
17. Intervention organizations to increase women's engagement with IT: a case study of NCWIT¹

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INTRODUCTION

There has been almost exponential growth in information technology (IT) employment opportunities, yet the IT sector continues to have a major problem with diversity in the United States. For instance, in 2017 women constituted 47 percent of the overall workforce, but only 25 percent of the computer and information sciences workforce. The racial and ethnic distribution of employed women in computer and information sciences was 12.6 percent for White, 7.5 percent for Asian, 3.4 percent for Black, and 1.4 percent for Latinx (National Science Foundation 2019). White people make up approximately 60 percent of the US population; the numbers for Latinx, Black, Asian, Native Peoples, and others are 18.5 percent, 12.5 percent, 5.8 percent, 0.9 percent, and 2.2 percent respectively. In other words, women in all racial and ethnic groups except for Asian are underrepresented as their representation in computer and information sciences is less than their representation in the population as a whole.

There are various reasons why underrepresentation of women in IT is important. For one thing, it is a sector with great careers, especially for women. Economically, graduates in IT fields such as computer science, computer engineering and computer information systems receive high starting salaries. There is a gender pay gap in most science, technology, engineering and math (STEM) occupations, but it seems to be shrinking in IT. For instance, new female graduates in computer science average \$79,223 in pay, whereas their male counterparts average \$82,159 (Pratt, 2021). Location-wise, IT skill and knowledge are used in all sectors of the US economy and they are not limited to just the IT industry itself. Similarly, IT work occurs throughout the country and not limited to the Silicon Valley in California or Route 128 in Massachusetts – popularly known as the leading centers of electronics innovation. So, women with a degree in an IT field can find a job where they would like to live. In terms of work, IT jobs are increasingly office based and have flexible hours. This goes well with a desire to have work–life balance. Most importantly, it is a social equity issue that women are missing from these best well-paying jobs.

It should be noted that lack of diversity in IT has serious implications for the US economy. According to the US Bureau of Labor Statistics (2021), employment in IT occupations is projected to grow 11 percent from 2019 to 2029, much faster than the average for all occupations. These occupations are projected to add about 531,200 new jobs. Without an adequate supply of IT workers, the United States is likely to face challenges to its global competitiveness. Thus, a larger participation of women is likely to meet the growing demand for IT workers. This will also enhance innovation since a wider variety of people will bring diverse perspectives.

Scholarly literature on the reasons for underrepresentation of women in IT has grown in the last three decades. In contrast, there are a few studies on forces that have shaped efforts to broaden participation in IT (an exception is Aspray 2016a, 2016b). This chapter focuses on

organizational interventions to increase the proportion and experiences of women in IT education and thus in employment. In particular, it presents a case study of the National Center for Women in Information Technology (NCWIT), the largest organization focused on advancing innovation by correcting underrepresentation in computing.

NCWIT convenes, equips, and unites nearly 1,500 change leader organizations nationwide to increase the influential and meaningful participation of girls and women – at the intersections of race/ethnicity, class, age, gender identity, sexual orientation, disability status, and other historically marginalized identities – in the field of computing, particularly in terms of innovation and development.²

In many ways, NCWIT is unique as it has sought to build the organization's work on a strong foundation of social science research. Historically, social sciences and IT fields have been viewed in terms of "two cultures" that are mutually exclusive. Social sciences are concerned with value, culture, belief, subjectivism, emotion, personality, ethics, and other human aspects, whereas, IT fields are concerned with fact, reason, logic, objectivism, rationality, and other aspects of STEM (Perlman and Varma 2005). NCWIT, on the other hand, recognized that to address diversity in IT, one needs to know factors that influence how IT fields and sectors operate, which has been social scientists' areas of expertise. To this end, NCWIT has its own social science researchers, and it formed the Social Science Advisory Board (SAAB). According to William Aspray (2016a, p. 189), reliance on social science research "has led to a better understanding of such issues as unconscious bias, stereotype threat, collective intelligence, and changing mindsets – all of which have helped illuminate the causes of under-representation in computing." Unconscious bias occurs when people consciously reject stereotypes but still unconsciously make evaluations based on stereotypes (American Association of University Women 2016). Stereotype threat is understood as a situational predicament in which individuals are at risk of confirming negative stereotypes about their group (Inzlicht and Schmader 2012). Collective intelligence holds that when groups of people work together, they create intelligence that cannot exist on an individual level (Malone 2004). Changing mindsets promote the idea that one's talents and abilities can be developed over time through effort and persistence (Dweck 2007). Most importantly, social sciences focus on the nature of economic and political systems and how they impact underrepresentation in computing.

The author of this chapter has been a member of SAAB since 2008 and was a co-chair from 2010 to 2012. This chapter is the author's perspective of NCWIT as a gender scholar and a SAAB member with a focus on areas of particular importance for women of color – a term used mostly for American Indian, Alaskan Native, Asian, Black, Latinx, Native Hawaiian, and Pacific Islander. It is mostly because there is a need to question an underlying assumption that what applies to white women also applies to women of color. While white women have been discriminated against based on gender, they still enjoy privileges based on race which women of color do not.

