

## Role Models in Engineering and Technology

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### Abstract

“The telephone. The light bulb. The automobile? Quick. Name the inventors. Of course you can. How about the flat-bottomed bag, bulletproof vest, and Scotchgard? The dishwasher, the fire escape, AZT? Of course you can’t. Why? Because they were invented by women,” says Anne McDonald<sup>9</sup>.

Women have been making strides in engineering and technology for many years. This is apparent by the above mentioned inventions. However, women in the fields of engineering and technology could not have made these strides without working through the challenges they faced. In the past women were not encouraged to admit to their inventive or mechanical talents. According to McDonald, “rather than admit to such unladylike leanings, it was not unusual for women in the 1800’s to claim to be under the influence of spirits when defending their inventions.”<sup>9</sup> For example, Amanda Theodosia Jones told the world that her idea for vacuum canning came from her brother’s ghost that was instructing her from the grave, and not from any personal cleverness<sup>9</sup>. The ironic part of all of this is that being mechanically talented was not accepted, but receiving instructions from a ghost was.

This paper focuses on women who are currently in the fields of engineering and technology, and discusses their successes and their challenges. While the challenges women face today do not relate to “ghosts”, they still create roadblocks that women must recognize and overcome.

### Introduction

When young women are considering career choices, they sometimes have the false impression that women cannot advance in careers in engineering and technology as successfully as men can. These impressions may result from the lack of information about women who have been successful and how they succeeded. Literary research documents that women in all fields still encounter many challenges on their way to success. This fact may be even more true in the male dominated fields of engineering and technology. However, many women have overcome these challenges, and these women can serve as role models who are willing to share their secrets of success with other women.

Recently, fifty women from thirty-nine different companies participated in a survey. Each of these women is currently working in an area of engineering or technology. The survey was designed to gather data about facilitators that have helped them achieve success, and to identify challenges the women have faced along their career paths. The result of this survey is a concrete list of tips that other women may find useful in navigating hurdles on the road to success in engineering and technology.

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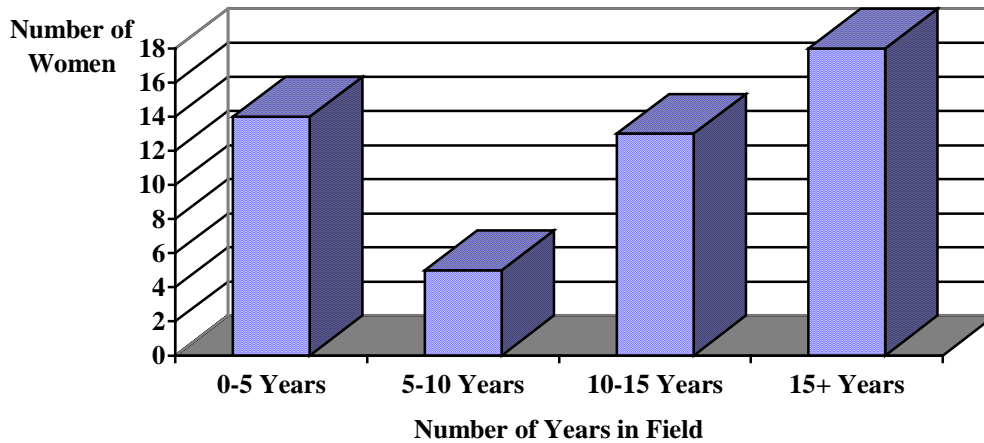
### The Survey and the Respondents

The women surveyed represented a variety of professions within the engineering and technology fields. Refer to Figure 1 below for the breakdown. The women surveyed had spent anywhere from 1 to 15-plus years in their fields. A majority of the women represented the 15-plus category, as shown in Figure 2. Other demographic information revealed that the respondents to this survey worked for companies that ranged in size from 1-100,000 employees. The survey also divulged that the respondent’s education level ranged from a high school diploma to a Ph.D. with a majority having a Bachelor’s and/or a Master’s degree.

**Figure 1: Number of Women Surveyed in Each Field**

Information Systems	22
Medical Technology	7
Mechanical Engineering	5
Computer Engineering	3
Manufacturing	3
On-Line Technologies	3
Chemical Engineering	2
Technical Education	2
Agricultural Engineering	1
Industrial Engineering	1
Aviation Technology	1
Total	50

**Figure 2: Years in Field for Women Surveyed**



*“How to Succeed In Business”* from Successful Women in Engineering and Technology

All of the women surveyed considered themselves successful in their fields. As part of the survey process, these women commented on facilitators for advancement and made recommendations regarding how others could achieve their career goals. These tips may be especially helpful to women graduates who are just starting out. A majority of these tips could be divided between the three following categories: (1) internal factors for success -- or how you can help yourself succeed, (2) external factors for success -- or how others can help you succeed, and (3) continuous education/learning factors for success -- or how education/learning can help you succeed.

