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WHY WE NEED WOMEN IN DATA SCIENCE

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Ada Lovelace. Jean Jennings Bartik. Grace Hopper. Adele Goldberg. And that's just naming a few.

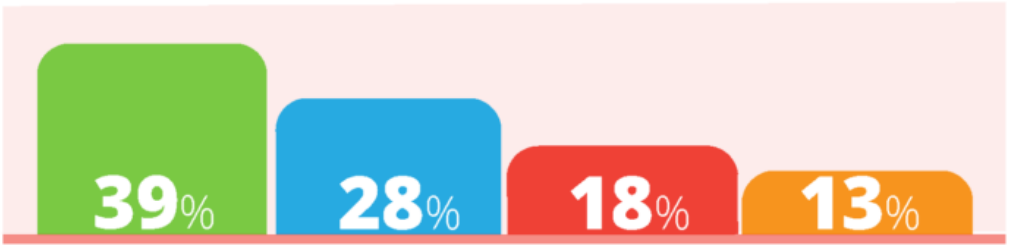
Women have always been instrumental in technology development. Yet, according to a report by the National Center for Women & Information Technology (NCWIT), the amount of women in computing occupations has steadily declined since 1991 (https://www.ncwit.org/sites/default/files/resources/womenintech_facts_fullreport_05132016.pdf), when it peaked at 36%.

Do women now have a general lack of interest in Science, Technology, Engineering and Mathematics (STEM) positions? Is there a bias inhibiting women's success in these roles? Are there cultural elements causing the decline?

We've tried to get to the bottom of the large gender gap in the tech and data science field.

THE FACTS

Women make up only
26% of data professionals:

