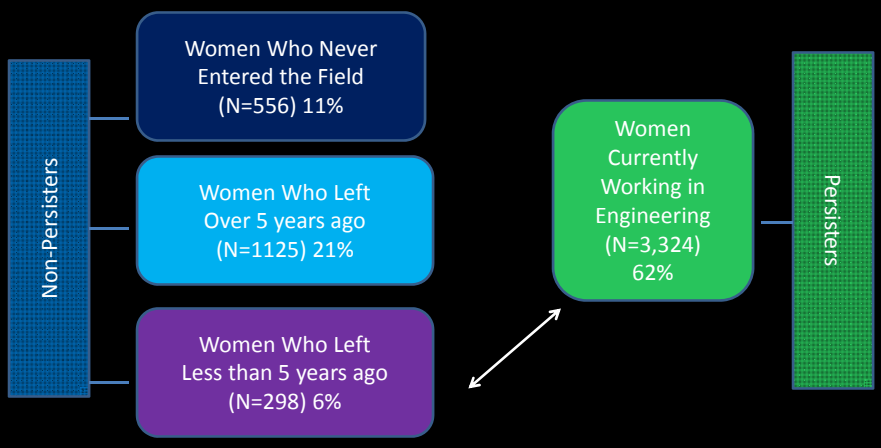
- As of August 2012, over 5,700 women responded to the survey; (Response rate ~ 31%) (5303 useable responses)
- Engineering alumnae targeted across different life and career stages (graduates spanned over six decades: 1947-2010)
- Thousands of women added comments at the end of survey
- *Who's an engineer?* Women asked to self-identify whether they were currently working in engineering

Partner Schools

California Polytechnic State University, SLO	Southern Illinois University
California State Polytechnic University, Pomona	Stanford University
California State University, Northridge	University of California, San Diego
Cornell University	University of Florida
Georgia Institute of Technology	University of Illinois
Iowa State University	University of Maryland
Marquette University	University of Michigan
Michigan State University	University of Missouri-Kansas City
Massachusetts Institute of Technology	University of New Mexico
North Carolina State University	University of Texas, El Paso
Ohio State University	University of Washington
Penn State University	University of Wisconsin-Madison
Purdue University	University of Wisconsin-Milwaukee
Rutgers University	University of Wisconsin-Platteville
San Jose State University	Virginia Tech

Participants: Four Groups

Three most cited majors: Industrial Engineering, Chemical Engineering, and Mechanical Engineering



Left less than 5 years ago:

Women Who Left Less than 5 years ago (N=298) 6%

- Two-thirds left to pursue *better opportunities* in other fields and organizations
- A third left to stay home with the children *(because companies weren't flexible enough to accommodate work-life concerns)*
- Currently:
  - 54% in Executive roles, 22% in Project Management and/or Management roles, 24% in Individual Contributor roles
- Average compensation: $51,000-$100,000

In their own words…

Left Less than 5 years ago (N=298) 6%

"Women leave engineering due to a *lack of job satisfaction*, lack of reliable female role models, *inflexible work schedules*, workplace discrimination, *white mid-western men syndrome*, and glass ceiling issues."
– Latina Civil Engineering Graduate

"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

"…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

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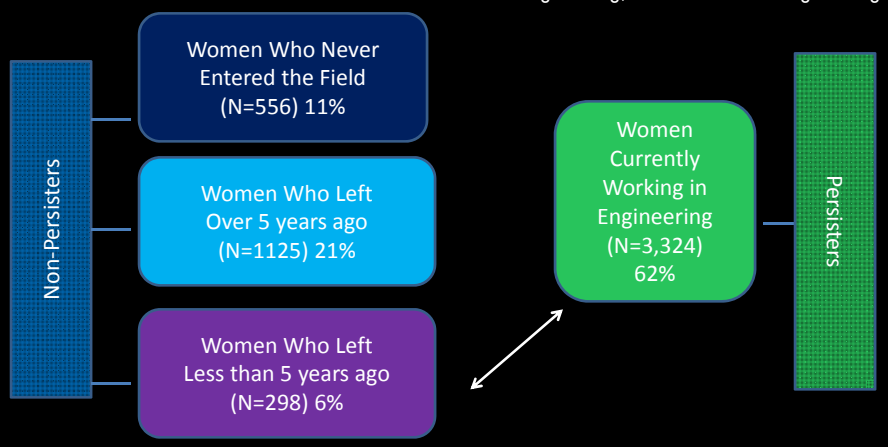


Current Engineers

Persisters (N=3,324) 62%

- On average worked 43.5 hrs/week, 8 years at organization
- Salaries ranged from $76,000 to $125,000.
- About half of them were “individual contributors,” one-third were in project management positions, 15% were in executive roles.
- Majority of managers supervised between 1 to 5 individuals.
- Group composition was predominantly male, 18% reported working in gender-balanced groups.