The goal of this chapter is to present the case study of NCWIT as an intervention organization. First, the chapter gives a brief overview of women's movements in the United States as they laid the foundation of women's collective actions to improve their conditions. It shows that historically American women's movements have had a problem with class, ethnicity and race. Second, it briefly discusses the status of women in STEM, and a number of professional organizations that formed after World War II to broaden participation in STEM. Without these organizations laying the groundwork, we would not have organizations principally broadening

participation of women in IT. It is followed by the section on why there is such a separate push solely for the status of women in IT. The next section presents how NCWIT evolved, its organizational structure, and some of its projects that are contributing to broadening the participation of girls and women in IT. Finally, the chapter discusses NCWIT's approach to broaden ethnic representation within its overall goal to encourage all women to pursue IT. To this end, it looks at women's movements and the role they played to improve the status of women of color. The chapter concludes with some of the lessons learned towards the future work for women in IT especially for women of color.

BACKGROUND

Women's Movements in the United States

With the rise of industrialization, urbanization, and liberalism in the United States in the nineteenth century, the first wave of major women's movements took place from the 1840s to the 1920s. During this time period, American men dominated commercial and political spheres, while women were consigned to the domestic domain. The women's suffrage movement demanded the improvement of women's status in the family and society through women's right to vote. The Seneca Falls Convention – the first women's rights convention held in 1848 in Seneca Falls, New York – protested women's lower economic, political and social positions in the country, and launched the women's suffrage movement (O'Connor 1996). In the temperance movement, white women primarily belonging to the upper and middle classes sought to limit the consumption of alcoholic beverages which were seen to cause domestic violence against women (Edman 2015). The abolitionist movement sought to end the practice of slavery everywhere. American abolitionists saw slavery as an abomination and an affliction on the United States and had many women such as Harriet Beecher Stowe, Susan Anthony, Harriet Tubman and Sojourner Truth (Bessler 2015). The anti-lynching movement composed of mainly Blacks and women (e.g., Ida Well, Mary Burnett Talbert and Angelina Weld Grimke) aimed to eradicate the practice of public killing of Blacks (Smith, 1996).

The depression of the 1930s, World War II in the 1940s, the civil rights and the farm-workers unionizations of the 1960s, and the anti-war and anti-nuclear movements of the 1970s had a major impact on women's movements. From the 1960s to the 1980s, women's movements focused on women's liberation. Their major effort was on passing the Equal Rights Amendment to the Constitution to secure social and economic equality regardless of sex. Women's subjugation was seen to center on the prevalence of patriarchy which viewed women as limited to being wives and mothers. Sex as a biological construct (e.g., chromosomes, sex organs, hormones and other physical attributes categorizing people as female and male) was differentiated from gender which was seen as a social construct (e.g., social role, position, behavior, or identity). The main feminist motivation for making this distinction was to counter biological determinism or the view that biology is destiny (Mikkola, 2019).

American women's movements contributed to reducing discrimination, harassment and prejudice against women at home and in the workplace. The 13th Amendment to the US Constitution ratified in 1865 abolished slavery in the United States. The 18th Amendment to the US Constitution ratified in 1919 prohibited consumption of alcohol in the United States; however, it was repealed by the 21st Amendment in 1933. The 19th Amendment to the US

Constitution, ratified in 1920, prohibited the government from denying the right to vote to its citizens based on sex. Since 1918, over 200 anti-lynching bills were introduced, all of which were voted down. Finally, in 1920 Congress moved to make lynching a Federal crime. The US Equal Employment Opportunity Commission (EEOC) established in 1965 made it illegal to discriminate against people because of their race, color, sex, national origin, religion, age, ability status, and genetic information. In 1973, the Supreme Court in *Roe v. Wade* legalized abortion. In the 1970s, women's studies emerged in academia to change the basis from which women's position in society is understood.

Though a lot of progress has been made to deal with injustice and discrimination which women have faced throughout history, not all women were benefiting. For instance, women earned the right to vote in 1920. However, minority women (and men) were blocked from voting due to Jim Crow laws – those laws that enforced racial segregation from the 1870s to 1950s – and other barriers such as poll taxes and literacy tests (Mack, 1999). It was not until the Voting Rights Act of 1965, which banned several discriminatory voting practices at the state and local levels, that it became easier for minority women to exercise their right to vote. Martha Jones (2020) has argued that Black women were not included in the women's suffrage movement to hold onto the support of many white southern women. The whole process of the Seneca Falls Convention was premised on voting rights for white women. Betty Friedan's (1963) *The Feminine Mystique*, known to spark the second wave of feminism, focused on the problem endured by white upper- and middle-class women. bell hooks (2000) has argued that Friedan was mostly concerned with the needs of white privileged women and excluded women of other races and classes as though they simply did not exist. Though largely excluded from the major white-led women organizations, minority women were engaged in race and gender-related issues. For instance, Sarah Remond filed one of the earliest lawsuits protesting race segregation; Ida B. Wells advocated for federal laws against lynching; Mary Church Terrell established the National Association of Colored Women; Frances Ellen Watkins Harper challenged Susan B. Anthony and Elizabeth Cady Stanton at an 1866 women's rights meeting; and Mary McLeod Bethune led voter registration drives after women gained the right to vote (Schuessler, 2019).