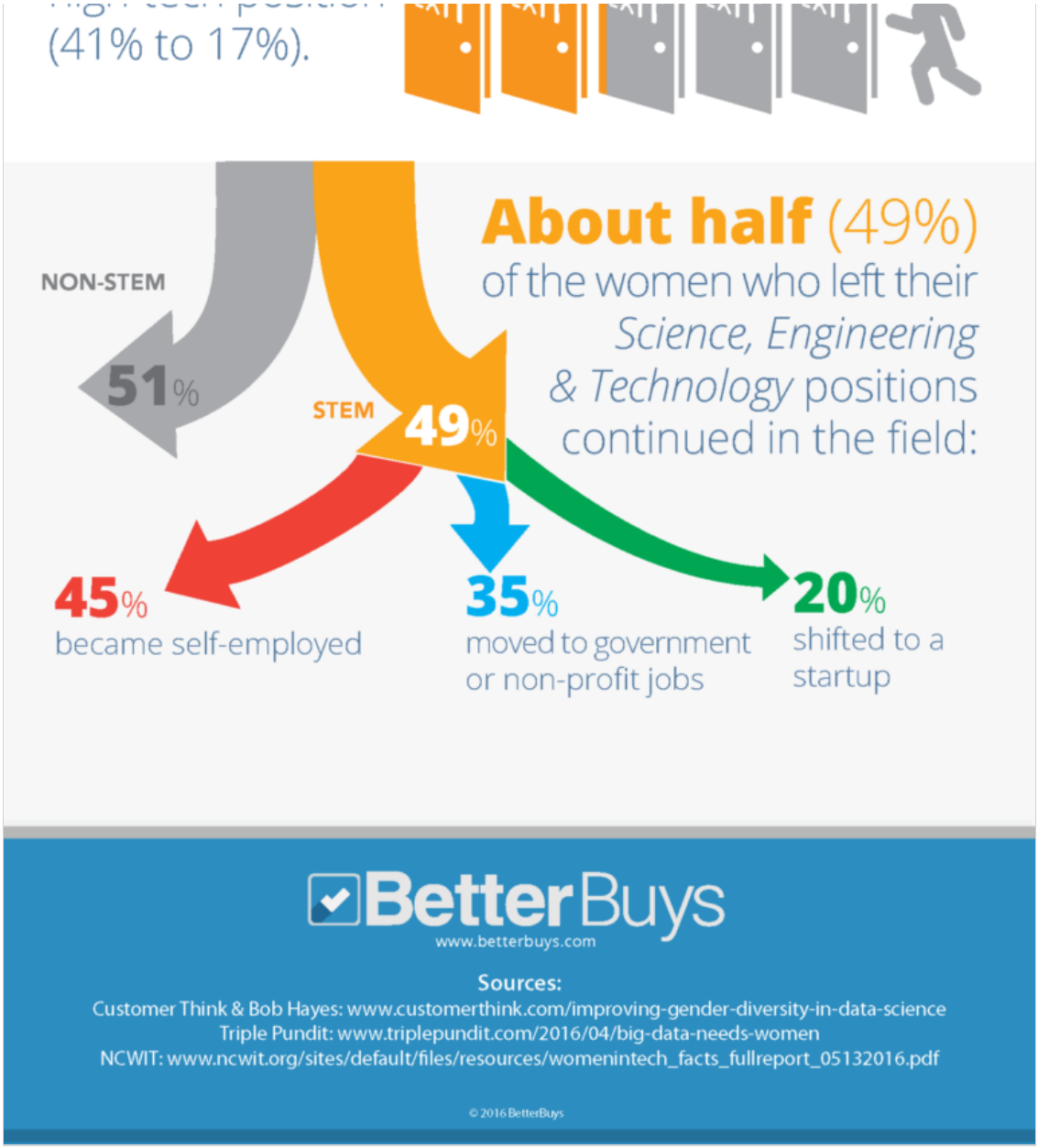


In 2014, women held just

25%
of
CHIEF DATA OFFICER
positions

13%
of
CHIEF INFORMATION OFFICER
positions

Women are **2x** more likely than men to quit a high-tech position



The gender gap in technology and data science has grown significantly over the last two decades, raising global concern about the state of open-mindedness of the information and tech industry. However, O'Reilly's *Women In Data* (http://www.oreilly.com/data/free/women-in-data.csp) report, a book of interviews with today's most prominent women in computing and data science, says that the growing awareness is slowly bringing more women into the field.

In the updated *Women in Tech: The Facts* (https://www.ncwit.org/sites/default/files/resources/womenintech_facts_fullreport_05132016.pdf) report, the NCWIT states that women's involvement in information technology patenting has significantly increased from 1.7% in 1980 to 7.8% in 2010. Also, Triple Pundit reported

(http://www.triplepundit.com/2016/04/big-data-needs-women/) that women held 25% of the Chief Data Officer (CDO) positions in 2014. The CDO is a recently created executive role (http://www.cio.co.uk/cio-career/chief-data-officer-salary-job-description-cdo-role-3596334/) responsible for the overall management of a company's data by developing a data governance structure and leveraging the data for insight. Compared to the number of female Chief Information Officers (CIOs) in 2014, the number of female CDOs was almost twice as large.

The technology field is currently growing, offering an explosion of opportunities for women and men alike. In fact, the U.S. Department of Labor predicts there will be 1.4 million computer specialist positions open by the year 2020, as reported in *How the 'Girls Who Code' Movement Can Change the World (http://www.inc.com/james-kerr/how-the-girls-who-code-movement-can-change-the-world.html)*.

In the article Women in Data Science: 4 Perspectives (http://www.mastersindatascience.org/blog/women-in-data-science/), the four interviewees agreed that "the current landscape is rich with opportunity – regardless of gender," as stated by Dr. Jennifer Priestley of Kennesaw State University.

Claudia Perlich from Dstillery made a comment that the ratio of women to men is not an issue in the field. Instead, she says that women being recognized for the work they do without gender getting in the way is the challenge:

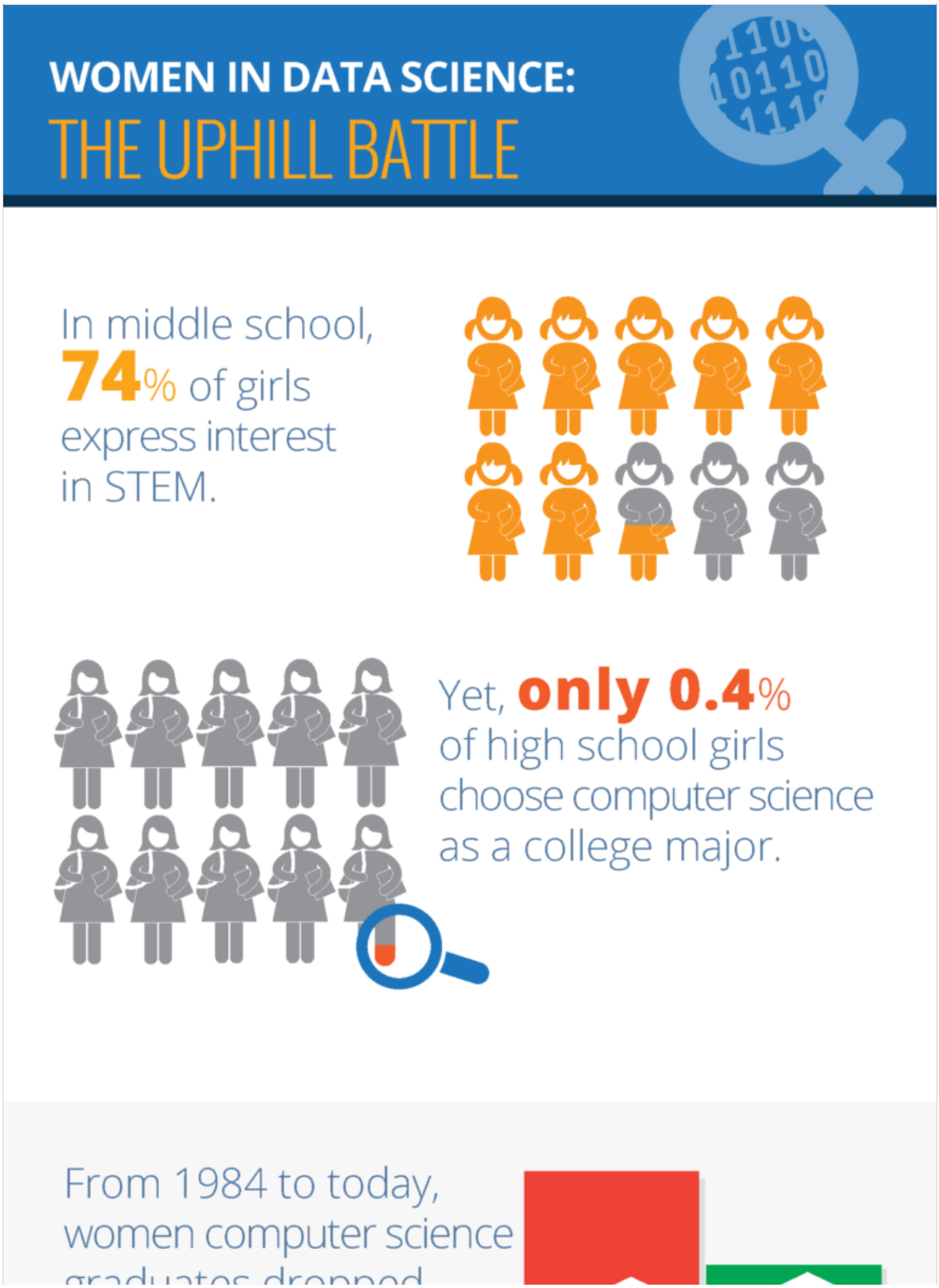
> *Ultimately, data science is another technical field where women remain statistically a minority, but I do not believe that we need to force the issue or "fight" for a higher female quota. I want to come to work and do what I love and be recognized for what I bring to the table and not waste even one thought on the fact that I am female.*

However, like Perlich mentioned, women are still underrepresented in the computing and data science fields overall.

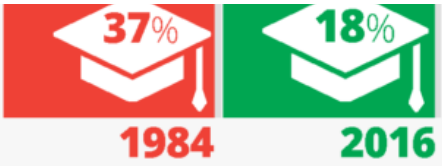
A survey by Bob Hayes (http://customerthink.com/improving-gender-diversity-in-data-science/) of Business Over Broadway (B.O.B.) found that one in four data scientists are women, and they hold only 26% of all data professional positions (https://www.betterbuys.com/bi/comparing-data-science-roles/). According to Girls Who Code (https://girlswhocode.com/), although 57% of bachelor's degrees are earned by women, only 12% of them are in computer science. Of the of the women who left their Science, Engineering and Technology (SET) position, 51% abandoned their training all together, the NCWIT report states.

There's a lot of speculation as to why this happens.

CHALLENGES IN THE FIELD



graduates dropped from **37%** to **18%**.