Electrical Engineers N= 671

- Average Age: 40
- 258 not working as engineers
- Half married, relatively equally distributed across cohorts, biggest 1984-89 and 2000-2004

Electrical Engineers N= 671

- Only 7% have additional degrees
- Top industries: Aerospace, Government, Computer Services, Communications, Education
- 91% working full time
- Half are individual contributors, 30% executive management, 19% managers

In their own words….Persisters

- I just don't feel connected to it as a field of work; it is very male dominated and black and white with a focus on THINGS/mechanisms, without a tie to a greater purpose.
- [There is a] Lack of training directly applicable to job, lack resources and facilities to perform job, unethical workplace, uninteresting job functions
- I personally never had problem working in engineering areas and I feel it's closer to my heart and my mind. I feel than dealing with people. it's easier handling computer related issues

In their own words….Persisters

- I still want a good paying job, which is what engineering has provided me, but I don't really consider it a career. Also, you get to a certain level and there's no where higher to go unless you want to put in much more time at work and at home, and even then, there's no guarantee as there are less numbers at the higher levels.
- Although many of my male coworkers have families and talk about their kids, most of them also have a stay at home wife which enables them to put in enough energy to work.

In their own words…Nonpersisters

- I left engineering b/c salary/compensation was much more lucrative in other fields
- I was tired of dealing with the men who thought women were not equal (including a boss who used to change shirts in front of me). I was tired of being underappreciated by bosses at three different companies.

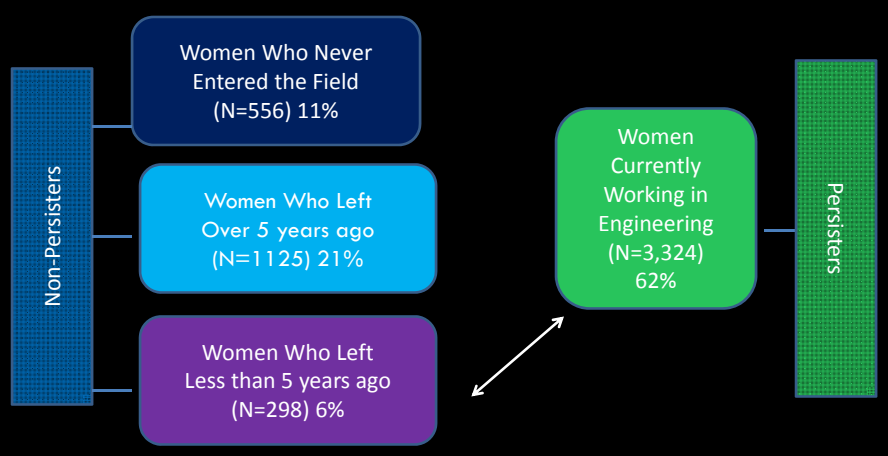
In their own words…Nonpersisters

- Lack of flexible hours. No possibility to work part-time and be taken seriously._
- I left engineering because I lacked the passion for the work and the desire to continue to learn. …I just was not excited about the work I was doing each day. I was bored and uninterested.
- I was bored, not given good assignments, wanted to get out of the defense business

In their own words…Nonpersisters

- Had I stayed in my engineering position, other issues would need to be addressed. 1) business culture of long hours in salaried positions 2) business culture (contract manufacturing) of not always being honest with customer at levels higher than mine that made engineering discussions difficult 3) culture of not stopping production to prevent manufacturing defects

Do Persisters differ from Non-Persisters?



Do Persisters and Non-Persisters Differ?