In the 1980s, with post-colonialism – how people in formerly colonized countries continue to be marginalized by western power – (see, Loomba, 2005) and post-modernism – questioning of the ideas and values associated with modern progress and innovation – (see, Lyotard, 1984), many previous constructs especially the notion of “universal womanhood” were deconstructed. Feminism was seen as multicultural and global where differences due to class, ethnicity, nationality, genetic information, and so forth were to be celebrated. Gender was no longer seen as a social construct in terms of rigid power relations; instead, it became a fluid concept based on social norms, societies' determination of men's and women's roles and activities, and how individuals understand their identities. Women of color challenged the growing inequalities with their white sisters inside the United States, and between western and non-western women outside the United States. For instance, Alice Walker (1982) depicted what it was like for a Southern Black woman to grow up and come to self-realization. Patricia Hill Collins (1990) presented a rich intellectual tradition of Black feminists despite confronting race, gender and class oppression. Chandra Talpade Mohanty (1988) critiqued western feminists for reducing third-world women into a single collective “other.”

In short, if it were not for women's movements, we would not have reforms on issues such as domestic violence, equal pay, maternity leave, reproductive rights, right to vote, sexual

harassment, and so forth. Nonetheless, women's movements in the United States have had a problem with class, ethnicity, and race. They have assumed that white women are the norm, and have not been inclusive of the needs, perspectives and concerns of women of color. In short, historically the women's movements have lacked an inter-sectional analysis.

Women in STEM

In 1969 when Margaret Rossiter, an American historian of science, asked, "Were there ever women scientists?" She received an authoritative answer: "no, never, none" that reflected the oppression and devaluing of women of the times (cited in Dominus, 2019). Before World War II, very few women had received bachelor's degrees in science or engineering which were mostly from all women's colleges (Rossiter, 1982). Further, opportunities for higher education in STEM were mostly available to white women from wealthy families. After World War II, rapid growth took place in STEM areas such as computers, microwaves, missiles, penicillin, radar, satellite, and a host of technologies, which gave STEM a new image with the American public. On October 4, 1957, the Soviet Union launched Sputnik – the first artificial satellite put into orbit – which created a perception of the US weakness in STEM education in general and in space science in particular. The US government began providing money and facilities for growth in STEM on a larger scale than before. The National Defence Education Act of 1958 focused on mathematics, science and foreign language education to meet the demands posed by national security needs. It encouraged students to continue their education in STEM beyond high school. By making federal student aid available to women for the first time, the Act removed financial need as a barrier to higher education in STEM for women (Rose, 2016). Prior to the 1958 Act, on the one hand, families mostly invested in higher education for their sons who were seen as breadwinners; women, on the other hand, were seen as not remaining in the labor market after getting married and having children.

Various women's organizations were formed to broaden women's participation in STEM. For instance, the Society of Women Engineers (SWE)³ was founded in 1950. Its mission is to give women engineers a unique place and voice within the engineering industry. The Association for Women in Science (AWIS)⁴ was created in 1971. It is the leading organization that advocates on behalf of women in STEM to achieve business growth, social change, and innovation. It is dedicated to driving excellence in STEM by achieving equity and full participation of women in all disciplines and across all employment sectors. The Women in Engineering ProActive Network (WEPAN)⁵ was established in 1990. It leverages research and best practices to propel the inclusion of women in the field of engineering. WEPAN's network connects advocates who actively pursue strategies and implement solutions to increase participation, retention, and success of women and other underrepresented groups in engineering from college to executive leadership. Many professional STEM organizations also established women's committees within them.

National Science Board (2018) data shows that since the 1980s, women have out-numbered men in undergraduate education in the United States. Since the late 1990s, they have earned about 57 percent of all bachelor's degrees and half of all STEM bachelor's degrees. In 2015, women earned half or more of the bachelor's degrees in psychology, biological sciences, agricultural sciences, and all the social science fields within social sciences except for economics. In the same year, women earned 45 percent of all science and engineering (STEM) master's and 51 percent of doctoral degrees. Field selection at masters and doctoral levels followed

the same pattern as bachelors level. In 2015, women in all racial and ethnic groups earned the majority of bachelor's degrees and more than half of the master's and doctoral degrees in the social and behavioral sciences and non-STEM fields. Overall men have been earning the vast majority of degrees awarded in engineering, computer science, physics, mathematics, and statistics; whereas, women are earning lower proportions of bachelor's, master's, and doctorate degrees in computer science, engineering, and physics. So, the question remains, why is there a gender gap in some STEM education and thus in occupations?