According to Harvard,women with **8 years of programming experience** are as confident as men with **1 year of programming experience.**

55% of women without children stated they didn't want a leadership role because of the **stress & pressure.**

Women are

There's no argument that the number of women in computing and data science has been dwindling. Even when it was on the rise, there was still a staggering difference between men and women in the field. A number of factors have contributed to this, such as workplace culture, confidence levels, lack

of interest and inherent bias.

Some speculate that the decline of women started when personal computers became commercialized.

As an NPR article, *When Women Stopped Coding* (http://www.npr.org/sections/money/2014/10/21/357629765/when-women-stopped-coding?utm_campaign=storyshare&utm_source=twitter.com&utm_medium=social), states, "The share of women in computer science started falling at roughly the same moment when personal computers started showing up in U.S. homes in significant numbers."

Here's why, according to the article: Early computers, which weren't capable of much more than playing simple games like Pong, were marketed as a toy for young boys, which became the narrative for "techie culture." Heavily influenced by branding, families at the time were more likely to buy these "toys" for boys than girls, even when girls showed interest.

In *Women In Data*, business analyst and self-proclaimed "data nerd" Majken Sander recalled this divide of boys and girls over computers. She said her interest in computer programming started early, when a neighborhood boy got a computer and wouldn't let her play with it:

> *The common idea back then was that "programming was for boys" and if something had to do with data or math, you had to be a boy to participate.*

This attitude affected more than child's play.

According to Girls Who Code, from 1984 to today, the amount of female computer science graduates dropped from 37% to 18%. The disconnect between girls and STEM-related career paths happens before college. In fact, 74% of middle school girls express an interest in STEM topics and careers, but only 0.4% of high school girls end up choosing computer science for a college major.

There are a few reasons why this is the case:

Inherent Bias: The narrative from the early marketing campaigns is still used in many media forms today, usually defining a "techie" individual as a geeky computer-tinkering male. Although times have changed since the first home computers, and strong, highly intelligent female characters are more

common, these characters still tend to cause a sense of surprise within plots or are gawked at because of their "rarity." This idea could cause girls to turn away from computer science as an option for future studies and careers (https://www.betterbuys.com/bi/big-data-analytics-programs/).

No Early Exposure: The lack of introducing computing skills, such as coding or programming, at an early age can cause a disconnect between initial interest in STEM related topics and choosing other subjects for career paths. Within the *Women In Data* interviews, many of the interviewees, like Carla Gentry, Camille Fournier and Hannah Wallach, said they believe early exposure to STEM and computer-related skills will help close the tech gender gap.

Confidence Issues: Not having confidence in skills and potential success can cause individuals to put limitations on themselves. Harvard conducted a one-year study on the gender gap in its computer science program. They found that, even with computers now being standard in households, 67% of the women in the program said they had one or fewer years of programming experience, compared to 41% of their male counterparts who said the same. It also found that women with eight years of programming experience are as confident in their skills as their male peers with zero to one year of programming experience. Internalized stereotypes can cause women to feel they don't have the "right" knowledge or skillset for success in the field.

OBSTACLES IN THE WORKFORCE

The challenge of getting and keeping women in tech and data science goes beyond educational exposure though. Recruitment and attrition seem to be other obstacles causing the numbers of women in the field to drop.

The NCWIT report questions the common belief that the lack of gender diversity among qualified applicants is the top reason for the unbalanced ratio of men to women in the tech industry. According to a LinkedIn study, more women are hired as software engineers outside of technology, comparing the 20% hired in technology to the 32% hired in healthcare and 25% in banking.

So qualified women are out there.

Gender diversity could be unbalanced based on the way a company recruits for a position. Many recruiting efforts rely on referrals to determine top candidates. However, according to the NCWIT report, a study by the Federal Reserve Bank of New York found that 64% of employees recommend

candidates of the same gender as themselves. And in a 2015 study, Looksharp found women are three times less likely to seek tech internships than men. These internships are another common way to recruit for STEM related positions.

Once women do break into the field, keeping them poses another problem.

According to the NCWIT, women are two times more likely to quit their job than men in the high tech industry (41% to 17%). However, the primary reason for leaving is not due to family obligations, contrary to popular belief.

In the same NCWIT report, it was found that 49% of the women who left their SET job remained in the industry. In fact, 22% of these women went on to create their own company.

WHY ARE WOMEN LEAVING?

A study by McKinsey and Lean-In asked similar questions of women in the workforce as a whole. They found that women are four times more likely than men to feel like they have fewer opportunities than men in the workplace.

