

# Closing the Gender Divide in Tech: Challenges and Achievements in Vogue

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**Abstract.** This paper investigates closing the gender divide in technology. A literature review was conducted to disclose the factors that lead to the current gender divide in the technology sector classified as stereotypes, bias, lack of female role models, low college enrollment in technology, college student experience, cultural background, interests, personality, aptitude, family responsibilities, fewer opportunities, university and college faculty bias, limited support, and inequity in leadership. A framework was developed to explain the relatively low number of female graduates getting into the technology field, the low number of female remaining in the technology field, and the low number of female in technology management roles. The challenges and achievements faced by women in technology were addressed. The strategies to bridge the gender divide in technology comprise three broad aspects, namely, childhood, education, and career.

**Keywords:** Gender divide · Technology · Challenges · Achievements · Ways to close the gender gap

## 1 Introduction

Although more women are in the technology field than previously, they are still outnumbered by their male counterparts. In some of the technology fields, the number of women is even shrinking. For example, according to U.S. Department of Labor, Bureau of Labor Statistics [17], in the United States alone only 18% of 2012 computer and information sciences undergraduate degree recipients were women. There was a 64% decline in the number of first year undergraduate women interested in majoring in computer science between 2000 and 2012. This presented a serious gender divide problem in the technology field. Therefore, how to close this gender gap becomes essential. This paper examines closing the gender divide in technology with challenges and achievements in vogue. The objective of this paper is to bridge the existing gender divide in technology through identifying factors that lead up to the gender divide, followed by addressing the challenges women face and their achievements, and proposing and discussing strategies for this purpose. A framework to elaborate the factors

that contribute to the gender divide was developed and described. The rationale is to garner support for the combined effort of women in technology around the world and to reveal accurate metrics on gender ratios in technical roles in organizations so as to solve the lack of gender diversity issue in the technology field [2].

## 2 Literature Review

A literature review focusing on the gender divide in technology field was conducted. The focus was to gather full-text articles presenting the data or cases regarding the current status of the gender gap and potential solutions. To manage the scope and timeliness of the study, only articles published between 2010 and 2014 were included. A brief investigation in the literature revealed several factors that lead to the existing gender divide in the technology field. To illustrate these factors, a framework was designed to classify them into categories and sub-categories. Each category and sub-category was then further explained with a description and illustration of the sample scenarios.

**Factors that Lead to the Existing Gender Divide in Technology.** Many factors were discussed in the literature regarding how the gender gap was created in the technology field. Common factors include stereotypes [3, 9, 10, 14], bias [9, 10, 14], lack of female role models [9, 14], low college enrollment in technology [1, 9], college student experience [10], cultural background [14], interests [9], personality [4], aptitude [4, 5], family responsibilities [7], fewer opportunities [11, 12, 18], university and college faculty bias [10], limited support [11, 12, 18], and inequity in leadership [11, 12, 18].

Stereotypes [3, 9, 10, 14] are described as the perception imposed upon particular groups of people, individuals, places or objects by the society at large. Home bias [9, 10, 14] and cultural background [14] facilitate further illustration. A typical perception of stereotypes would be technical courses are perceived as training for boys, while home economics are perceived as training for girls. In some cultures, boys are allowed to attain high levels of educational qualifications, while girls are expected to stay in the home and marry boys who will take care of them financially when they become of age and they take full responsibility for the household duties instead of being educated or highly educated. Because of this stereotype, females are less likely to pursue higher education which may prevent them from getting into the positions that require specific technical qualifications.

Bias [9, 10, 14] is defined as dislike or favor of certain groups of people, individuals, places or things without valid reasons or basis. Home bias [9, 10, 14], university and college faculty bias [10], and workplace bias [3, 9, 10, 14] are the sub-categories of bias. In certain homes, universities and colleges, and workplaces, particular people are given preferential treatment. An excellent illustration of home bias would be where a female child is discouraged from pursuing her interests, let alone pursue bachelor degree programs in technology, while a male child is given support to pursue his interests. University and college faculty bias can come in the form of assignment and exam tips, student grading, internship approval, student leadership participation, student scholarship applications, and job references. Workplace bias can

involve a manager favoring one department employee over another by being more lenient when mistakes are made or giving the first priority when there are career advancement or development opportunities. When the preference is given to male counterparts, females are more likely to be discouraged to pursue the field that they may originally be interested in.