Scholarly literature on women in STEM is enormous. Earlier, Sue Berryman (1983) coined the phrase the STEM pipeline – young women are engaged with STEM in elementary, middle, and high school education, select a STEM major in higher education, and then go into STEM careers. The leaky pipeline metaphor has been used for the likelihood of women leaving STEM fields because of missteps. The STEM pipeline metaphor has been criticized as being too simplistic, without much empirical support (Cannady et al., 2014). The “STEM pathway,” which suggests more fluid steps women take to careers in STEM, has been proposed as an alternative to the pipeline metaphor (Wang and Degol, 2013). Most studies on the gender gap in STEM have focused on various barriers that women face such as gender stereotypes (Carli et al 2016), masculine educational and work environments (Simon, Wagner and Killion 2017), unconscious gender bias (Corbett and Hill 2015), the dearth of female role models (Drury et al., 2011), questioning of mathematical abilities (Sax et al., 2015), lack of self-efficacy (MacPhee, Farro and Canetto 2013), and a sense of not belonging (Stets et al., 2017).

Often generalizations are made about all women even though the sample may be limited to white and privileged women. The classic report, *The Double Bind* (Malcom, Hall and Brown 1975) asserted that women of color are victims of two inter-related problems in science: racism and sexism. Some studies have emerged which document the lived experiences of women of color in both predominately white universities and minority-serving institutions (Ong et al., 2011; Borum and Walker, 2011; Martinez and Sriraman, 2015; Alexander and Hermann, 2016). There remains a need to do more research on women of color in STEM. A recent book *Hidden Figures* by Margot Lee Shetterly (2016) reveals the untold stories of Black women who were hired during World War II to work as “human computers” to run calculations that would launch rockets and astronauts into space.

In response to the US Civil Rights Movement – a struggle for social justice that took place from 1954 to 1968 for Blacks to gain equal rights – multiple organizations were founded in the 1970s to help minorities to engage in STEM education and careers (Aspray, 2016a). For instance, the National Action Council for Minorities in Engineering, the National Society of Black Engineers, and the National Consortium for Graduate Degrees for Minorities in Engineering and Sciences were set up to encourage Blacks to study STEM. Similarly, the Society for Advancement of Hispanics, Chicanos and Native Americans in Science, Latinos in Science and Engineering, and the Society of Hispanic Professional Engineers seek to advance the educational and career opportunities for Hispanics. The American Indian Higher Education Consortium and the American Indian Science and Engineering Society serve Native Americans in STEM education. These organizations assist both minority men and women in STEM education, though it is not clear if they have established subgroups focused specifically on women within their organizations. Nonetheless, the presence of these organizations and the affirmative action programs to make up for past racial and gender discrimination have led to claims of favouritism to minorities and women of color and the existence of reverse discrimination against whites.

Push for Women in IT

After World War II, the United States was characterized as entering what Daniel Bell (1973) called the post-industrial society. In this stage, the service sector was seen as contributing more to the US wealth than the manufacturing sector and employing more white-collar than blue-collar workers. The use of IT was seen to contribute to the country's structural shift to a service economy (Castells, 1996). Since the 1970s, IT has had a profound impact on the productivity, globalization, and growth of the US economy (Alberts and Papp, 1997). Many revolutionary technologies in the past (e.g., the printing press, the steam engine, the transistor) have brought profound changes to society. But the key qualitative difference with IT is not only that it has made fundamental changes, but more importantly, these changes have taken place at a very fast and unprecedented pace. IT has contributed to growth in demand for labor as well as an overall skill upgrade in the workplace (National Science Board, 2000).

With the rapid growth of IT, concerns were raised about the supply of IT workers. The IT industry itself reported a large shortage of IT workers (Information Technology Association of America, 1997, 1998). The US Department of Commerce (1997) issued a similar warning. The perception of the shortage of IT workers resulted in Congress adopting legislation to increase the number of temporary H-1B visas that can be awarded annually to foreign skilled workers from 65,000 to 115,000 for 1999 and 2000 fiscal years. In 2000, H-1B visas expanded to 195,000 for 2001, 2002, and 2003 fiscal years (Varma, 2020). Without strengthening its supply of IT workers, the United States was seen to risk the loss of its worldwide leadership in IT and other high-technology industries (Freeman and Aspray, 1999). It was argued that without an adequate IT workforce, these industries would experience slow innovation and product development and may become less competitive globally. Also, companies dependent on the IT workforce may move offshore to meet the competitive challenge, which may result in a negative impact on employment. A lack of IT workers may slowdown the productivity improvement, resulting in companies hiring fewer qualified people and reducing the range of products manufactured. The bottom line was that an IT worker shortage was seen to have a significant adverse impact on the US economy.

