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THE SCIENCE OF HIRING AND RETAINING FEMALE CYBERSECURITY ENGINEERS

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Intelligence, NBCUniversal

NBCUniversal

WHAT WE'RE DOING TODAY

- ✓Discussing good experimental design
- ✓Learning about the results of studies around women in tech
- ✓Exploring factors that negatively affect hiring, retaining, and promoting women
- ✓Introducing a scorecard framework
- ✓Q&A

This talk is about:

- Retaining women already in the field
- Why women leave
- Using numbers to figure out what is blocking hiring, promotions, training, or other opportunities
- Science! And where data science can't replace human judgment

We aren't talking about:

- Getting women interested in cybersecurity
- Politics, eliminating sexism in society or affirmative action measures
- Laws and regulations (important, but that's its own talk)
- Places your kids can learn cyber and programming skills (ask me after)

What do women want? Story time.

- University of Cape Town researchers tried to test how appealing various video game features were to women.
- They referenced a book called Gender inclusive game design which called out 10 criteria that make video games appealing to women. Other academics at the time agreed with the conclusions in the book.
- They made a game with options to choose each criteria, and found that only 7/10 of the criteria were necessary for the game to appeal to the population of 12-16-year-old girls who played the game.

MyWorld: Testing female preferred gaming criteria http://pubs.cs.uct.ac.za/archive/00000167/01/article.pdf

We …don't actually know.

Criterion	90% confidence interval for the population agreeing with the criterion
No over-sexualized avatars	(100%, 100%)
Emotionally involving	(40.74% , 92.59%)
Non-violent	**(17.11% , 71.77%)**
No player death or insurmountable penalties	(28.23% , 82.89%)
No sexual prejudice	(28.23% , 82.89%)
Simple graphics	(61.04% , 100%)
Creativity	**(17.11% , 71.77%)**
Process orientated	(100% , 100%)
Indirect competition	(40.74% , 92.59%)
Collaboration	**(7.40% , 59.26%)**

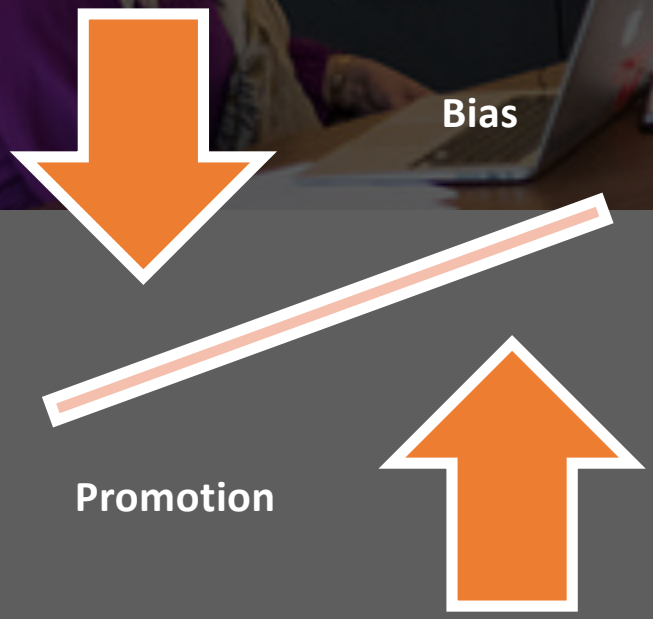
And that's okay. Keep in mind…

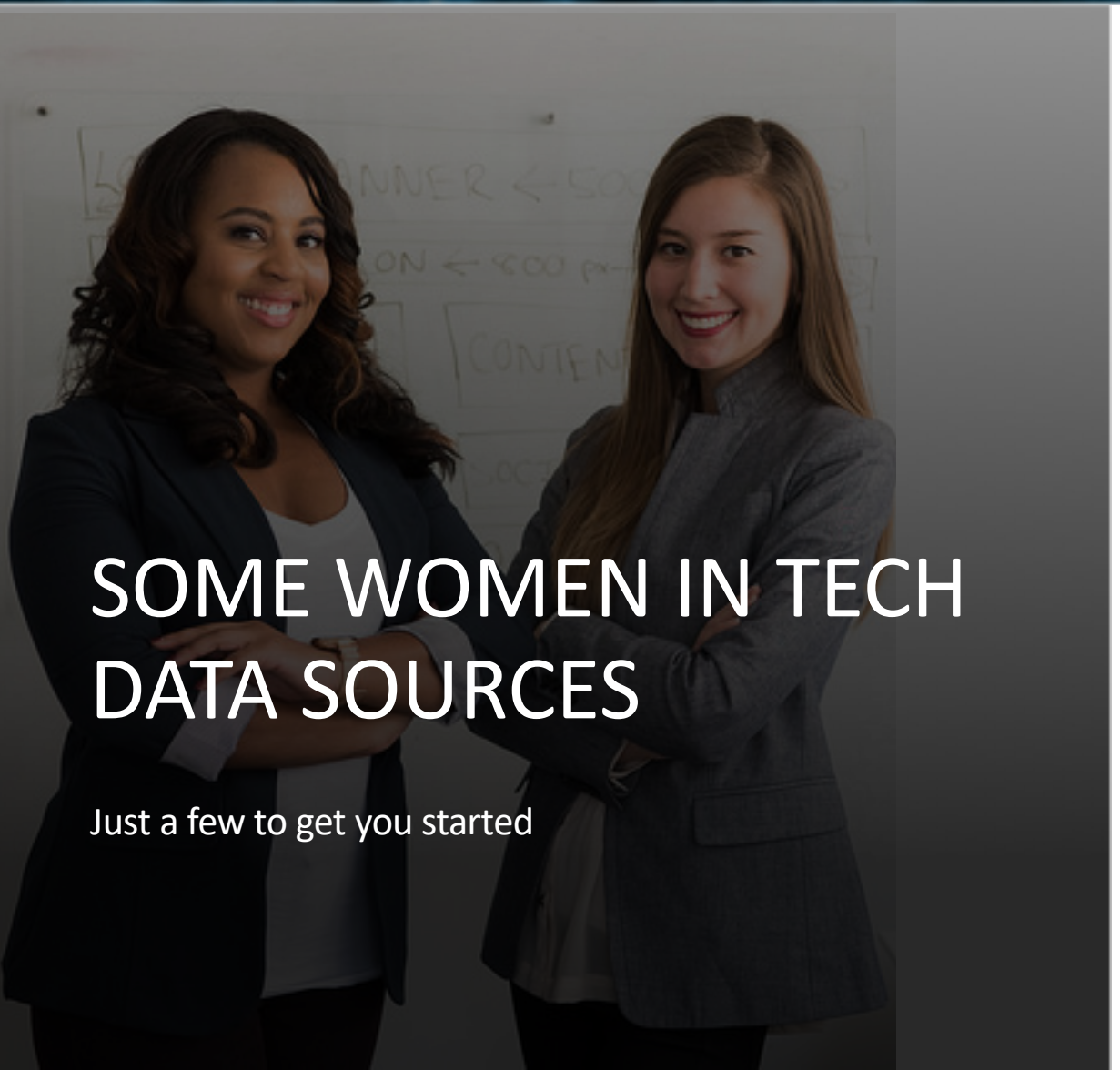
- People are individuals and will be outside of the curve sometimes – dealing with employees is a relationship/people issue
- Studies do not account for the exceptional. Learn from studies but you should never let those ideas predetermine how you interact with or judge someone
- Numbers are good but they can't replace human judgment
- People of all backgrounds (read: genders) can be affected by the same factors that make hiring and retaining women challenging

Observations after evaluating a lot of studies

- Some studies used questions that pre-supposed women experience bias or discrimination or are unhappy
  - Which of these types of discrimination do you face at work? Check all that apply.
- Many studies on women in tech have small sample sizes with self-reported data
  - While women only make up around **11%** of cybersecurity workforce and **20%** of tech workforce, opinions vary greatly and sometimes certain data points can appear more important in the sample than the general population
  - Small sample sizes are less bad if the sample is across a diverse random population
    - Usually the samples are taken from women all at one org or in one club/group
- Fewer studies exist around retention and attrition reasons for mid-career women

How do we recruit/retain technical women and grow them into effective technical leaders?

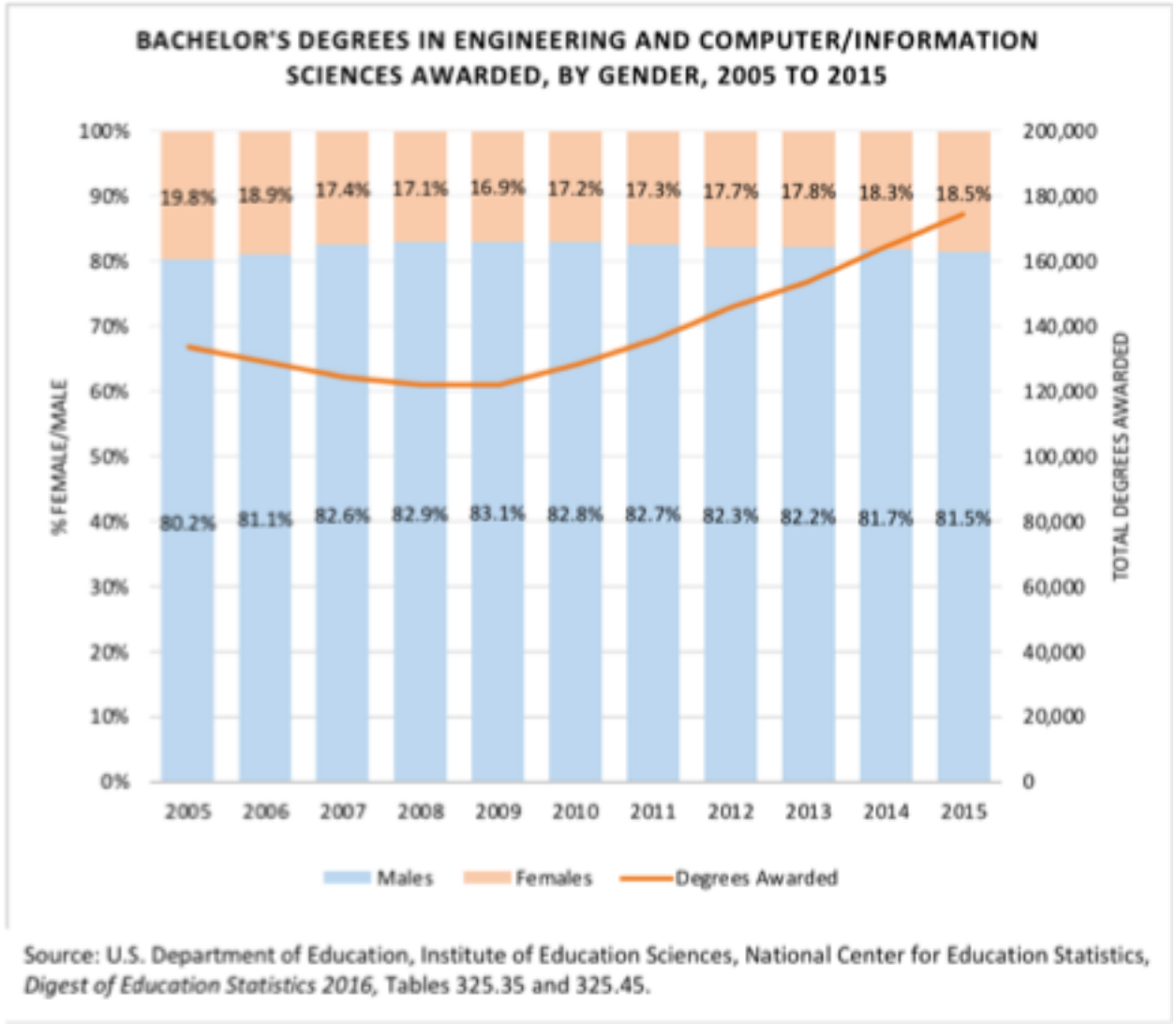




SOME WOMEN IN TECH DATA SOURCES

Just a few to get you started

- **NCWIT**: National Center for Women in Technology https://www.ncwit.org
- **SWE**: Society of Women Engineers https://research.swe.org
- **IEEE WIE**: "I triple E" Institute of Electrical and Electronics Engineers Women in Engineering http://wie.ieee.org/
- **BLS**: Bureau of Labor Statistics https://www.bls.gov/
- **ISACA**: Information Systems Audit and Control Association http://www.isaca.org/
- **GISWS**: The 2017 Global Information Security Workforce Study, Women in Cybersecurity https://iamcybersafe.org/wp-content/uploads/2017/03/WomensReport.pdf