Lack of female role models [9, 14] refers to the situation where there is an insufficient number of female examples in the technology field. Stereotypes [3, 9, 10, 14], home bias [9, 10, 14], cultural background [14], fewer opportunities [11, 12, 18], and limited support in the home [11, 12, 18] contribute towards the explanation of lack of female role models. In several cultures, female children have few or no female examples in the technology field within the family, extended family, friends, and/or in society in general, are not encouraged or supported to pursue a career in technology, and are not exposed to the use of technology as a feminine activity. This explains the low adoption of technology by female adults as a career.

Low college enrollment in technology [1, 9] is seen as low number of female students pursuing degrees in technology at universities. Stereotypes [3, 9, 10, 14], home bias [9, 10, 14], cultural background [14], interests [9], personality [4], lack of female role models [9, 14], limited support in the home [11, 12, 18], and aptitude [4, 5] help in further explanation. In many cultures, female children are not given encouragement, support, and/or do not have sufficient female role models in the technology field. Besides that, if these female children do not have an interest in technology, have no patience towards managing technology, and are not able to learn technology with ease, they are unlikely to pursue tertiary studies in technology.

College student experience [10] can be described as university experience as a student pursuing a degree in technology. University and college faculty bias [10], interests [9], personality [4], and aptitude [4, 5] are the sub-categories. For instance, a female student found the subjects in the technology bachelor degree program very difficult and dull, and was struggling to keep up with her peers throughout the program. In addition, this student faced preferential mistreatment by faulty members in terms of not receiving the same level of assignment and exam tips, student grading, internship approval, student leadership participation, student scholarship applications, and job references upon graduation as fellow students. As a result, this student cannot see herself joining the technology field as a professional upon graduation, made several unsuccessful attempts in getting a place at the teachers' training college, and ended up giving private home tuition to elementary school students as an alternative to being a school teacher, since it is financially viable to survive.

Cultural background [14] describes the place of birth, the country where one resides, and the culture one identifies with. Nationality, country, and culture of an individual form his or her cultural background. Interests [9] can be described as the inclination of an individual towards technology. Personality [4] is seen as an attribute of an individual towards managing technology. Aptitude [4, 5] is the ability of an individual to learn technology.

Family responsibilities [7] constitutes the duties of an individual to his or her family and it is contributed by stereotypes [3, 9, 10, 14], home bias [9, 10, 14], workplace bias [3, 9, 10, 14], cultural background [14], limited support in the home [11, 12, 18], and limited support in the workplace [11, 12, 18]. In cultures where females are seen to be

the sole care giver in the home, being in the workforce does not relieve her of household duties on top of office responsibilities, which is often frowned upon by employers who may not be pleased whenever there is a need for female employees to leave the office at knock off times.

Fewer opportunities [11, 12, 18] can be described as having lesser exposure to use technology or chances for career advancement. Stereotypes [3, 9, 10, 14], home bias [9, 10, 14], workplace bias [3, 9, 10, 14], cultural background [14], limited support in the home [11, 12, 18], and limited support in the workplace [11, 12, 18] are used to further illustrate fewer opportunities. An excellent scenario of fewer opportunities would be female professionals in technology getting bypassed while their male counterparts are given the promotion due to subjective reasons such as men are able to spend more time at the office and are more able to get the job done.

University and college faculty bias [10] is described as unequal treatment of students or fellow faculty members by faculty holding positions of authority. This involves limited support in the university and college [11, 12, 18]. A common scenario of university and college faculty bias would be tenure application of female faculty in technology being less favored by faculty holding positions of authority, likely resulting in a low number of female faculty in technology holding tenured positions at universities.