One important way to produce a continuous supply of IT workers is to expand the representation of women in IT education and thus in the workforce. However, in IT fields the gender gap has remained large. For instance, in the United States, women make up about 18 percent of the bachelor's, 30 percent of master's, and 20 percent of the doctorate degrees in computer science. These statistics have gone down since the mid-1980s. Women's share of bachelor's degrees in computer science peaked at 15,126 in 1986 and came down to 7,063 by 1995 (National Science Board, 2000). It started to increase and went up to 10,522 in 2000. Since then, the share of bachelor's degrees awarded to women in computer science has declined by 10 percent in 2015 (National Science Board, 2018). Black women's share of bachelor's degrees in computer science has declined from 4.9 percent in 1996 to 2.2 percent in 2016; Latina women's share of bachelor's degrees in computer science has not gone up from 1.87 percent over the past two decades (National Science Foundation, 2019). The proportion of master's degrees earned by women declined in computer science from 33 percent in 2000 to 31 percent in 2015. Although women earned less than one-third of the doctorates awarded in computer science, they increased their numbers from 131 in 2000 to 439 in 2015 (National Science Board, 2018). A recent study by Frieda McAlear and Allison Scott (2019) shows that

among all women employed in computer and information science occupations, only 12 percent are Black or Latina women.

Given the importance of IT to the US economy and society, those interested in the US global competitiveness and those interested in social justice for women found a common platform to increase women's representation in IT. The National Science Foundation (NSF) – an independent federal agency created by US Congress in 1950 to promote the progress of science – has supported studies to improve underrepresentation in the STEM disciplines since the 1970s. In the 1990s, NSF began to invest funds specifically in computing education and human resources through various programs namely IT Workforce (2000–2005), Broadening Participation in Computing (2006–2012), and Computing Education for the 21st Century (2010–present). Since the beginning of the twenty-first century, women's underrepresentation in IT was being scrutinized from many angles (Ahuja, 2002; Margolis and Fisher, 2002; Katz et al., 2003; Larsen and Stubbs, 2005; Cohoon and Aspray, 2006; Singh et al., 2007; Papastergiou, 2008; Lang, 2010; Cheryan, 2011; Good et al., 2012; Quesenberry and Trauth, 2012; Beyer, 2014; Aspray, 2016a). Some studies have addressed class, ethnicity and race factors on women in IT (Varma, 2007a, 2007b, 2010).

A CASE STUDY OF NATIONAL CENTER FOR WOMEN IN INFORMATION TECHNOLOGY (NCWIT)

After World War II, several organizations cropped up to increase women's representation in STEM. When computer science emerged as a distinct academic discipline, these organizations provided support for women in computing. Since the late 1980s, new organizations began to surface to help women to build computing careers. For instance, the Anita Borg Institute⁶ started a digital community for women in computing in 1987. The Computing Research Association Committee on the Status of Women in Computing Research (CRA-W)⁷ was established in 1991 to increase the success and participation of women in computing research. In 1993, the Association for Computing Machinery started its Committee on Women in Computing (ACM-W).⁸ It supports, celebrates, and advocates internationally for the full engagement of women in all aspects of the computing field.

In 2004, NCWIT was founded by Lucy Sanders, Robert Schnabel, and Telle Whitney as an American non-profit 501(c)(3) organization to focus on women's participation in IT across the entire ecosystem with the \$3.25 million award from NSF (2004). Since then, NCWIT has grown to help over 1,400 organizations recruit, retain, and advance women from kindergarten to 12th grade (K-12) and higher education through industry and entrepreneurial careers by providing support, evidence, and action. At present, NCWIT is the largest organization that assists women to build a career in IT both in scope and participation.

NCWIT's success has been in its vision to move beyond an NSF-funded project at a university to a full-fledged non-profit organization. This way, NCWIT could both raise and distribute funds as well as control intellectual property generated in the process (Aspray, 2016a). NCWIT has been extremely successful in raising funds from IT and traditional technology companies. Currently, it has (i) Apple as lifetime partner, (ii) NSF, Microsoft, Bank of America, Google, Intel, Merck, AT&T, and Cognizant US Foundation as strategic partners, (iii) Avaya, Pfizer, Bloomberg, Hewlett Packard Enterprise, Qualcomm, Facebook, Morgan Stanley, Amazon, and Johnson and Johnson as investment partners, and (iv) individuals.

Though their main office is on the University of Colorado campus, NCWIT staff is distributed throughout the United States. This way, NCWIT keeps a fluid organizational structure, that is, increasing importance of flexibility and dynamism and decreasing importance of organizational boundaries, structures and processes (Jarvi et al., 2018). In addition, NCWIT is able to hire a workforce that is likely to be diverse as they come from different places.

Instead of building infrastructure based on physical plant, NCWIT has been mostly functioning through “Alliances” which are groups of like-minded organizations. The Academic Alliance,⁹ NCWIT’s first alliance, focuses on changing the local conditions that create barriers to attracting and graduating women in postsecondary computing by adopting and contributing research-based practices. It brings together more than 1,700 representatives from more than 500 colleges and universities nationwide such as the Boston University, California Institute of Technology, Harvey Mudd College, and United States Naval Academy to focus on local barriers to attracting and graduating women in postsecondary computing. Its main goal is to address all issues of gender and computing in higher education (Aspray, 2016a).