Source: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, *Digest of Education Statistics 2016*, Tables 325.35 and 325.45.

https://research.swe.org/2016/08/degree-attainment/

Pipeline stats: SWE

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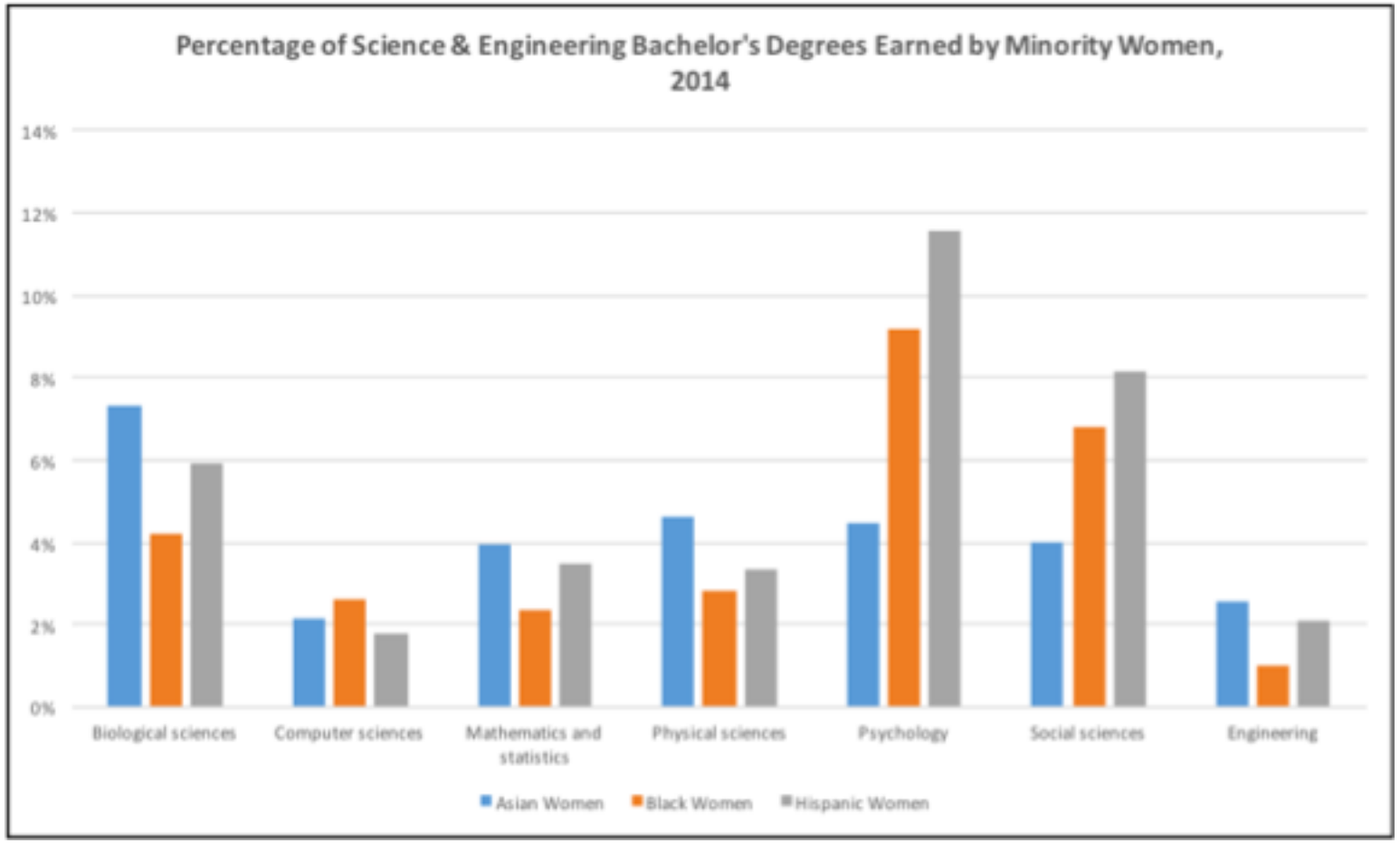
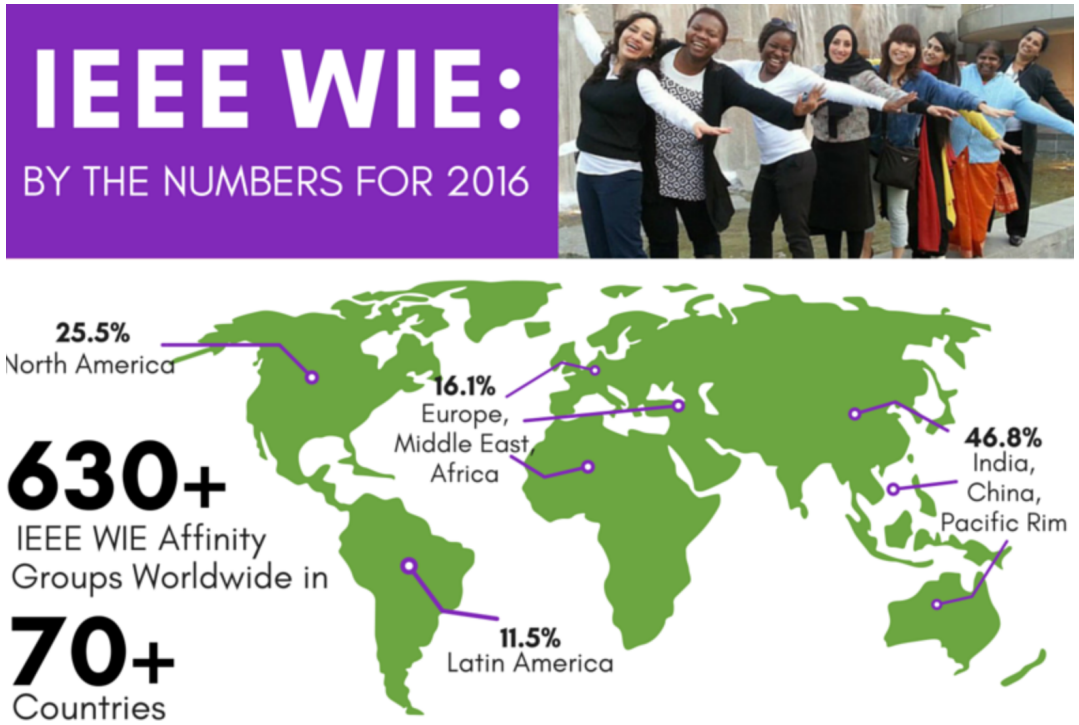
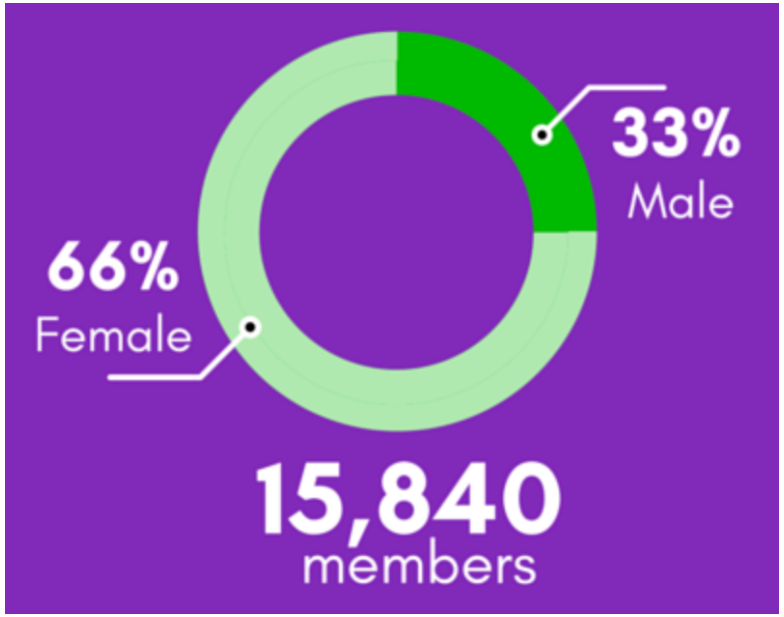


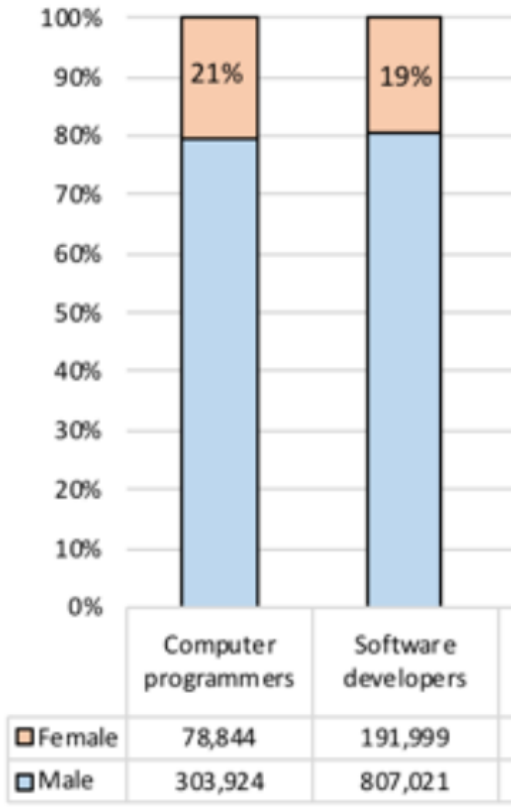
Membership stats: IEEE Women in Engineering