Random sample of 250 persisters compared to 264 non persisters

Persisters	Non-Persisters
• 82% White, 9% Asian, 4% Latina and 2 % African American, • 67% married/partnered, • Mean age 36 • Median earning of $75,000-$99,000	• 79% White, 8% Asian, 3% Latina and 3 % African American, • 65% married/partnered, • Mean age 35 • Median earning of $75,000-$99,000

Do Persisters and Non-Persisters Differ?

Non Persisters

NO Differences

- Self Confidence
- Outcomes Expected
- Interests

Persisters

Do Persisters and Non-Persisters Differ?

Non Persisters

Persisters: Greater

- Perceived Manager Support Work/family Balance
- Training and Development Opportunities

Persisters

Persisters

Leaving Engineering
OR
Being Pushed Out?

Flight Risk?

Persisters
(N=3,324)
62%

Why are women considering leaving their organizations?

Why are women considering leaving the engineering profession?

Correlated *r* =0.55

Organizational Flight Risk

Persisters
(N=3,324)
62%

- Women who thought about leaving their organizations experienced :
  - excessive workload without enough resources, conflicting work demands, and unclear expectations about work goals and standards
  - a career plateau with few advancement opportunities
  - low satisfaction with their jobs and careers
  - a variety of climate related barriers

Climate Related Barriers

Persisters
(N=3,324)
62%

- Undermining behaviors by managers and co-workers:
  - Being belittled, insulted, talked about behind their back
  - Being pulled back when trying to succeed at work
- Perceptions that companies stressed:
  - Face-time
  - Taking work home on weekends and evenings
  - Working more than 50+ hours/week to get ahead
  - Regularly putting work before family

Professional Flight Risk

Persisters
(N=3,324)
62%

- Poor workload management
- Supervisor undermining
- Lack of training and development
- Lack of promotion opportunities
- Perception of poor organizational support

It's the climate, stupid!

TOM PERRY
DIRECTOR, ENGINEERING EDUCATION
AMERICAN SOCIETY OF MECHANICAL ENGINEERING

Why Do Engineers Stay?

ENGAGE

- Currently recruiting
- Men and women who identify as engineers
- Professional associations
- Organizations

Who's responded to date? (N=1743)

	Men (63%)	Women (37%)
Age **Industry Tenure** **Org. Tenure**	Mean 50.59 years 25.52 years 14.74 years	Mean 39.72 years 14.12 years 8.84 years
Race	92% White	88% White
Marital Status	83% married	61% married
Dependent care (Children)	43% have children	38% have children
Working hours **Compensation**	Mean: 45.1 hrs/week $101-125k	Mean: 44.6 hrs/week $76-100k
PE License	77% have	52% have

What Predicts Engagement?

- Workload management
- Psychological safety at work
- Supportive leadership behaviors
- Fair and Transparent promotion and mobility policies, avenues
- Equitable developmental opportunities
- Supportive work-life policies AND culture

NO Gender Differences!

- Workload management
- Satisfaction (Pay)
- Training and development opportunities
- Promotion opportunities
- Level of work-family conflict

Where do Men and Women Differ?

- Supervisory Undermining (W > M)
- Job search behaviors (W > M)
- Work withdrawal (W > M)
- Engineering turnover intentions (W > M)
- Job Turnover (W > M)
- Work Withdrawal (W > M)

Where do Men and Women Differ?

- Empowerment (M > W)
- Perceptions of Organizational Support (M > W)
- Job and Career Satisfaction (M > W)
- Job and Career Commitment (M > W)
- Fit with engineering profession (M > W)
- Engagement (M > W)
- Satisfaction with desired promotions (W > M)
- Psychological safety (M > W)

In their own words: Why are Engineers Engaged?

- "*My boss is very supportive* of his employees, giving kudos and *kind words for accomplishments*, and *encouraging us to try and have work/life balance*."
  --Male engineer
- "One of our senior project managers *will brag about me to anyone who will listen which helps me out quite a bit*."
  --Female engineer

In their own words: Why are Engineers Engaged?

- "I love that I can *make a difference*.. Especially the ability to work on large-scale projects that *impact a lot of people*." --Male engineer
- "I love my job because I can be *engaged in solving problems*." --Female engineer

Engagement is Malleable

What Can Organizations Do to Retain & Engage Engineers?

Step 1: Recognize the problem

Step 2: Change starts from the top, but leaders all the way down to the front-line supervisor must model the change.