Limited support [11, 12, 18] is seen as low level of encouragement or reinforcement by family members, faculty staff or work colleagues and this can be subdivided into limited support in the home [11, 12, 18], limited support in the university and college [11, 12, 18], and limited support in the workplace [11, 12, 18]. A good scenario of limited support would be a female technology professional or academic also requiring to be the sole care giver in the home apart from her career without the support of family members, while also not receiving recognition for her contribution at work, is more than likely to leave her career in technology.

Inequity in leadership [11, 12, 18] can be described as an unequal distribution of leadership roles between male and female. Stereotypes [3, 9, 10, 14], workplace bias [3, 9, 10, 14], fewer opportunities [11, 12, 18], and limited support in the workplace [11, 12, 18] clearly illustrate inequity in leadership. A significant scenario of inequity in leadership would be female technology professionals are usually being perceived to play the support role rather than the leadership role, are not always receiving acknowledgement for their achievements, and are often overlooked when it comes to being promoted to a management position.

Low college enrollment in technology [1, 9] and college student experience [10] can contribute to a low percentage of female tech professionals [1, 9], followed by stereotypes [3, 9, 10, 14], home bias [9, 10, 14], limited support in the home [9, 10, 14], lack of female role models [9, 14], cultural background [14], interests [9], personality [4], and aptitude [4, 5].

Family responsibilities [7], fewer opportunities [11, 12, 18], university and college faculty bias [10], workplace bias [3, 10–12, 18], limited support in the workplace [10–12, 18], and inequity in leadership [11, 12, 18] can prevent career advancement [7] and can encourage career change away from technology [7].

**Framework to Illustrate Factors.** The framework below presents the reasons that lead to the gender divide by putting them into three categories, such as the relatively low number of female graduates getting into the technology field, the low number of female remaining in the technology field, and the low number of female in technology management roles (Fig. 1).

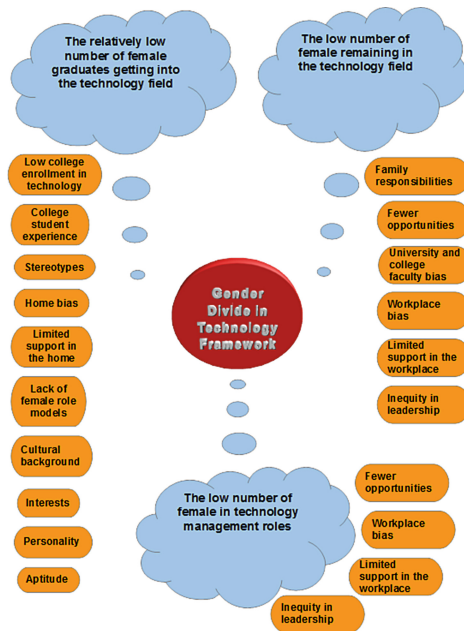


Fig. 1. Gender divide in technology framework

### 3 Challenges and Achievements in Vogue

The authors propose and discuss strategies in bridging the gender divide in technology by considering the challenges and achievements pertaining to women in technology.

**Challenges Women Face in Technology.** Some of the challenges women face come in multiple forms of the “glass-ceiling” [7, 11, 12, 18]. Due to several millenniums of male dominated societies, it created a practice where girls are not encouraged to study technical subjects, or permitted to express their preference for themselves [7, 9]. Although times have changed towards more liberalism in this aspect, women are still a long way from being well-represented in the technology sector [1, 2, 8]. According to a study in 2012 published in the journal of the Sociologists for Women in Society, high school math teachers still think that male students are more capable, although other research shows that male and female students obtain similar grades in both math and science. Such psychological bias appear to be the main barrier towards closing the gender divide [5]. Girls are not encouraged, supported or motivated to take up college

degrees resulting in male-dominated careers and in some instances are discouraged from doing advanced degrees. In other cases, child-bearing often propels women to choose between personal and professional life. For those who choose to continue their professional life, it does not mean that they are freed from the tasks in the house, and striking a balance between personal and professional life affects their career development. The small number of female role models working in a male-coded professional environment are not permitted to diversify, resulting in frustration, insufficient motivation, and ultimately a quiet exit from their careers. With women under-represented in the technology sector, it also results in poor gender dynamics, low visibility, promotion, and salary [7].