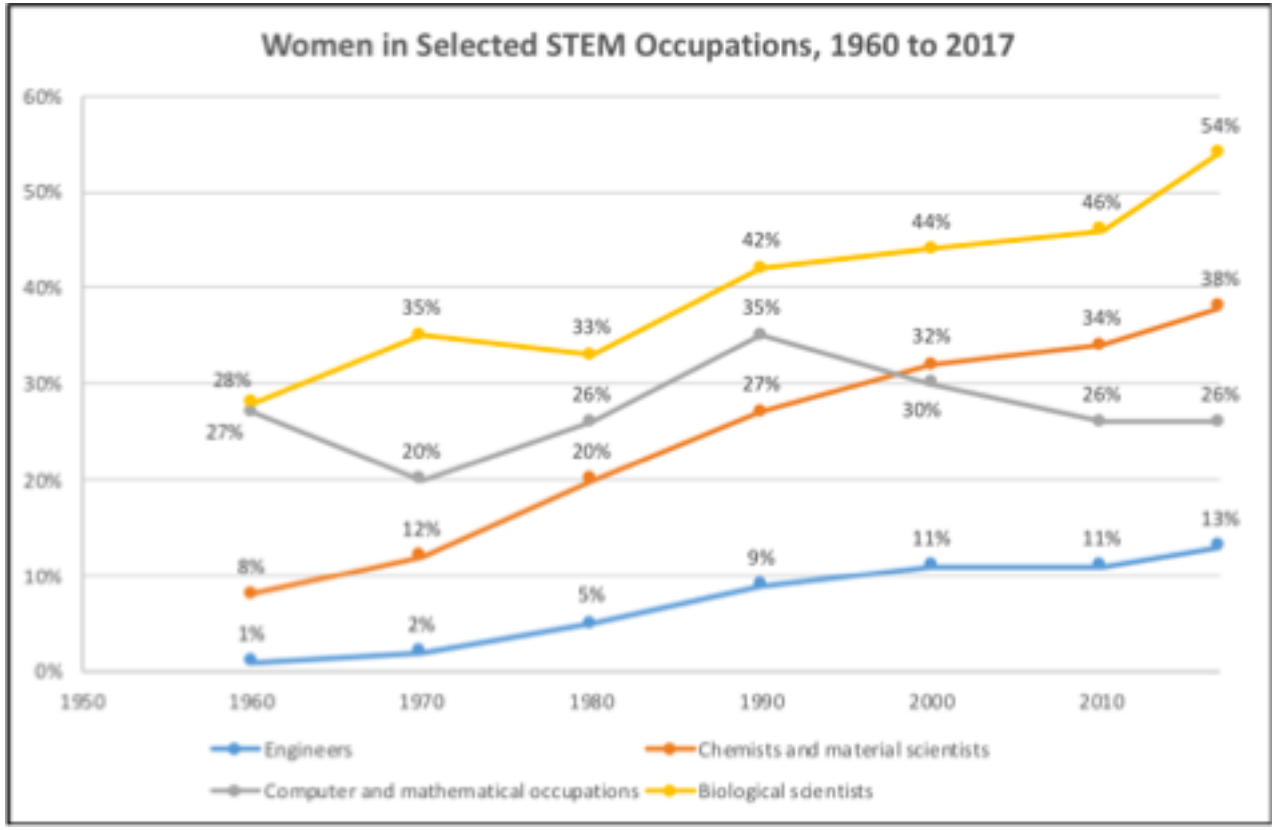
http://wie.ieee.org/wp-content/uploads/2016/07/IEEE-WIE-Infographic.png

Employment Stats: SWE



	Computer programmers	Software developers
Female	78,844	191,999
Male	303,924	807,021

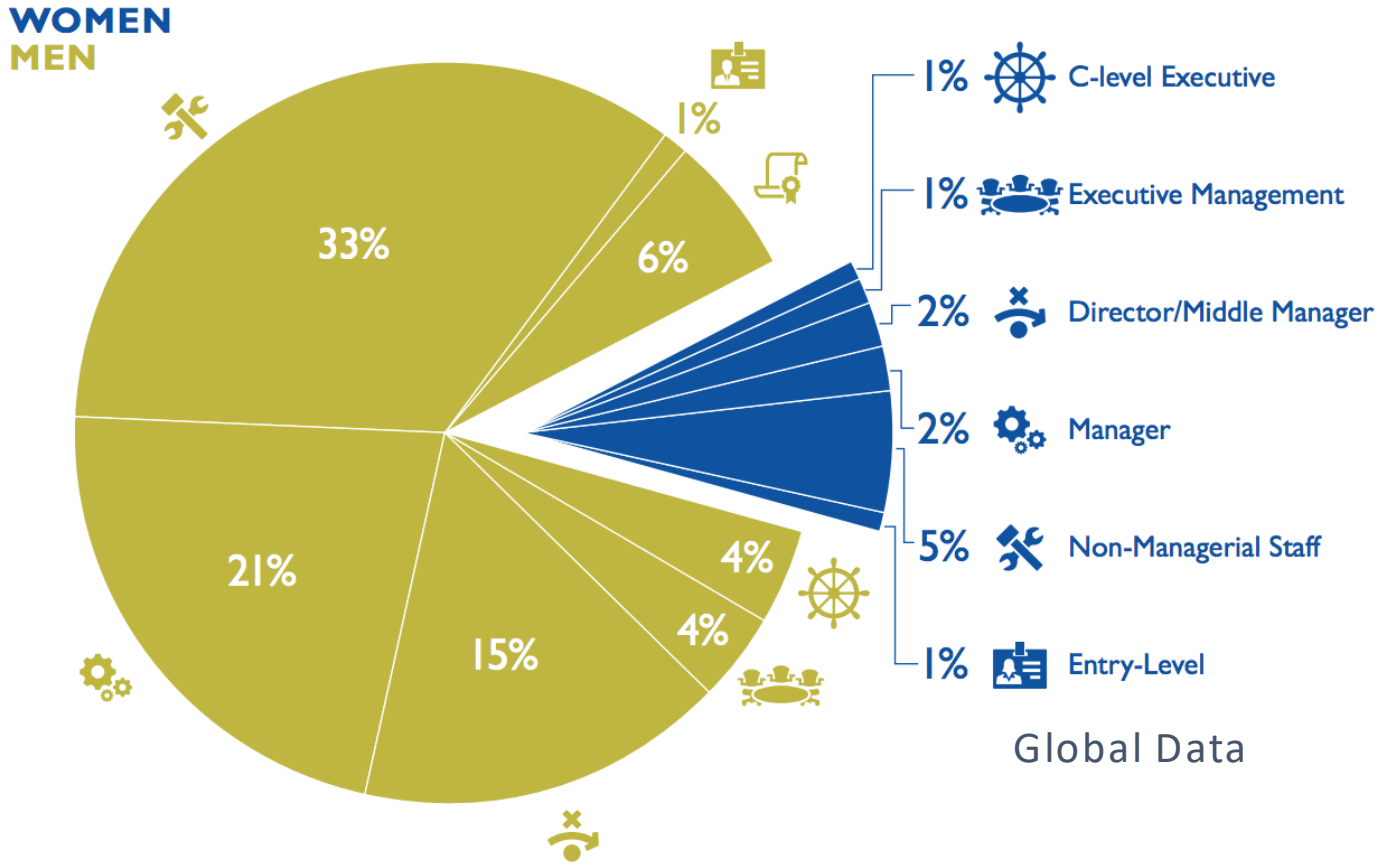
Computer-related fields are around 20% female.