In 2005, NCWIT started its K-12 Alliance¹⁰ which is made up of youth-serving organizations, professional educator associations, academic institutions, and businesses. It leverages the reach and diversity of its members to create national outreach programs that increase the participation of girls in computing. For organizations such as Girl Scouts, Campfire and YWCA who are focused on girls, the K-12 Alliance brings them together to learn how to run a successful computing program for girls by showing gender and culturally responsive STEM/computing hands-on activities. Organizations that serve educators such as the Computer Science Teachers Association and National Girls Collaborative Project, the K-12 Alliance offers research-based practices and resources to do a better job in engaging girls in computing. For organizations such as Code-org, Bootstrap and Black Girls Code who teach coding to students and teachers, the K-12 Alliance ensures that coding is taught in an inclusive way (Aspray, 2016a). NCWIT believes that the K-12 Alliance has the potential to reach 100 percent of the girls in the US.

The Workforce Alliance¹¹ started in 2006. It focuses on internal corporate culture change to promote more inclusive environments, build stronger technical teams, and enhance technical innovation. NCWIT provides the Workforce Alliance members such as Amazon, Pfizer, Samsung, Sony, and Wells Fargo guidance in applying research-based strategies to mitigate bias in systems such as hiring, task assignment, performance evaluation, and promotion, making company cultures more inclusive, so every voice is heard. Unlike the Academic Alliance and K-12 Alliance, however, the Workforce Alliance has been slower to grow. It is partially due to the fact that many companies are reluctant to collect/provide internal data and reveal their best practices (Aspray, 2016a). NCWIT believes that companies have gradually become interested in improving their internal operations to broaden participation. At the end of 2020, NCWIT introduced the magazine *e:think*, which advocates for a more diverse, equal and inclusive technology industry.

NCWIT has numerous successful programs. For instance, its Aspirations in Computing Program¹² started in 2007 uses awards, scholarships, internships, and professional opportunities to get girls involved in computing. So far 90 percent of its award winners have reported a college major or minor in an STEM field. NCWIT’s Extension Services Program¹³ uses research-based tools, processes, and best practices to increase women’s participation in undergraduate and graduate computing programs. NCWIT’s Pacesetter Program¹⁴ started in 2010 is a fast-track program in which industry and university leaders committed to increasing their

numbers of technical women. These organizations set for themselves a numeric goal of “Net New Women” to recruit and retain women. NCWIT’s Sit with Me¹⁵ is a national advocacy program in which people are invited to sit on a red chair to create spaces where everyone can reflect on the value of diversity and inclusion. The red chair gives all individuals an engaging way to sit in solidarity with technical women and invite others to participate. Every year at the beginning of summer, NCWIT holds an annual summit on women and IT that is free and open to the public. The summit brings educators, scholars, people working in the industry, university administrators, and the community interested in improving diversity and equity in computing. It should be noted that NCWIT has many other programs than what has been mentioned in this section.

Organizationally, NCWIT has over 30 experienced boards of directors representing academia, industry, policy, and the community. They approve the NCWIT annual budget, strategies and operation plans, audit finance, ensure legal and ethical integrity, and enhance NCWIT’s public standing. NCWIT research teams consists of almost 15 scholars with doctorates in a variety of fields including education, sociology, communication, and psychology. They create research-based resources to increase awareness for systemic change, translate existing research into actionable practices, and conduct original research and evaluation. NCWIT has a number of consultants who provide expert analysis and recommendations. In addition, NCWIT has created the Social Sciences Advisory Board (SSAB) which consists of approximately 20 non-NCWIT scholars who bring expertise from the areas of anthropology, education, evaluation, gender studies, history, policy, psychology, sociology, technology, and workforce studies. They provide a support for NCWIT initiatives and goals through their knowledge of research and theory at the intersection of women and computing.

Over the years, the SSAB members have reviewed NCWIT resources and suggested improvements; contributed to setting NCWIT’s research agenda; collaborated on reports about relevant theoretical and empirical issues which are published as white papers; and reviewed computing courses to remove gender bias. Often, annual summits’ agendas have reflected the discussions that have previously taken place in SSAB’s meetings. Some of the titles of SAAB members presentations at NCWIT are (Aspray, 2016a):

- The performance vs persistence paradox: Myths about women in IT
- Changing the image of computing to increase female participation
- Programs for undergraduate women in STEM: Issues, problems and solutions
- Crocheting the way to math equality: The effects of teaching style on math performance
- Preventing stereotype threat in standardized testing
- Beyond the double bind: Women of color in STEM
- Persistence research in STEM
- Female recruits explore engineering (free project) and free pathways
- The STEM agency initiative for STEM learning among marginalized youth
- Gender and computing: A case study of women in India.