#### Internal Factors for Success

- Be yourself
- Prove yourself in actions not words.
- Don't be intimidated in an all-male environment.
- Have confidence in yourself and your abilities.
- Be prepared to be challenged.
- Be in charge of your time.
- Be prepared to take risks.
- Be smart, noisy, and persistent.
- Know what you are talking about.
- Gain respect slowly.
- Ask lots of questions and ask others for help.
- Set goals and find out how to achieve them.
- Cultivate an awareness of other's agendas.
- Have an agenda yourself.

- Voice your opinions where warranted.
- Don't be intimidated by others.
- Suggest creative "twists" to old ways of doing things.
- Don't measure your success by comparing it to the success of others.
- Work twice as hard and "smarter" than your male counterparts.
- Ignore as much of the pettiness in the work place as possible.
- Be as mobile as possible (at first).
- Never be afraid of change.
- Go with the flow of life.
- Love what you do, and if you don't--change what you do.
- Know your job better than anyone does.
- Keep your sense of humor.
- Trust your instincts (especially in selecting a career).
- Recognize the people (publicly if possible) who help you on your way.
- Volunteer for activities you believe in.
- Network, network, network!
- Join professional organizations and meet other women in your career field.
- Be able to set priorities - personal and professional.
- Pick a spouse who is supportive.
- Be persistent.
- Be "high profile."
- Be prepared for the next promotion.
- Be ready to move on if the promotion doesn't come.
- Play by your own rules.
- Do not conform to the "boys club" rules.
- Be in the right place at the right time and recognize it.
- Don't expect yourself to be "super woman".
- Work so that you have time for family and personal responsibilities.

#### External Factors for Success

- Look for a great manager.
- Look for a great mentor (preferably another woman).
- Pick a company that is family friendly.
- Pick a company that offers tuition reimbursement and continuing education opportunities.

#### Continuous Education/Learning Factors for Success

- Learn how to learn.
- Don't become obsolete.
- Make sure your communication skills are top notch.
- Learn how to problem solve.

- Learn about new ideas and concepts.
- Learn to work well in teams.
- Learn leadership skills.
- Learn time management skills.
- Learn about the different areas of your field.

## The Challenges Women Have Faced

Even though all the women surveyed considered themselves successful in their fields, they indicated that they had faced many challenges along the way. These challenges fell into four major categories: (1) the leaky pipeline, (2) balancing family and career, (3) the glass ceiling, and (4) gender differences.

### Leaky Pipeline

The leaky pipeline is a metaphor for the mechanism that should deliver qualified females into careers in engineering and technology. This pipeline starts with pre-school age girls and continues throughout the educational process. However, as statistics have shown, young girls frequently drop out of this pipeline delivery system as they pass through the various grades of schooling. In fact, the engineering and technology pipeline leaks women at every twist and turn. Factors that contribute highly to the leaky pipeline syndrome include: (1) the lack of necessary schooling, (2) lack of family encouragement, (3) lack of female role models, and (4) lack of required skill building<sup>3</sup>.

Supporting research shows that 16% fewer girls than boys talk to their parents about science and technology issues<sup>3</sup> during their early school years. It is also reported that 34% of high school girls do not take senior math on the advice of a teacher or counselor<sup>3</sup>. Although most girls are as talented in math and science as boys are, and most girls are excited about science during their childhood, they begin to lose interest in math and science around the age of twelve<sup>3</sup>. Another discouraging statistic recently revealed that in 1997 only 18% of B.S. Degrees awarded nationwide in Engineering were awarded to women<sup>15</sup>. These statistics suggest that women are either not enrolling in university engineering programs in the first place or are dropping out before graduation.

Lack of skill building in young women can easily be resolved. “Every girl should have mechanical toys like Lego sets”, says Erica Williams of Systems Integrators, Inc<sup>32</sup>. Toy building sets and video games are usually advertised for boys, while girls are encouraged to play with “girl toys” such as dolls. “Girls encounter a world of video games designed almost exclusively for boys”, according to Ilana DeBare of the Sacramento Bee<sup>8</sup>. To influence girls toward science and technology, opportunities should be provided for every young girl to develop dexterity, math, science, and computer technology skills. Family and educators also need to provide encouragement for girls to practice spatial reasoning and analytical skills—beginning at an early age.

Much is being done to increase the number of women making it through the pipeline. For example, Advocates for Women in Science, Engineering & Mathematics (AWSEM) is an advocacy program designed to promote science and math for young women ages 11-18. Hollis MacLean, Director of AWSEM, states, “AWSEM is built on the belief that giving girls a chance to have meaningful interactions with female role models in the sciences is the single most powerful thing you can do to change attitudes and stereotypes.” In addition, AWSEM and Women in Technology International (WITI) have formed a partnership to promote nationwide interest in science and technology for young women. Through organizations like AWSEM and WITI, young high school women are offered opportunities they have not had in the past. By being exposed to math and science at a young age and interacting with encouraging role models from engineering and technology fields, women will be more likely to survive the leaky pipeline.

A majority of the women who participated in this survey reported that they were leaky pipeline survivors. They felt they were lucky to have been exposed to math and science early in their education and also had exposure to other women who served as role models. Thus they have been successful in engineering and technology and can serve as role models (mentors) themselves.