Looking at the computing and tech fields, 30% of women in SET positions felt isolated or stalled, according to the NCWIT report. The feeling stems from “having a limited number of important or special assignments that are highly valued by high-level managers,” and “not understanding the ‘unwritten rules’ or norms of [a] company or department,” which can be linked to a lack of mentorship and support. According to a Hewlett study from 2014, this type of dissatisfaction is found more in women ages 25 to 34 who are fresh in the field.

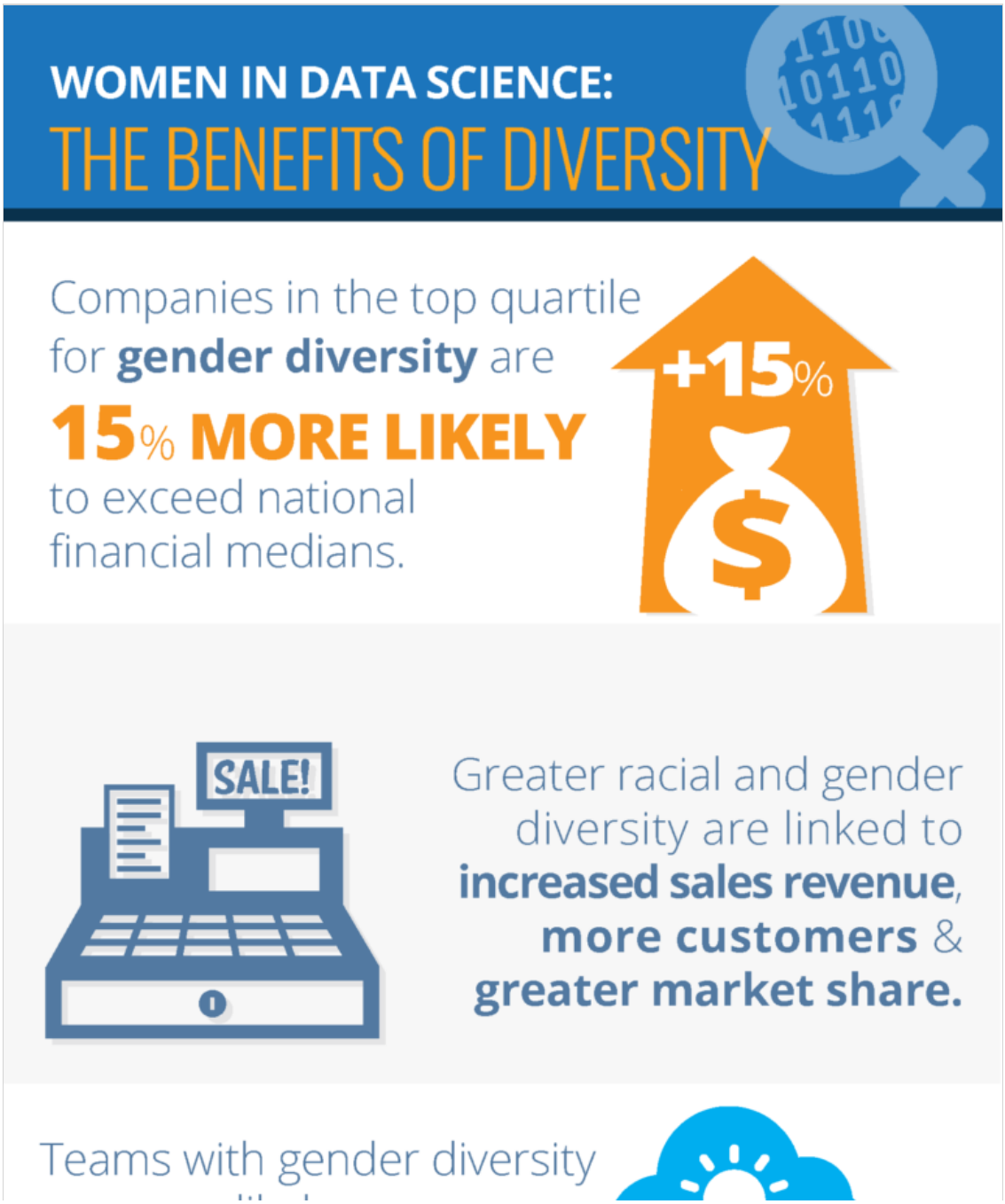
During a roundtable discussion, *Women in Data Science*, the data scientist of Data-Mania, Lilian Pierson said, “Women need to understand what opportunities are available to them, what those opportunities involve, and what the quality of life looks like for someone in this role.”