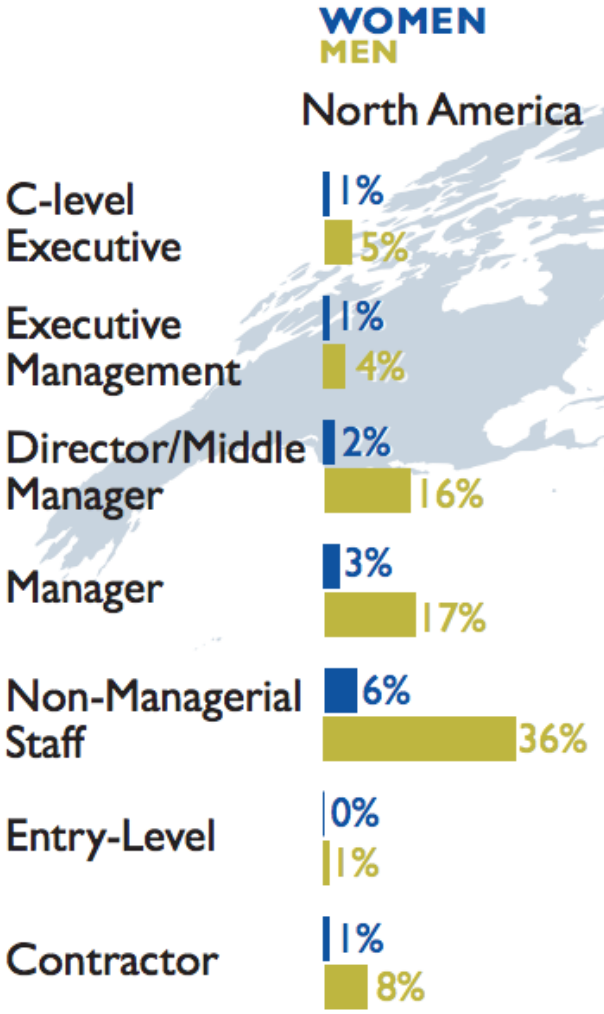


All computer and mathematical occupations: 26% female

https://research.swe.org/2016/08/employment/

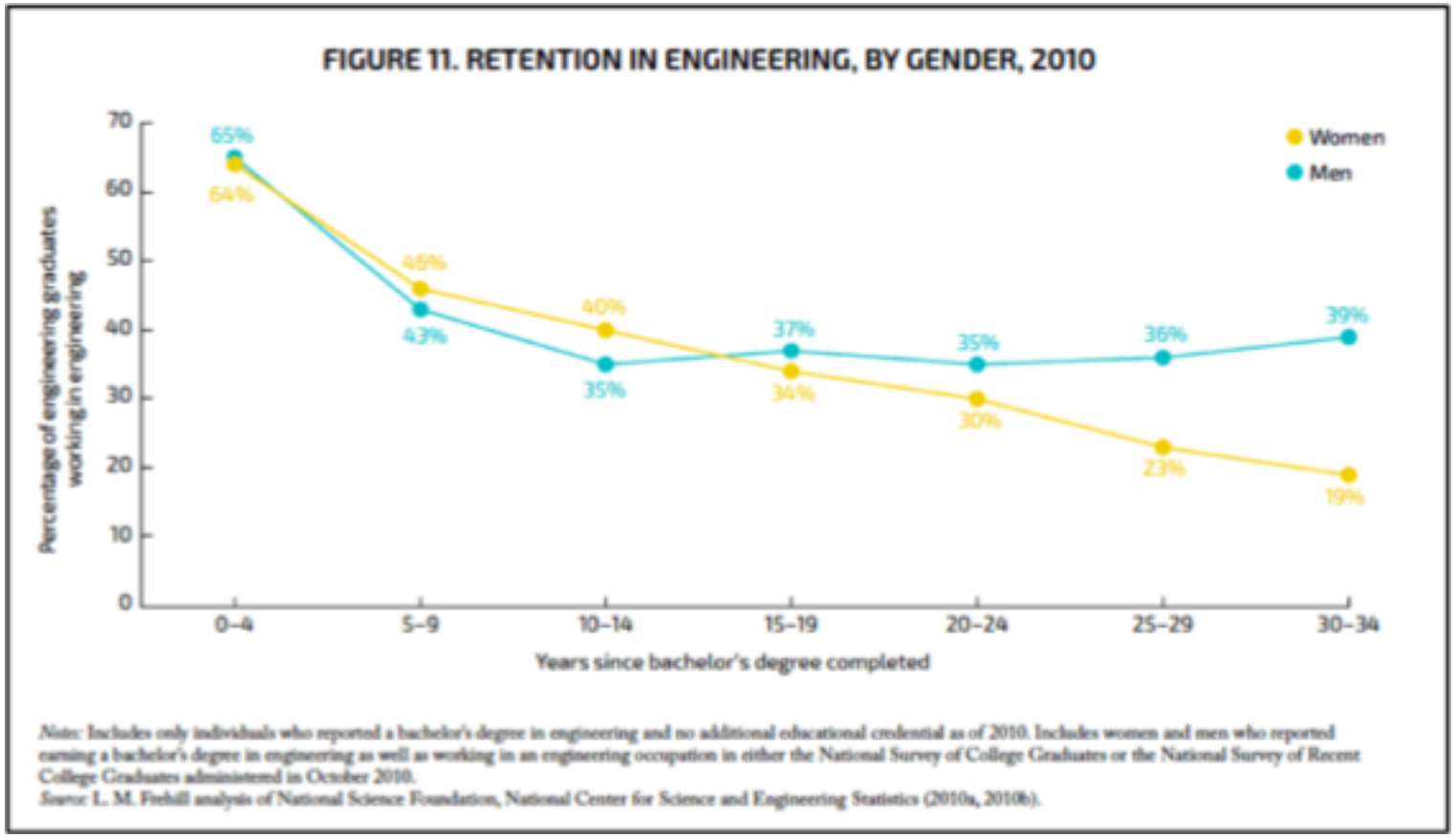
Employment Stats: 2017 GISWS





https://iamcybersafe.org/wp-content/uploads/2017/03/WomensReport.pdf

Retention Stats: SWE



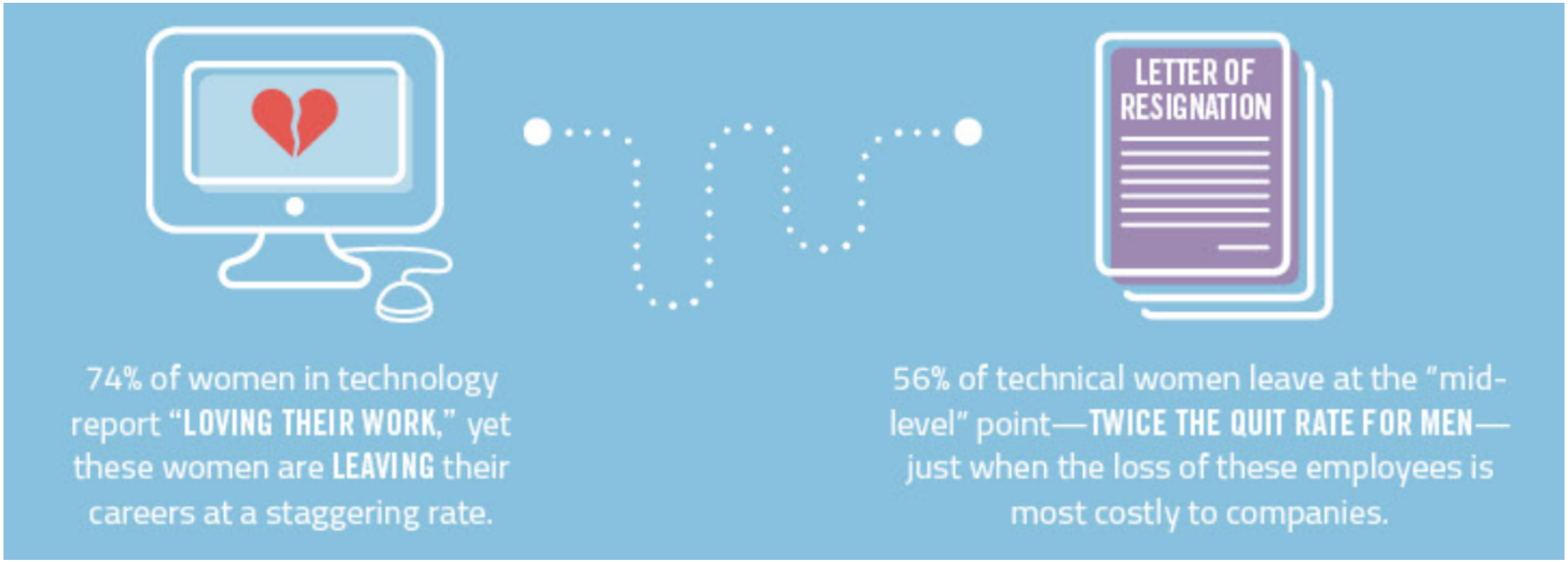
https://research.swe.org/2016/08/retention/: "Source: Corbett, C., & Hill, C. (2015). Solving the Equation: The Variables for Women's Success in Engineering and Computing. Washington, DC: American Association of University Women."

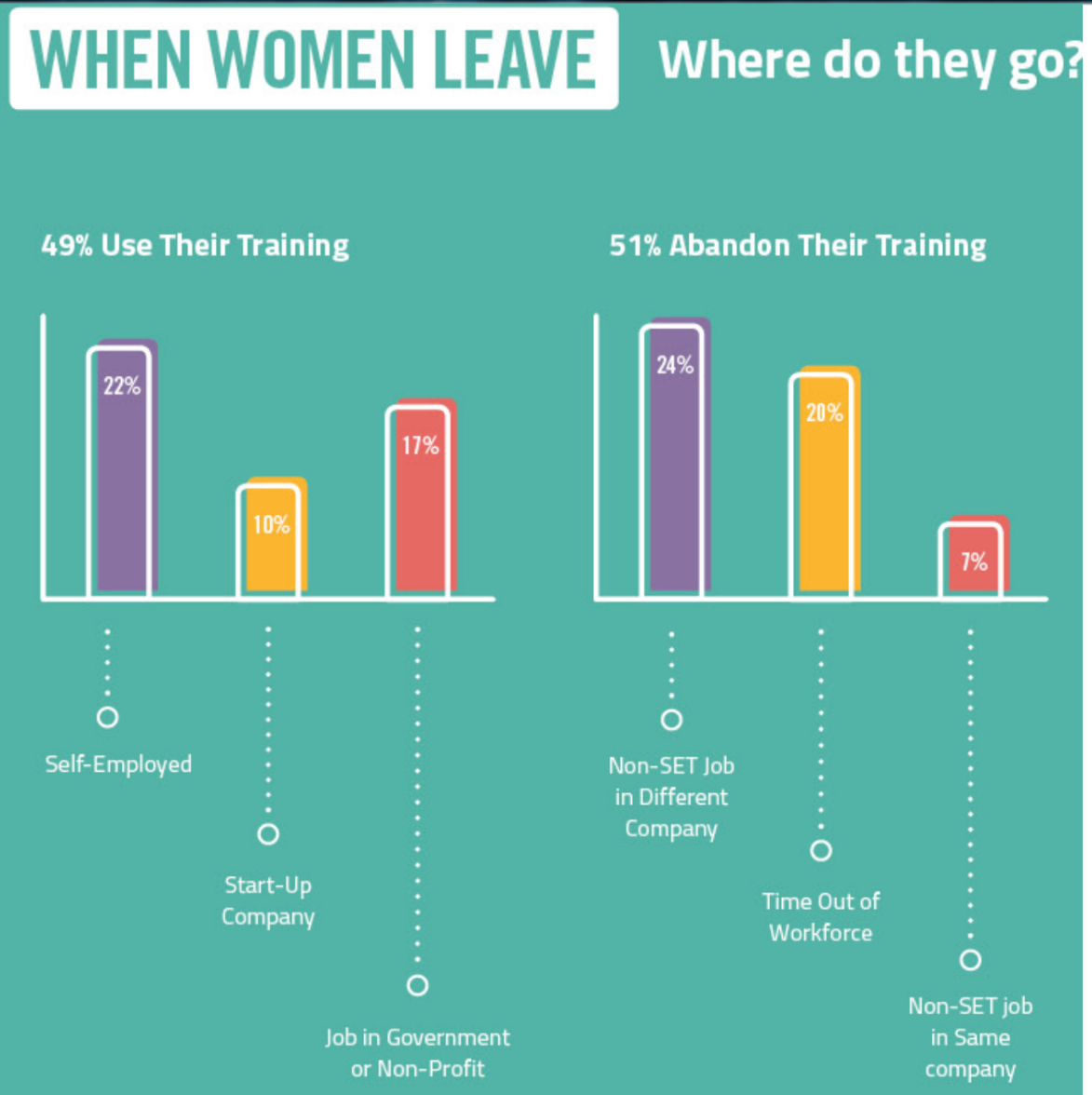
Retention stats: NCWIT

Women ages 25 to 34 are reporting **GREATER DISSATISFACTION** with their tech career prospects. These women cite **UNSUPPORTIVE WORK ENVIRONMENTS**, a lack of inspiring role models, and sacrifices in their personal lives that outweigh personal gains.

ONLY 20% of women who leave actually drop out of the workforce, and even these 20% indicate they would **STAY IF OTHER OPTIONS WERE AVAILABLE.**