**Achievements of Women in Technology.** In the last eight out of ten years, there have been more women taking up management positions according to a survey conducted by PricewaterhouseCoopers and Strategy. Although this is a promising trend, only 3% of leaders in public companies are female CEOs in 2013, with a 1.3% decrease from 2012 [5]. A notable achievement of women in technology is when Twitter appointed its first female board member, Marjorie Scardino, the former CEO of Pearson, a publishing and education company in December 2013 [15]. Another worthy achievement is Julia Gillard, the former prime minister of Australia's takeover of Twitter's handle, Global Development Professionals Network, where she answers questions on global education [13]. Four out of the top ten women featured in Fortune 50's most powerful women in business hold senior positions in tech giants in 2013. Marissa Mayer, CEO of Yahoo! has brought the organization out of predicament by overseeing a 111% rise in company stock in 2013 since she went on board as CEO in 2012. Sheryl Sandberg, COO of Facebook's publication *Lean In: Women, Work, and the Will to Lead* ignited debate in 2013. Other headline grabbers include Ginni Rometty, chairman, president and CEO of IBM, and Meg Whitman who led in a management reshuffle and oversaw a 48% rise in stock value as a new CEO of HP in 2013. Women tech leaders in Ireland and Irish women at the helm of start-ups are other celebrated achievements of women in technology [15]. Women in tech being very engaged in networks [6] is also another illustrious achievement.

## 4 Strategies to Bridge the Gender Divide in Technology

After considering the challenges and achievements in vogue, the authors recommend a set of strategies to bridge the gender divide in technology. The three broad aspects to group these strategies are childhood, education, and career [7].

**Childhood.** Under the childhood aspect, create awareness in both boys and girls by exposing them to using computers as soon as they are able to differentiate between male and female. Encourage, support, and motivate girls to pursue male-dominated college degrees, careers, and postgraduate degrees [7]. Undo stereotypes by not discouraging girls from playing with traditionally boys' toys and games [16]. Conduct programs for both parents and children to make the childhood aspect of these strategies a success.

**Education.** As for the education aspect, revise primary and secondary education to include technology and participating in technology initiatives [16] as part of the school curriculum for both boys and girls [9]. Invite women tech professionals as guest speakers to schools to talk about their profession and encourage girls to do the same if technology interests them [9]. Involve parents of students in technology initiatives and talks by guest speakers to help them understand technology and how girls can also excel in a technology career.

**Career.** For the career aspect, tech organizations can encourage networking among women tech professionals [6] or even create networks for women in technical roles to instill awareness in gender diversity at all levels, to reveal the aptitude of women, to raise visibility, to work towards being on par with male co-workers in promotion and salary, and to increase women representation in leadership [7]. Each organization should have a tech network for women to encourage awareness, obtain support, and facilitation of career development and advancement.

## 5 Conclusion

This paper explored closing the gender divide in technology by considering the challenges and achievements in vogue, and recommending a set of strategies to bridge the gender divide in technology. The gender divide in technology framework encompasses three aspects. The relatively low number of female graduates getting into the technology field is contributed by low college enrollment in technology [1, 9], college student experience [10], stereotypes [3, 9, 10, 14], home bias [9, 10, 14], limited support in the home [9, 10, 14], lack of female role models [9, 14], cultural background [14], interests [9], personality [4], and aptitude [4, 5]. The low number of female remaining in the technology field is due to family responsibilities [7], fewer opportunities [11, 12, 18], university and college faculty bias [10], workplace bias [3, 10–12, 18], limited support in the workplace [10–12, 18], and inequity in leadership [11, 12, 18]. The low number of female in technology management roles is a result of fewer opportunities [11, 12, 18], workplace bias [3, 10–12, 18], limited support in the workplace [10–12, 18], and inequity in leadership [11, 12, 18]. Due to time constraints, an instrument to collect data on gender ratios in technical roles in organizations and to verify the framework identified from this literature review will be distributed later.

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