This can’t be achieved without proper support. Mentoring has had a large influence in closing the gender gap in tech and data science.

In the *Women In Data* interviews, almost all of the interviewees mentioned a mentor that they relied on for encouragement to remain in the field, whether a supportive family member or a co-worker open to questions.

Sarah Aerni, the data scientist at Pivotal, said in the roundtable discussion, "... One of the main challenges is that mentors are most effective when they can see themselves in those they are helping. I actually do not believe that this means women should only be mentored by women. Instead, I think it has to do with the path that you have taken, so mentors can recognize and help with challenges they faced themselves."

CLOSING THE GENDER GAP



are more likely
to **experiment**,
be **creative**
& share **knowledge.**

Studies have shown that diverse teams
consistently outperform
even teams made up of
only the highest-skilled staff.

Successful technology startups
have **2x as many women**
in senior positions as
unsuccessful startups

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Sources:

NCWIT: www.ncwit.org/resources/women-it-facts-infographic-2015-update
McKinsey & Lean-In: www.womenintheworkplace.com/ui/pdfs/Women_in_the_Workplace_2015.pdf

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The stats above show that a mixed-gender team is linked to more success for a company.

In fact, Craig Newmark, the founder of Craigslist, reported in his article, *Let's Get Real About Supporting Women in Tech* (http://www.recode.net/2016/6/2/11834380/craig-newmark-women-tech-funding-gender-gap-diversity), that tech companies led by women have an average of a 35% higher return on capital than those led by men. He also referenced a study stating that tech companies with female founders perform 63% better than ones with founding teams completely composed of men.

Ultimately, this is why we need more women in computing and data science – to bring their skills and perspectives to the table for better performance overall.

In its infographic, *Women in IT: The Facts* (https://www.ncwit.org/resources/women-it-facts-infographic-2015-update), the NCWIT reported that teams with equal numbers of men and women are more likely to experiment, be creative, share knowledge and finish tasks than teams of unequal genders.

However, closing the gender gap in technology shouldn't only be about reaching a certain ratio of women to men within the field. Although recruitment is still an issue, the focus should be about empowering women already in the field and recognizing their accomplishments, as well as reminding girls and women interested in or entering the field that skill proficiency isn't based on gender.

Women remain the minority in technology and data science, but it's not necessarily a *push* to bring more in. Rather, it's a movement to bring awareness to the current situation, highlight the growth opportunities available, and bring the benefits of gender diversity to light. Women bring a lot to the technology table, just as they always have. But having the support and being recognized for what they bring will continue to close the gender gap at a slow, steady pace.

HELPFUL RESOURCES

We've listed prominent resources for female support in data science and computing below. Groups and programs interested in being considered, please contact us (http://contact@betterbuys.com).

Women in Data Science (WiDS) Conference (http://www.widsconference.org/) – A 1-day technical conference at Stanford University for women to learn leading trends in data science and network

with mentors and peers.

Women in Machine Learning and Data Science (WiMLDS) (http://wimlds.org/) – A community hosting events, conferences and workshops for women interested in machine learning and data science.

Harvard's Women in Computer Science (WiCS) Advocacy Council (http://advocacy.harvardwics.com/)– A community of faculty and students at Harvard University aiming to understand and reduce the technology gender gap.

Girls Who Code (https://girlswhocode.com/) – A national non-profit organization inspiring high school girls to pursue opportunities in the computing field.

National Center for Women & Information Technology (NCWIT) (https://www.ncwit.org/) – A non-profit community of universities, companies, non-profits and government organizations working to increase women's participation in computing and technology.

Women in Big Data Forum (https://www.linkedin.com/groups/6981086/profile) – A LinkedIn forum aiming to increase the diversity in the big data field through mentoring and peer engagement.

Progressive Women's Leadership (https://www.progressivewomensleadership.com/) – A resource center with a mission to advance women's leadership in the workplace. For resources in data science and computing, see the article *Women in STEM & the Organizations Supporting Them* (https://www.progressivewomensleadership.com/women-in-stem-organizations-supporting-them/).