Historically, the value of social sciences has not always been appreciated by those in physical or natural sciences. John Platt (1964), for instance, considered some scientific fields which rely on systematic methods of scientific thinking to be more productive than others. Norman Storer (1967) differentiated some science fields as “hard” and others as “soft” based on the degree of rigor directly related to the use of mathematics. Those in astronomy, biology, chemistry, geology, mathematics, and physics tend to consider social science research less

legitimate as it focuses on society and people (Editorials, 2012). When NSF was established in 1950, social sciences were included under the rubric of “other sciences.” Often, questions were raised about lack of rigorous methods, mathematical rigor, and verification of results in social science research. Many at NSF viewed the field of social sciences as not a “real” science (Aspray, 2016b). It was not until 1991 when a separate Directorate of Social, Behavioral and Economic Sciences was established, that social sciences began enjoying recognition and visibility like other fields at NSF. By the 1990s, NSF had also implemented various programs to increase participation of underrepresented groups in STEM. However, the outcome was not what NSF had hoped for. Some of the NSF supported programs had local success, but very little progress was made to broaden participation at the national level. There was a concern that the funding which NSF was putting into diversity was not leading to increased participation of women and underrepresented minorities in STEM (Aspray, 2016b). Most of these NSF-supported programs were limited to research conducted by social scientists on the underrepresentation of women and minorities in STEM disciplines. When the Presidential Information Technology Advisory Committee (PITAC) issued a report on September 8, 1999, that called for broadening participation in IT, NSF started its IT Workforce Program to support multi-disciplinary collaborative projects among investigators in IT and the social sciences and/or education. NSF sought to harness social science research to generate findings that would offer guidance about how to address pressing social issues such as representation of women and minorities in IT (Rosenbloom and Ginther, 2016). It is, therefore, no surprise that NCWIT sought a support from NSF with multi-disciplinary and collaborative research efforts using a variety of methods.

NCWIT has been very successful in growing from a small to a very large organization in a very short time period. NCWIT's success has been rooted in its dynamic leader Lucy Sanders, who has done most of the operational work – how to handle day-to-day activities and how to address the problem of underrepresentation of women in an effective and efficient way. According to Sanders, her goal is to make enough changes that NCWIT can put itself out of business in 20 years (cited in Aspray, 2016a). It means there should be high involvement of women in IT. However, as previously described, the problem of gender diversity in IT education and workforce in the United States has yet to be solved

Women of Color and SAAB

NCWIT's agenda has been to address “all” women – at the intersections of race, ethnicity, class, age, sexual orientation, and disability status – in the field of IT. It is similar to recent debate that instead of “Black Lives Matter” – a global organization in the United States, the United Kingdom, and Canada whose mission is to eradicate white supremacy and build local power to intervene in violence inflicted on Black communities by the state and vigilantes – focus should be on all lives matter. Many SSAB members especially those who have been chairs and co-chairs in the past feel that NCWIT ought to have a special focus on women of color. It is because women of color have a different history of oppression and injustice, and thus are not in positions in computing similar to their white sisters. According to SAAB leadership, NCWIT's focus on “all” women with intersectionality is not the best way to express its purpose and priorities because of racial history of the United States and the persistence of racial/ethnic bias. For instance, NCWIT's theory of change argues that women's absence from computing is rooted in societal systems. It discusses bias, sexism, and stereotypes and,

as pointed out by Jane Margolis (2019), misses out a key variable – “racism.” In August 2018, the Kapor Center and the Center for Gender Equity in Science and Technology at the Arizona State University have formed the Women of Color in Computing Research Practitioner Collaborative.¹⁶ It is working across a broad range of stakeholder groups to build a detailed and robust foundational body of research on the barriers, trends, and effective interventions specific to underrepresented women of color in technology to inform and scale new initiatives, policies, and funding priorities.

In its 2017 summit in Tucson, Arizona, NCWIT attempted to engage the Black community by holding a workshop “NCWIT Resources Review: Ensuring Relevance for Black Communities.” According to Enobang Branch (2017), one of the speakers of the workshop, it was mostly symbolic and lacked deep discussion on underlying issues which Blacks face. A similar workshop “Ensuring Engagement and Relevance in Black Communities: From Kindergarten to Workplace” was repeated at NCWIT 2018 summit in Grapevine, Texas, with similar outcome. As an example, women of color were trying to make an argument about why Black women in technology companies needed more support. However, they felt undercut when NCWIT declared that it is for “all” women. This led SAAB to discuss what “all” women means in historical times. At NCWIT 2019 summit in Nashville, Tennessee, Jane Margolis (2019) made a “Presentation to SAAB on All Women.” She argued that why talking about “all” women can appear to be undercutting to the most marginalized women in the American society. SAAB members believe that an “all” women approach is limited to promoting the meaningful inclusion of girls and women from diverse backgrounds. According to them, holding such workshops, recruiting SSAB members belonging to different race/ethnicity, and having some Black speakers at its summits, NCWIT merely gives an impression that it is doing something for women of color, when in reality it is not doing it in a meaningful way.

Intersectionality, the term coined by Kimberlé Crenshaw (1989), stresses the importance of paying attention to complex interactions between multiple identities and dynamics of power and oppression. It should be noted that there is a growing concern within women’s movements to re-evaluate how women face bias along with multiple identities such as: ability, age, class, ethnicity, gender identity, genetic information, nationality, race, and sexual orientation. In fact, Robin DiAngelo,¹⁷ one of the plenary speakers at the NCWIT summit in 2019, discussed how hard it can be for white people to “see the racial water,” that is, to become conscious of the constructions of whiteness and white racial identity that stand-in for “normal” in a society that is deeply divided by race. In other words, to speak for “all” women ignores the needs of women of color; instead, it ends up addressing issues of upper- and middle-class white women. Emphasis on “all” women recognizes the voices of women of color as long as it appears inclusive of the aims of white women. Even Michelle Bernard (2013), a Black woman, has argued that “Friedan’s unintentional exclusion of African American women in *The Feminine Mystique* was in fact a gift because it might be what led to the development of a black feminist movement and scholarship in the area of black feminist thought” (paragraph 16). In other words, Black women owe their gender consciousness to white women. This shows how deep the problem is for women of color.