Step 3: Implement system-wide changes; reinforce the change with metrics and accountability

Step 4: Implement role-level changes (fair, realistic workload management standards)

Summary and Final Thoughts

- Women's departure from engineering is not a "women's issue" and just about "leaning in"
- Climate issues and advancement opportunities lie at the heart of women opting out and/or not leaning in
- Good management practices are good for all employees

Call to Action!

- How are YOUR engineers engaged?
- How and where to change the work environment?
- We can help!
- www.nsfengage.org
- It's about the future-a stronger, more innovative future. (paraphrasing Emily Howard, Chair of Technical Fellowship, Boeing)

"Too many work standards remain inflexible and unfair…Too many talented women try their hardest to reach the top and bump up against systemic barriers.

— Sheryl Sandberg, *Lean In: Women, Work, and the Will to Lead*

"***We as women must be able to bring ourselves fully to the workplace -- as ourselves, not by emulating men.*** Our future as a technical society depends on the kinds of leadership, insights and wisdom that women can bring to the workplace.

To empower women to become and remain engineers in this way means ***overhauling our educational systems as well as workplaces***, changes that can be made by dedicated people over time."

Caucasian Non-persister, Computer Engineering

Thank you!

nadya@uwm.edu
romila@uwm.edu

ENGAGE
Engineers engaged in creating change

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Non-Persisters

- Women Who Never Entered the Field (N=556) 11%
- Women Who Left Over 5 years ago (N=1125) 21%
- Women Who Left Less than 5 years ago (N=298) 6%

Persisters

- Women Currently Working in Engineering (N=3,324) 62%

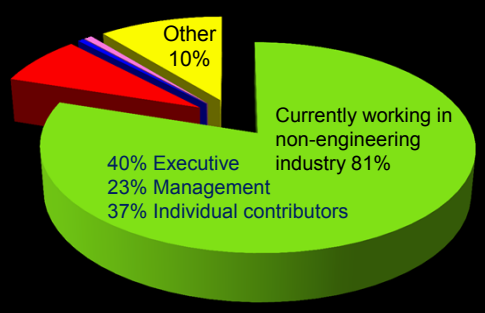
Some never entered the field:

Women Who Never Entered the Field (N=556) 11%

Why Didn't They Enter?

- Not interested in engineering (24%)
- Wanted to start their own business (18%)
- Didn't like the engineering culture (17%)
- Planned to go into another field (15%)
- Low salary (7%)

Where Are They Now?



In their own words…

Women Who Never Entered the Field (N=556) 11%

- "At the time I graduated no one was hiring except for the computer consulting companies that 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

- "I interviewed with a company where there were no women, no minorities and one in the young adult age group."

– African American Chemical Engineering Graduate

- "My first-class engineering education allowed me to pursue extraordinary opportunities as a strategy consultant."

– Caucasian/Latina Chemical Engineering Graduate

In their own words…

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Women Currently Working in Engineering (N=3,324) 62%

Persisters

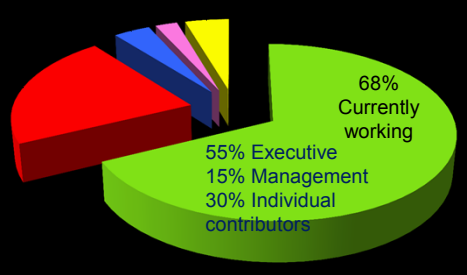
Those who left more than five years a

Women Who Left Over 5 years ago (N=1125) 21%

Why Did They Leave?

- To fulfill care-giving responsibilities (17%)
- Not offered opportunities for advancement (12%)
- Lost interest in engineering (12%)

Where Are They Now?



In their own words…

Women Who Left
Over 5 years ago
(N=1125) 21%

- " To advance, it 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

- "There isnt 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

What would motivate you to leave?

- The challenges in workplace culture part is an interesting question and leaves me a little depressed when I look back, particularly with other female engineers I started out with during my earlier career days. (Male)
- Getting a job with the opportunity for more autonomy, advancement and/or responsibility (Male)

What would motivate you to leave?

- If I felt that I could no longer contribute to meaningful projects, I would start looking for something else to do. (Male)

What would motivate you to leave?

- A big enough challenge with significant financial incentive. (Female)
- Hostile work environment or overly tedious work, or unreasonable work demands.