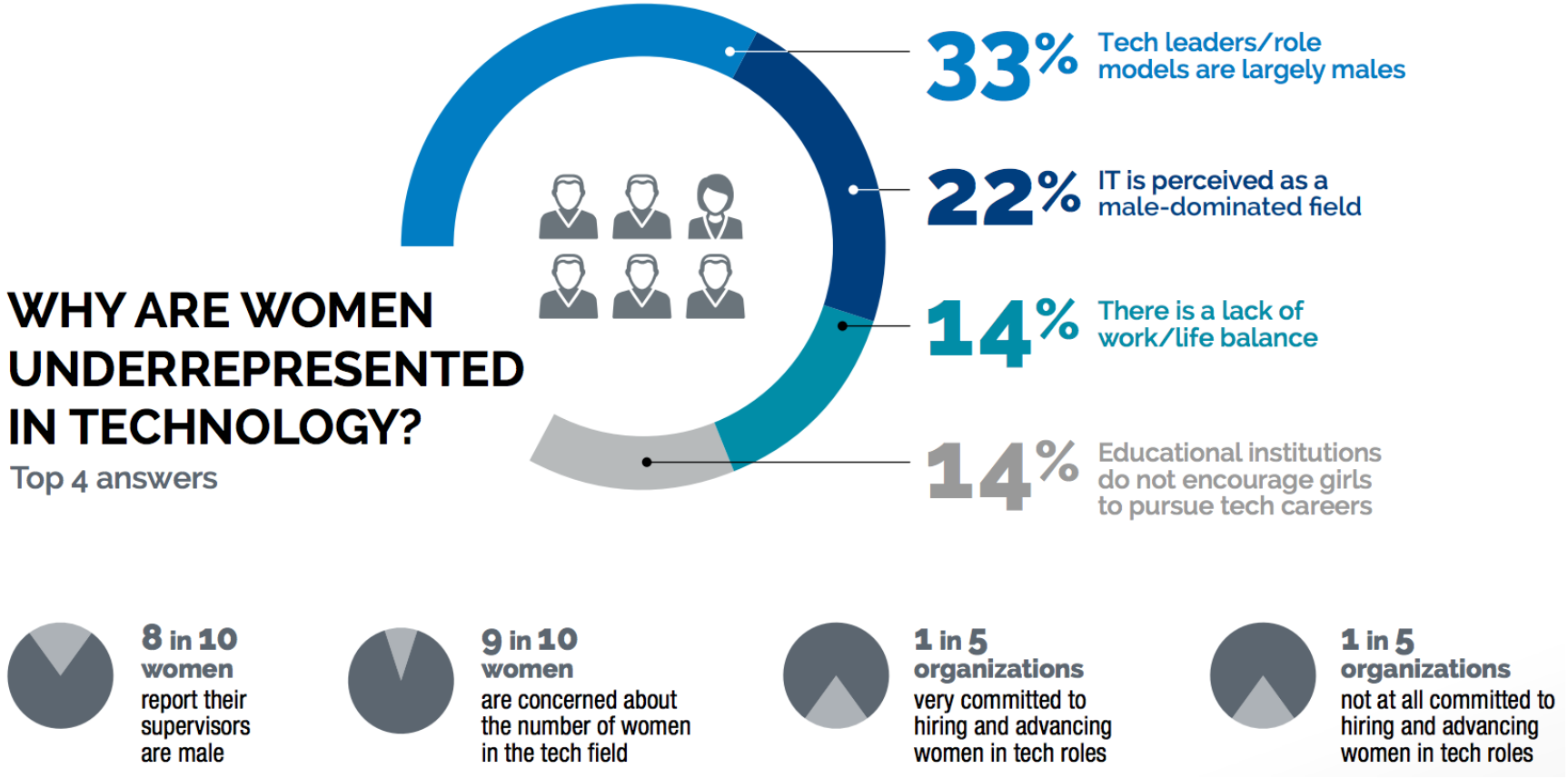
Retention Stats: NCWIT





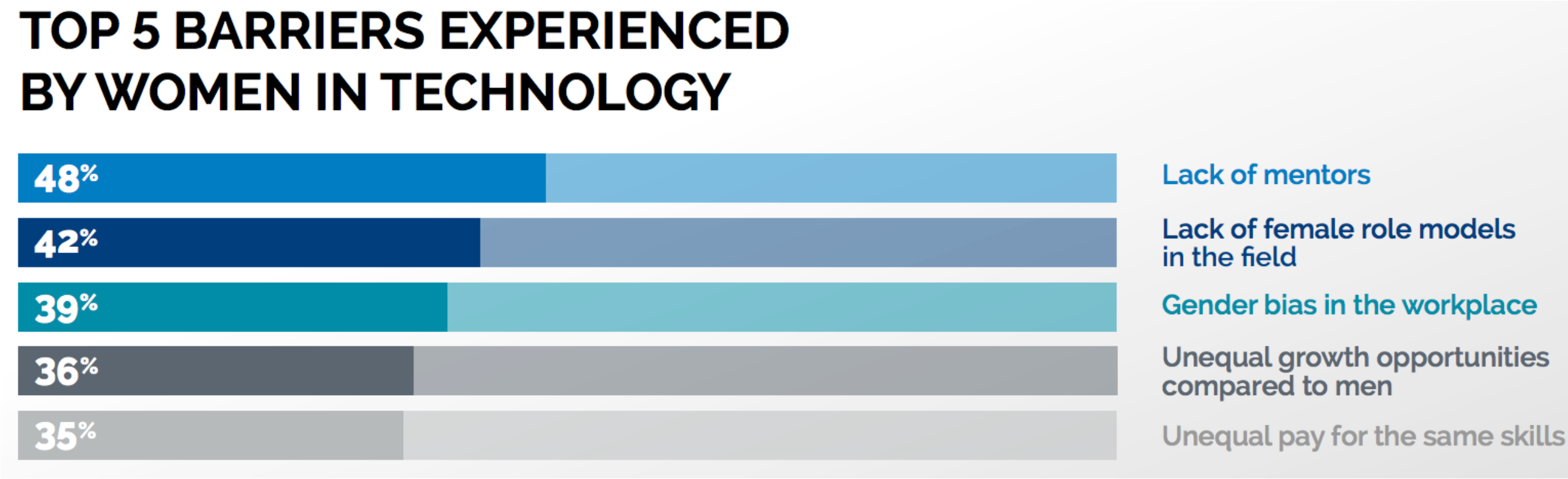
Turnover stats: NCWIT

Employment experience stats: ISACA



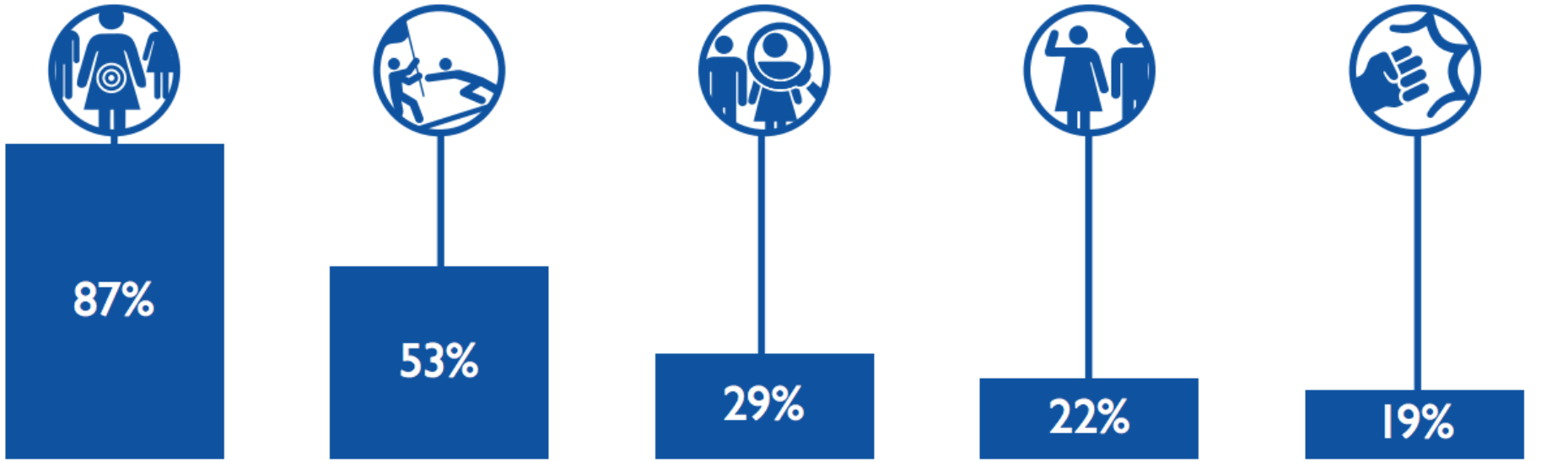
http://www.isaca.org/SiteCollectionDocuments/2017-Women-in-Technology-Graphic.pdf

Employment experience stats: ISACA



Employment Experience stats: GISWS

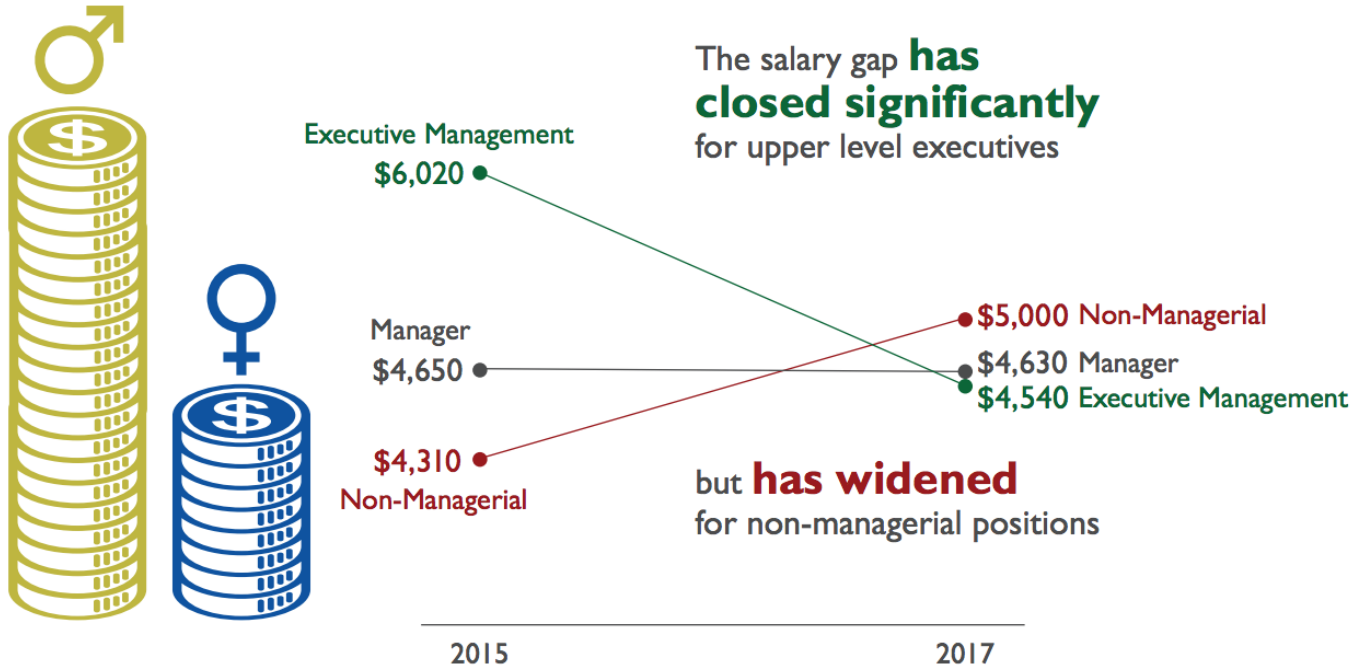
Exhibit #10: Forms of Discrimination Personally Experienced by Women in Cybersecurity, Globally



Source: 2017 Global Information Security Workforce Study

Employment Experience stats: GISWS

Exhibit #8: Average North American Cybersecurity Salary Gap in 2015 and 2017, by Organizational Position



Source: 2017 Global Information Security Workforce Study

https://iamcybersafe.org/wp-content/uploads/2017/03/WomensReport.pdf

Unscientific Twitter polls

Unscientific Twitter polls

What do you think of separate STEM/CS classes for boys and girls? Or adult women and adult men? Tell me if u think girls under 18 (but not adult women) classes are ok, women only (but not younger girls) ok, all ages ok, or female only classes NOT ok! #DFIR #infosec #womenintech

9% Girls only classes - ok!

4% Women only classes - ok!

27% Female only all ages ok!