### Balancing Family and Career

Having a family and maintaining a successful career at the same time are reportedly among the toughest challenges that women in this survey have faced. Careers in engineering and technology are often more demanding than other types of careers. This makes juggling both career and family more difficult. Working for a company that offers family friendly benefits makes this juggling act much easier. At one time employment that offered family friendly benefits was seldom an option for women in the workforce. Today, before accepting a position in an engineering or technology field, women should be sure to ask about or negotiate for family friendly benefits from the employer.

One family friendly benefit that is often overlooked is equal compensation. It is well recognized that women are still paid less on the average than men are. While the gap is reportedly narrowing, women must demand to be paid equally for equal work.

Flexibility in the workplace is another family friendly benefit that is cherished by women who are juggling both family and career. Job sharing, where two half-time employees work to meet the demands of a full-time position, is a popular practice. Flexible scheduling is also beneficial since it allows a working mother to adjust her schedule to match school or child-care schedules. Telecommuting has also become a popular family friendly option. With the increased use of technology in the workplace, many companies now allow their engineering and technology employees (male and female) to work from home.

Other family friendly benefits may include:

- On site child care services
- College tuition reimbursement

- College scholarships for children of employees
- Life insurance
- Dental insurance
- Short term disability
- Sick days for dependent's illness
- Elderly care service referrals
- Women's health care (free mammograms)
- Phase back to work
- Family leave

## Glass Ceiling

After two decades, the glass ceiling still exists—preventing women from climbing to the top of their professional ladder. The glass ceiling is that invisible barrier that blocks women from the top jobs in corporate America. The women who participated in this survey reported that one way they have broken through the glass ceiling has been by consistently exceeding performance expectations to prove their ability.

Catalyst, a nonprofit research firm based in New York, surveyed 325 males and 461 females about the glass ceiling<sup>17</sup>. The results indicated that male CEOs blame the glass ceiling on a shortage of women in the corporate pipeline. They believe that until recently the executive talent pool did not have enough women with the kind of managerial experience that makes them capable of being promoted to senior positions. The women that responded to the Catalyst survey said that negative preconceptions and stereotypes about their professional capabilities had stifled their careers<sup>17</sup>. About 49% of the women in the Catalyst survey said exclusion from informal corporate networks was an important factor, and 35% pointed to generally inhospitable corporate climates<sup>17</sup>.

Lorna Rosenstein, of Lotus Development Canada Ltd., described the glass ceiling as an obstacle. As Rosenstein puts it, “Women have to be smarter, more creative, more focused, more bottom-line oriented, simply better than men overall if they want to rise as far; and they still get just 70 cents on the dollar in earnings compared with their male counterparts.”<sup>3</sup>

Of the women we surveyed several contributed ideas to shattering the glass ceiling. Mary Ann Wassenberg offered some creative advice when she said, “unfortunately few women have succeeded. One way to succeed is to buy the company. We need to believe in our capabilities and make our own opportunities. We can start by refusing to buy stock in any company that doesn't have women in its management chain and board of directors, and letting all of them know why. Of course, some of us will have to continue to work in companies that don't have women in these roles; otherwise, they will never get them.”<sup>29</sup>

## Gender Differences

While last in our list of challenges, the challenge of gender difference or gender bias is certainly not one of the least challenges that the women in our survey have faced. Gender bias

is one of the most noticeable and emotional differences in life, which is unfortunately automatically integrated into a workplace stereotype. Susan Fiske, Ph.D., has identified some conditions that most often promote stereotyping at work<sup>11</sup>:

- When one group of people makes up 15 percent or less of a workforce.
- When there is an absence of written rules and policies, the woman's gender becomes her defining trait and gender rather than performance will evaluate her.
- When the people making the decisions have little information about a person to work from, people will go with their 'gut' feeling, which is often stereotypical.

Researchers and policymakers have become even more concerned about why such bias still persists, given women's increasing commitment to work. Nearly every study of women's attitudes shows that women work for the same reasons men do: first of all for the money, but also for the satisfaction of using their skills<sup>11</sup>. Belle Rose Ragins, an Associate Professor of Management at Marquette University in Milwaukee, claims that research findings indicate a continued and "profound disconnect" between female executives and their bosses when it comes to perceptions about gender equity in the workplace."<sup>3</sup>

Respondents to this survey had many tips on how to fight gender differences in the workplace. Most, however, were tips on how women could overcome those differences and not how it could be avoided or prevented. It appears that prevention of gender bias in the workplace will not be possible until more women are in positions to make policy changes throughout corporate America.

## Conclusion

The women who participated in this survey have identified challenges they have faced such as the leaky pipeline, balancing career and family, the glass ceiling, and gender differences. These challenges are familiar to many of us, yet these women have overcome the roadblocks and achieved success in their fields. As accomplished women in engineering and technology they should be and are serving as role models for other young women. In that capacity these role models have shared useful information about how they became successful and what young women can do to succeed in their chosen fields. It is easy to see that both external factors and continuous education/learning factors can help prepare young women for successful careers. However, a majority of the tips provided were "internal" factors or things women must do for themselves. By following the advice of the role models who participated in this survey other young women will be better prepared to avoid the pitfalls that lie ahead, succeed in their chosen careers, and become role models themselves.

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