Nonetheless, SAAB’s push for a specific focus on women of color appears to have resulted in two outcomes. First, NCWIT is figuring out how to address the long-standing issue in women’s movements which have centred on issues relevant to white and privileged women. NCWIT is listening to the critique that various categories like race and ethnicity need to be looked into in relational terms rather than as separate categories in isolation from each other,

and there is a need for grassroots activism. For instance, summits held 2019 onwards had a number of diverse speakers discussing issues pertaining to women of color. NCWIT Color of Our Future¹⁸ is a new program which anchors NCWIT programs, initiatives, and research-based resources focused on broadening the meaningful participation of underrepresented women and girls of color (Black, Latinx, and Native American) to positively impact the future of computing. Its Modern Figures Podcast¹⁹ guest stars Black women in computing who share their stories and perspectives on technical, societal, and personal topics. Similarly, TECHNOLOchicas²⁰ presents powerful stories of Latina technologists from diverse background backgrounds and environments. The Color of Our Future Conversation Series²¹ explores the advancement and inclusion of Black women and girls from K-12 through career. In response to high-profile incidents of Black Americans being killed at the hands of police in 2020 and protest against racial/ethnic injustice, Sanders has sent out two newsletters: “An NCWIT Community Call to Action for Racial Justice” in January 2021, and “Beyond Thoughts and Prayers: Dismantling the Racist, Sexist Root Causes of Violence” in March 2021.

Nonetheless, NCWIT has begun to question the usefulness of SSAB. This is despite the fact that a lot of discussions about race/ethnicity have been happening in the SAAB. To this end, NCWIT is planning to significantly restructure the SSAB as an advisory body, alter individual SSAB members' activities and membership lengths, and limit support for SSAB members to the annual summit. NCWIT has its own social science research team which has grown from two to almost 15 researchers with doctorates. They work on the projects that are generated by them within the current and future goals of NCWIT. In this sense NCWIT research team does not have the absolute freedom which SSAB members enjoy. While SSAB members can engage in intellectual debate without any constraint and can do critical evaluation of NCWIT programs, the NCWIT research team remains influenced by the NCWIT context. It seems NCWIT prefers to work with its own social scientists, rather than SSAB who provide access to advice from experts. SSAB has been providing multiple perspectives and is able to critically evaluate every part of NCWIT activities.

CONCLUSION

This chapter has presented a brief case study of NCWIT as an example of the interventions that organizations can conduct in promoting the participation of advancement of women in computing. The perspective on NCWIT is by the author who has been a member of NCWIT and SAAB for the last 12 years, and was a co-chair of SAAB for two years. This chapter is the author's perspective of NCWIT as a gender scholar and a SAAB member with a focus on areas of particular importance for women of color. The chapter has framed the case study in the context of three underlying themes: women's movements in the last 200 years; the status of women in STEM and organizational efforts to change that for the better; and the importance of IT for the US economy and the need to have a focused organizational effort to increase the representation of women in computing. The chapter has described the sharp expansion of NCWIT in a very short time period. The credit for this goes to the leadership's vision, flexible organizational structure, innovative programs, and continuous flow of resources from the corporate sector. Most importantly, NCWIT has laid the groundwork for women's organizations to base their activities and best practices on social science research. The chapter has

highlighted recent tension between SAAB members and NCWIT on “all” versus specific focus on women of color. NCWIT has begun to address diversity among women in IT.

NOTES

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2. See ncwit.org/about-ncwit/.
3. See <https://swe.org/about-swe/>.
4. See <https://awis.org/about-awis/awis-history/>.
5. See <https://wepan.org/page/aboutwepan>.
6. See <https://anitab.org/about/>.
7. See <https://cra.org/cra-wp/history>.
8. See <https://women.acm.org/>.
9. See ncwit.org/higher-ed/#alliance.
10. See ncwit.org/k-12/#alliance.
11. See ncwit.org/workforce/#alliance.
12. See ncwit.org/program/aspirations-in-computing/.
13. See ncwit.org/program/highered-programs/extension-services/.
14. See ncwit.org/ncwit-program/pace-setters-program/.
15. See ncwit.org/program/sit-with-me/.
16. See www.wocincomputing.org.
17. See ncwit.org/video/2019-ncwit-summit-robin-diangelo-white-fragility.
18. See ncwit.org/program/color-of-our-future/.
19. See ncwit.org/program/color-of-our-future/modern-figures-podcast/.
20. See ncwit.org/program/aspirations-in-computing/technolochicas/.
21. See ncwit.org/program/aspirations-in-computing/the-color-of-our-future-conversation-series/.

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