60% Female only NOT OK

97 votes • Final results

Quick note on female-only environments

- Research and wisdom here are contradictory, especially for certain ages
  - Researchers concluded that a "single-sex setting promoted supportive positive peer relationships that encouraged girls to build their cybersecurity skills" during a cyber summer program for adolescent girls.[1]
- There is debate around what age is the cut off for when single-sex environments make a positive impact and the experiences at home and at school that make an impact

1. "I Can Actually Be a Super Sleuth": Promising Practices for Engaging Adolescent Girls in Cybersecurity Education https://doi.org/10.1177/0735633116651971

Unscientific Twitter polls

[redacted] Why do you think women don't get into cybersecurity or computer science? I realize these choices don't begin to cover all the reasons you may have, if the poll answers are way off just hit other and optionally reply! #womenintech

30% Intimidation/bro culture

57% Unfamiliarity/no interest

3% Too difficult

10% Other (message or reply)

63 votes • Final results

Your next technical leaders already work on your technical teams. Are you hiring, evaluating, and mentoring them with this in mind?

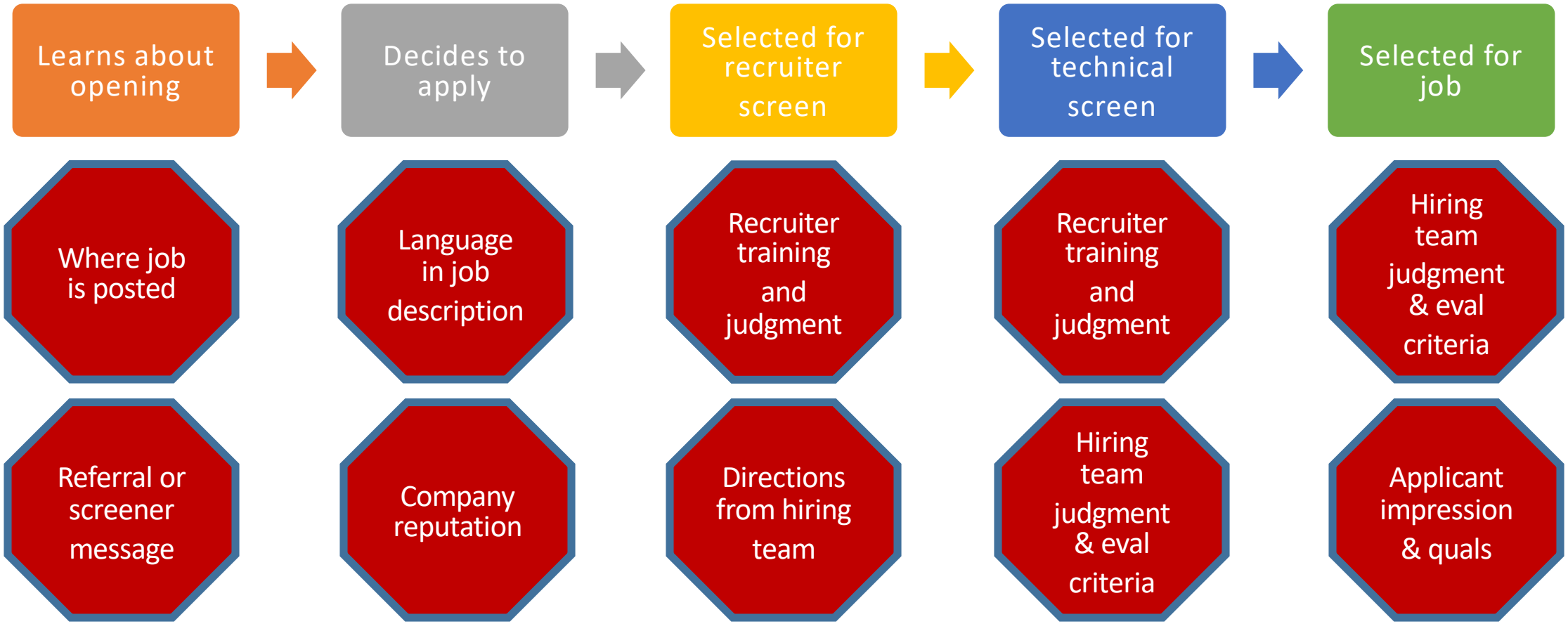
Recruiting Pipeline and Education

Feedback and Evaluation

Promotion and Mentorship

Hire → Retain → Promote

Factors Affecting Hiring During Applicant Lifecycle



The Harm of Affinity Groups

- Affinity groups are everywhere in tech
- Examples: Many people in the department went to the same school, many people in the department were referrals & share similar demographics, social events at conferences are used as a key recruiting tool (low female representation/you need to "know someone" to get in)
- Inject more diversity into networking, school, and mentorship groups, and you increase the likelihood that diverse candidates are hired
- Avoid affinity mentorship – women don't always need female mentors…choose the person who has the combination of skills and relationships that the employee needs to grow

Advice for Job Descriptions

- http://gender-decoder.katmatfield.com/ You can use a gender decoder like this one to identify masculine and feminine language in job ads.
- Focus on what the applicant will be doing day-to-day and highlight training and development opportunities
- Following 2 slides are examples from a job description that received favorable feedback from female peers: https://www.linkedin.com/jobs/view/658346104/

What We Provide

- **Leadership.** You will teach our teams how to develop securely and get into the security mindset by driving our architecture, reviewing new features and capabilities and mentoring engineers.
- **Opportunities to develop and grow as an engineer**. We are the forefront of our industry, always expanding into new areas, and working with open source and new technologies.
- **A set of talented and dedicated peers**, all the way from engineering and QA to product management and customer support.
- **Breadth and depth**. We take the security of our product seriously, and you will be able to help drive a security mindset in many areas. You will develop major authentication and authorization capabilities, secure our data storage and more.
- **Growth and mentorship**. We believe in growing engineers through ownership and leadership opportunities. We also believe mentors help both sides of the equation.
- **A stable, collaborative and supportive work environment**. We work in an open environment, have a shared kitchen and sit down for a quick sync every morning.
- **Balance**. We don't expect people to work 12 hour days. We want you to have a successful time outside of work too. Want to work from home sometimes? No problem. We trust our colleagues to be responsible with their time and commitment, and believe that balance helps cultivate a positive environment.

What you provide:

- **Desire to Learn and Adapt**. We have a lot of projects going on at once, and you'll have to learn to navigate the code and features. You'll constantly be learning new areas and new technologies.
- **Passion.** Our customers are passionate about Splunk and we want the same from our engineers. We want you to actively own your work and be excited about your projects.
- **Understanding of Systems Programming**. Examples of area you may be knowledgeable in may include how threads work, understanding of filesystems, server and kernel architectures, good grasp of data structures and algorithms, etc. You don't need to be an expert, but you should have foundation to build on.
- **Experience as a Security Engineer**. For this role we are looking to up our security game and bring in the engineers who can do that. You have experience working on security products and technologies such as SSL/TLS, SAML, X.509, JWT, AES, HMAC and others. You've worked to build end-to-end security features and products such as authentication/authorization systems.
- **Ability to work with multiple programming languages**. We have code in several languages, ranging from C/C++ and Go to Python and JavaScript. Experience with C++ is necessary, and you should feel comfortable working in others when the need arises.

Factors Affecting Retention & Promotion

- Studies around these factors vary greatly in their conclusions
- Some studies cite flexible work schedules and the "meritocracy" as reasons why women stay
- Majority of studies agree that women feel they are evaluated and supported in their careers differently than men (percentages and sentiment vary widely)

Marriage and Motherhood

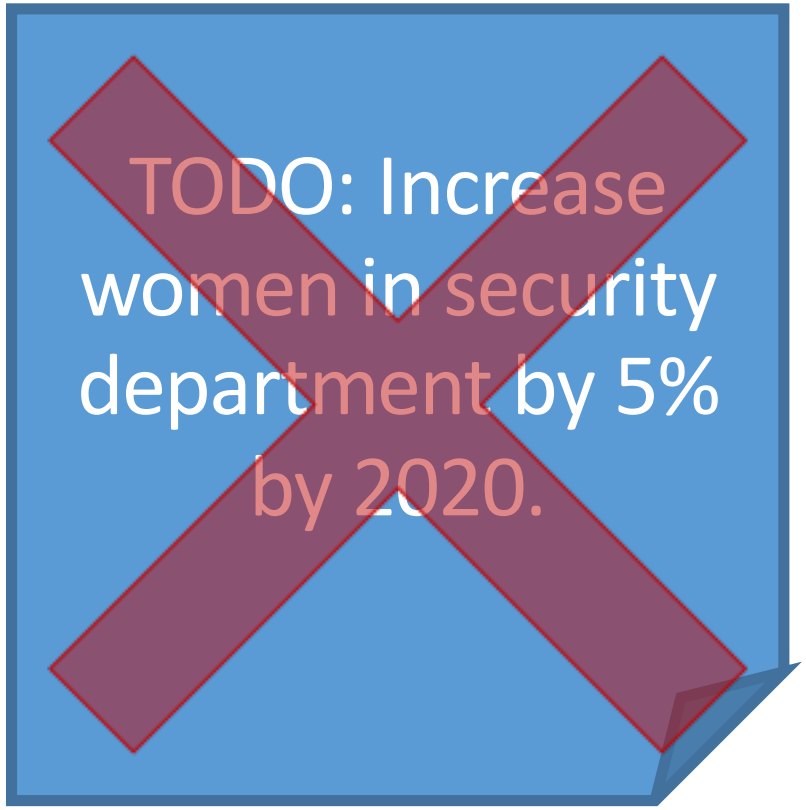
- The wisdom around why women leave tech in general mid-career is changing with regard to the affect of marriage and parental status
- We learned earlier that women often do not leave a tech job because they become mothers
- The role of marriage is less-researched
  - An AAUW paper[1] points to several studies stating that being single was a good predictor for being hired for a tenure-track job and being married was a good predictor for being hired as an assistant professor
  - The same researchers noted that mothers were at a disadvantage in promotion and tenure decisions
  - This research may or may not be relevant to women in cybersecurity careers

1: https://www.aauw.org/files/2013/02/Why-So-Few-Women-in-Science-Technology-Engineering-and-Mathematics.pdf

Goal: Framework to Identify Factors

We want to identify factors under each major stakeholder's control that negatively affect hiring, retention, and promotion

- Identify and track factors, NOT increases in population
  - If the factors are properly identified and progress is made, the retention and hiring numbers should become more favorable
  - Outcome by any means necessary is not typically a lasting outcome
- Useful factors are often not quantitative



Using the Framework to Evaluate Your Organization

Set Up Test

- Choose questions from each category for each stakeholder group
- List known and suspected factors
- Determine who will be surveyed, survey method, and who owns data

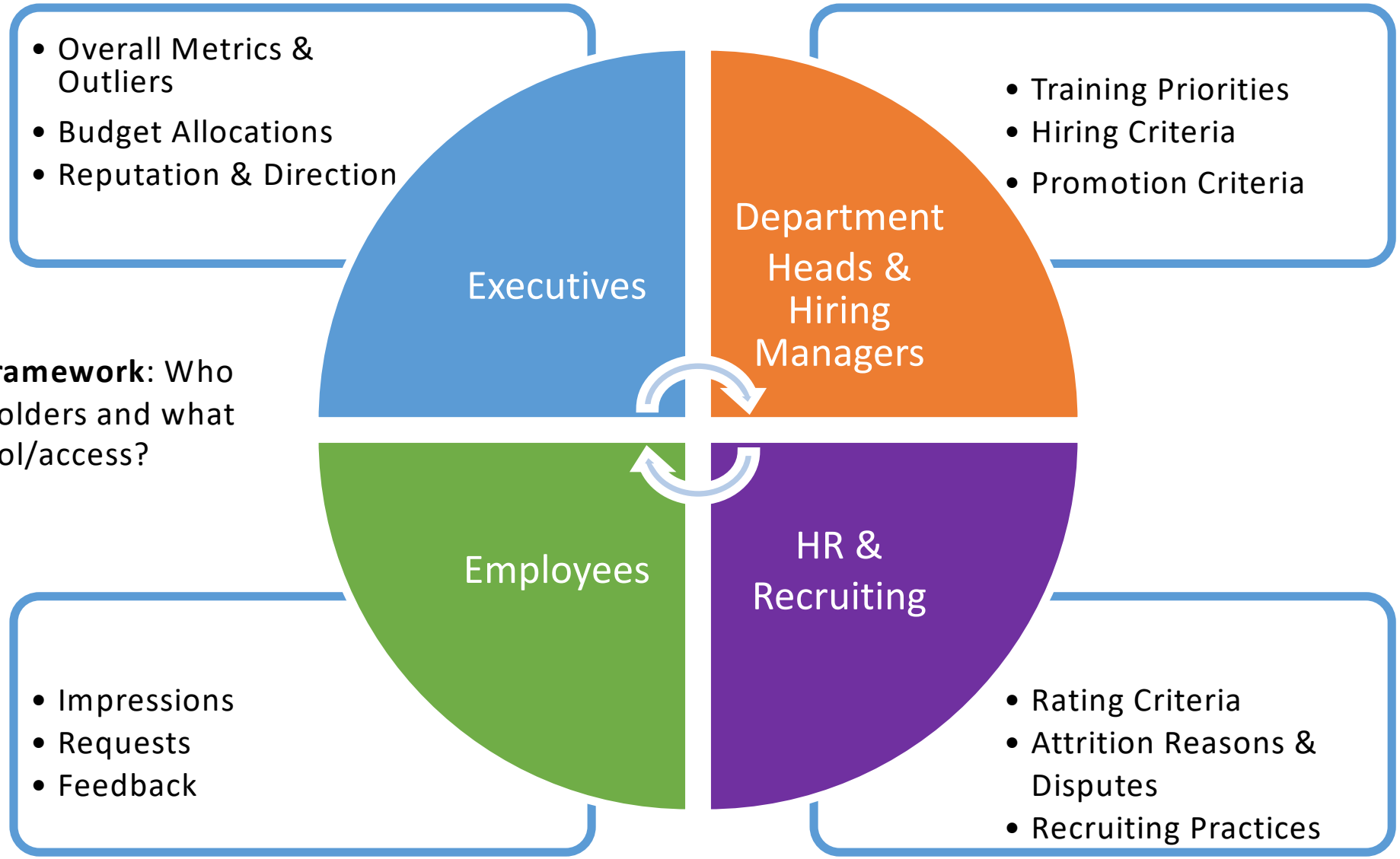
Collect Data

- Gather pay data (ERP system)
- Query demographic data by region, job role, and job level (HR system)
- Read exit interviews and HR reports
- Conduct employee surveys

Track & Evaluate Results

- After baseline round, design repeatable & automated tests
- Analyze data from test and report outcomes
- Test for presence of known factors and make new factors easy to discover

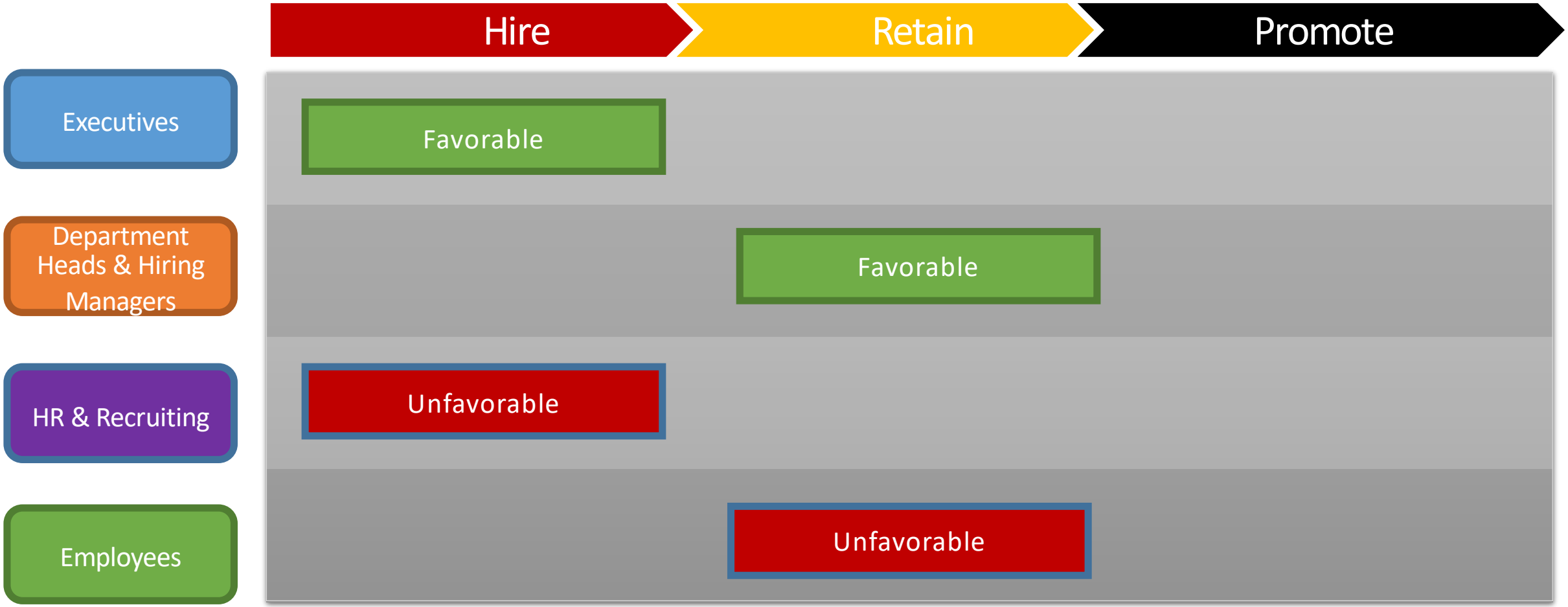
Stakeholder Framework: Who are our stakeholders and what can they control/access?



Factor Framework:

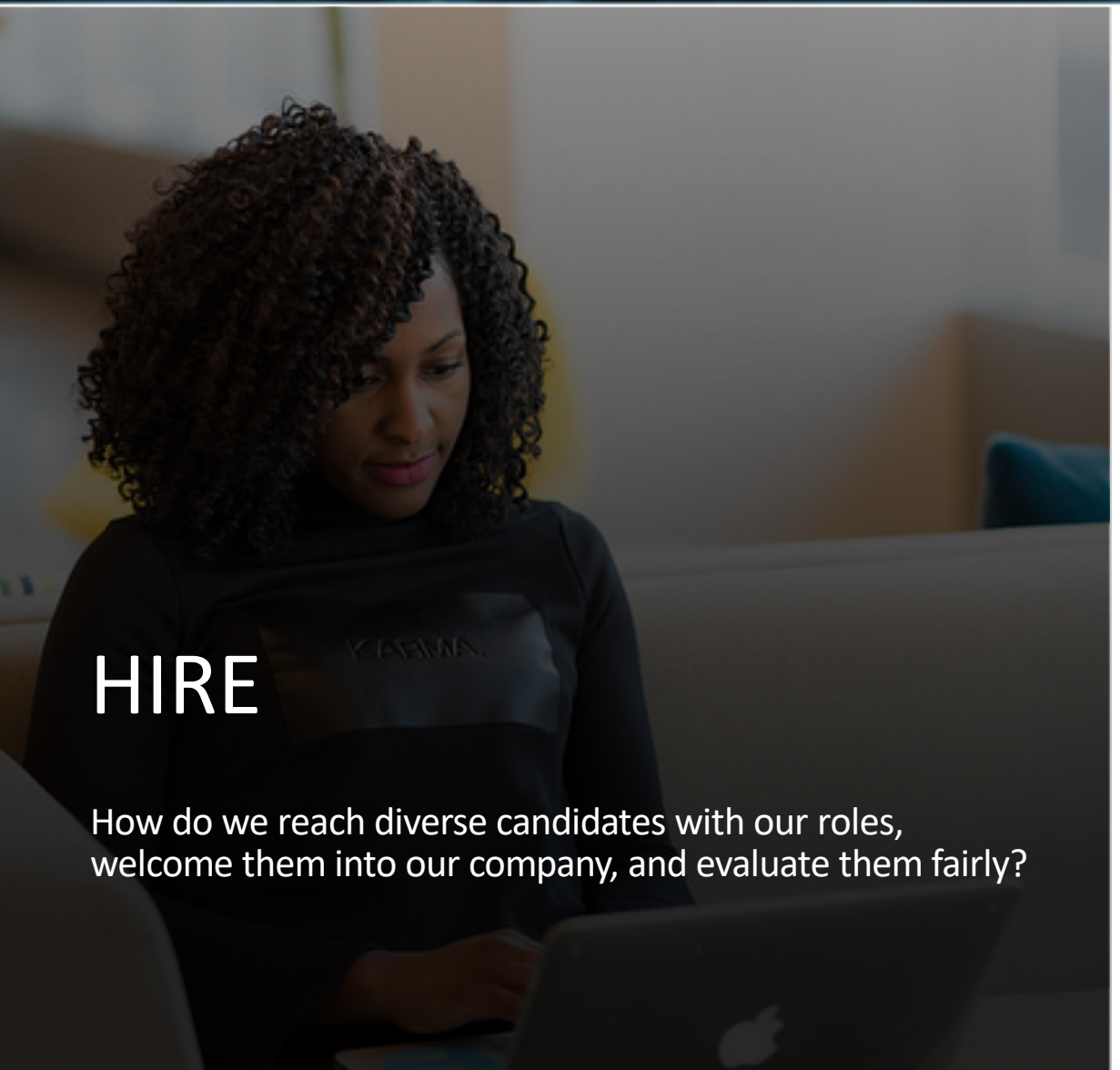
How we categorize factors that block desired outcomes

Combined Framework & Reporting Matrix



Sample Questions

More @ github.com/h45h

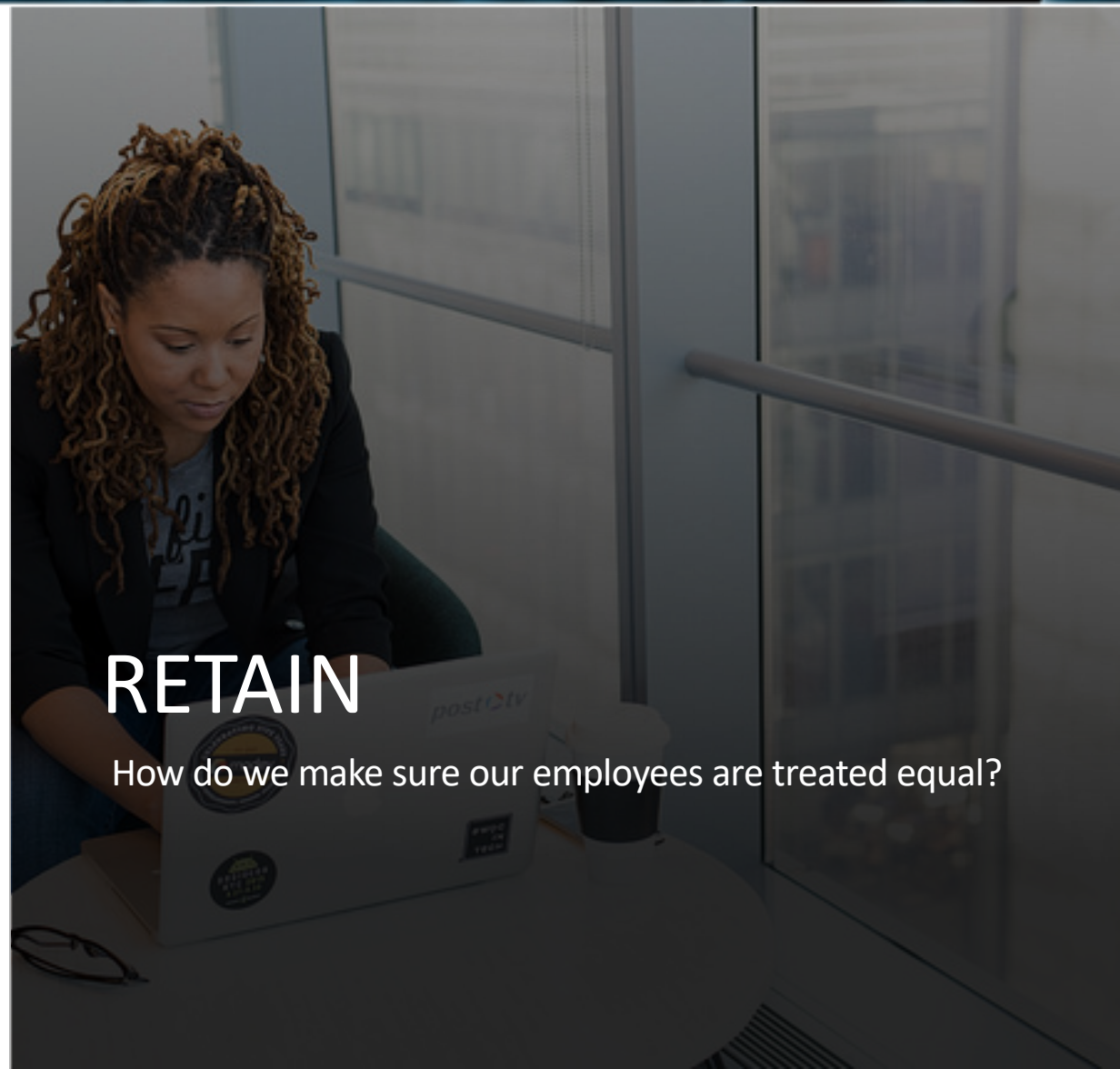


HIRE

How do we reach diverse candidates with our roles, welcome them into our company, and evaluate them fairly?

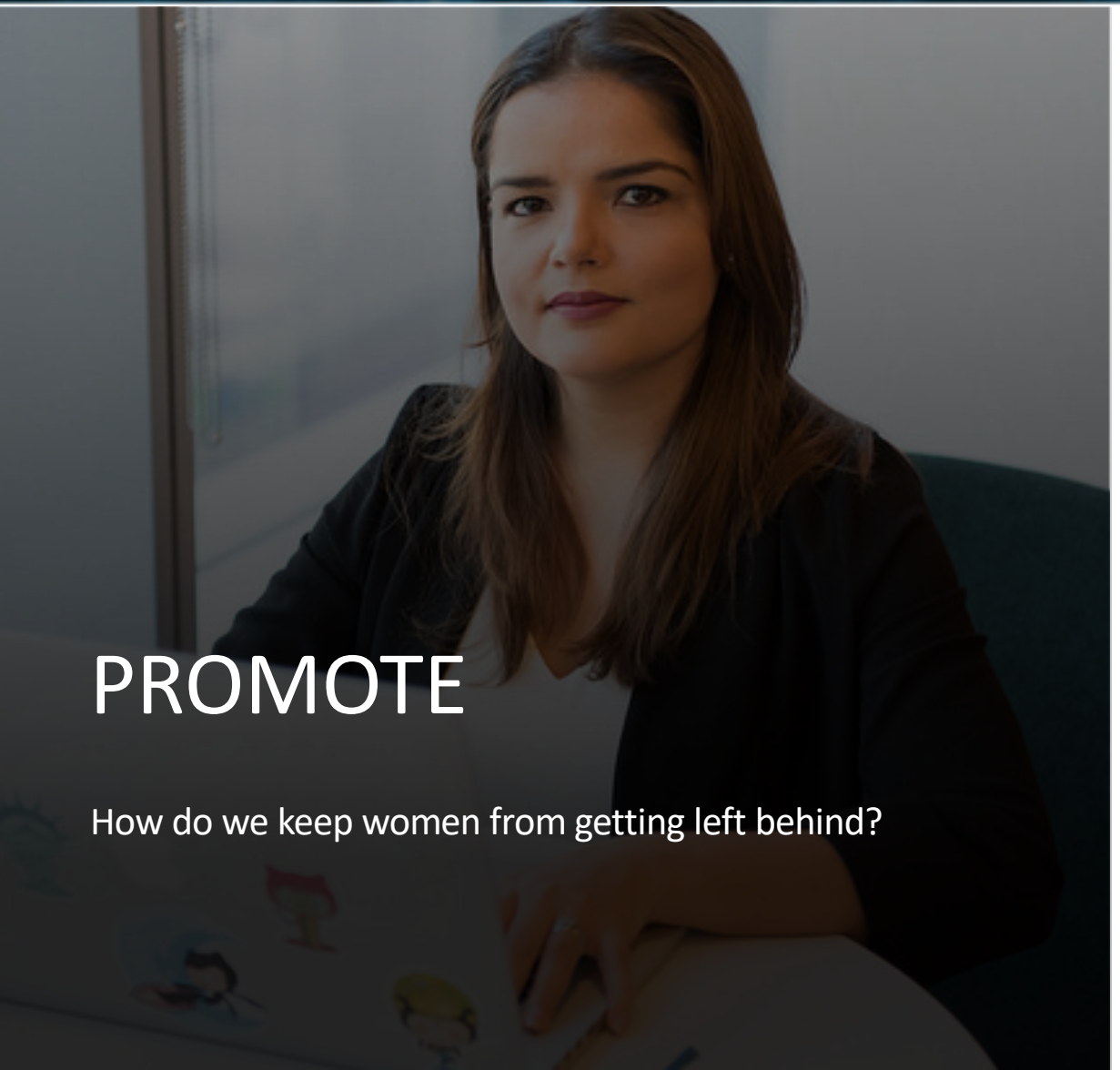
- Where are your jobs posted?
- Which organizations do you partner with for networking at universities and in the community?
- Examine your job descriptions for your last several jobs. Did the hired candidate actually meet those criteria?
- If education/certification is listed as requirement, is there a possibility for equivalent skills or training?
- Ask for resumes for all rejected candidates for the role – were there resumes that would have been interesting to you as the hiring manager? Why were they rejected?
- Do your recruiters use standard, non-technical questions in their script?
- Do your interviewers have a centralized system for recording their interactions, and specific screening criteria for the job?
- When possible, are candidates evaluated based on their skills and not their resume alone?

- Are employees rewarded and recognized equally?
- Do you analyze pay company-wide at a defined interval and address gaps?
- Are employees treated the same after taking leaves of absence?
- Are employees comfortable reporting harassment behavior (guarantees of confidentiality & non-retaliation)?
- Are managers trained to notice harassment and unfair treatment and are they empowered to take appropriate action?
- Do employees get credit for their work and are they empowered to speak/advocate for themselves?
- Do employees all have equal training opportunities?



RETAIN

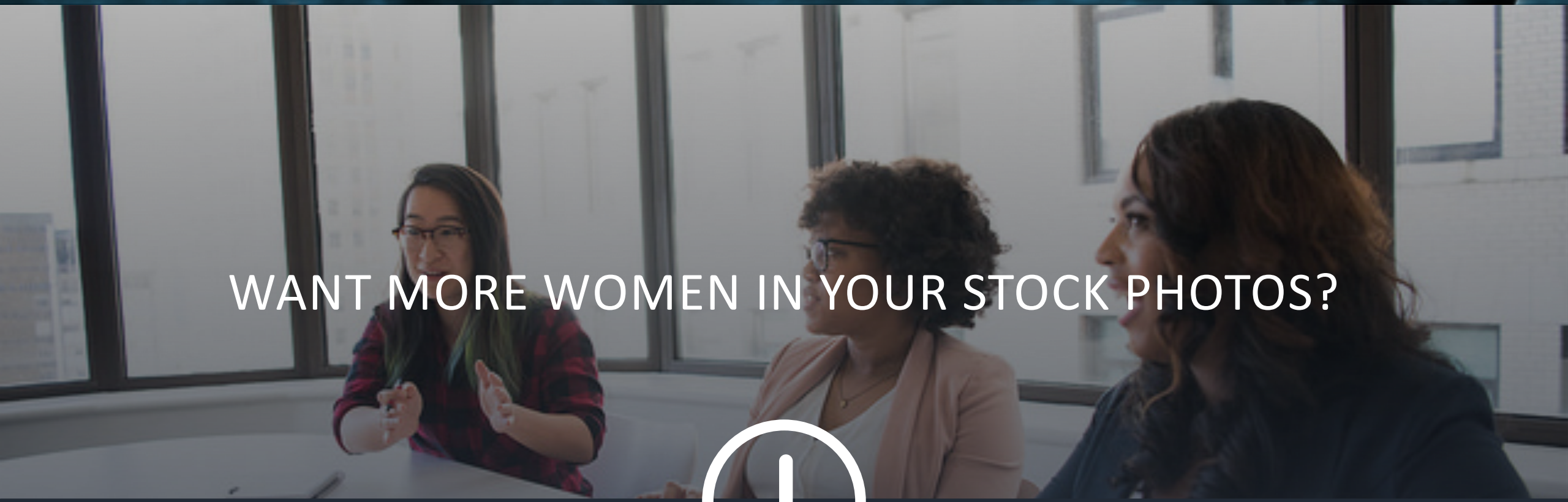
How do we make sure our employees are treated equal?



PROMOTE

How do we keep women from getting left behind?

- Are women actively sponsored and mentored by appropriate people to reach their goals?
- Are career goals part of frequent coaching and feedback cycles?
- Do all employees know the success criteria for their roles and are they evaluated the same?
- How are performance gaps addressed?
- Are leadership roles advertised internally and are employees encouraged to apply?
- If education like an MBA is required for certain roles, is there a sponsorship track for employees?
- Are women pushed into nontechnical/project manager roles when they could have been considered for technical management roles?
- Do executives have access to the data and metrics to determine if bias exists in the organization?



WANT MORE WOMEN IN YOUR STOCK PHOTOS?

All stock photos from #WOCInTech Chat, wocintechchat.com