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Being Asian American Women Scientists and Engineers in the United States: Intersection of Ethnicity and Gender

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Abstract

A high level of educational and occupational achievements in science and engineering (S&E) in the US has changed the image of Asian Americans from the "yellow peril" to a "model minority." Behind this new identity is the belief that Asian Americans as a group have equaled, if not surpassed, the standards of success set by White America in S&E. It is further assumed that Asian American women are advancing equally in S&E. The reality is that they are over-represented as Asian Americans but under-represented as women in S&E occupations. They experience challenges associated with both, their ethnicity and gender. They face "double bind"—a term used for women of color who simultaneously experience sexism and racism in S&E. This paper presents Asian American women's unique situations within S&E organizations, with a particular focus on high-technology industry, where most of them are employed. It focuses on their identities and socio-cultural categorizations.

Keywords

Asian women, double bind, bamboo ceiling, model minority, women of color

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Introduction

Recent US Census noted that Asian American—a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent—constitute 22 million or 7% of the US population. An analysis by the Pew Research Center (2021) shows that Asian American is the fastest growing ethnic group in the US with a growth rate of 88% from 2000 to 2020. The largest Asian group is Chinese (5.4 million), followed by Asian Indian (4.6 million), Filipino (4.2 million), Vietnamese (2.2 million), Korean (1.9 million), and Japanese (1.5 million). These six groups make 85% of all Asian American. Almost 60% of Asian Americans were born outside the United States. More than half of them ages 25 and older (54%) have a bachelor's degree or higher compared to 33% for the US population. Asian Americans have a slightly higher labor participation rate (65%) than the overall US population (62%) aged 16 and over. Asian American men have higher labor participation rate (73%) than Asian American women (57%). In 2019, the median annual household income for Asian American was $85,800, compared with $61,800 among all US households.

Asian Americans (hereafter Asian) make 7% of US population but 14% of its scientists and engineers—those with a bachelor or a higher degree in an S&E field or an occupation in jobs classified as S&E. Asian women make about 7% of its scientists and engineers (National Science Foundation, 2021). A large majority of scientists and engineers are from a small number of Asian countries. In 2015, for which the latest data are available, India accounted for 20.5% of the foreign-born S&E degree holders in the US; it was followed by China (10.1%), Philippines (5.1%), Taiwan (3.0%), Vietnam (2.9%), South Korea (2.5%), and Japan (2.2%). For S&E doctorate holders, China provided a higher proportion (22.4%), which was followed by India (16.2%), South Korea (2.4%), and Japan (1.9%) (National Science Board, 2018). Overall scientists and engineers make up about 5% of the US civilian labor force. Yet, they are considered an important engine for scientific and technical innovation and thus overall economic growth. The rising number of Asian scientists and engineers in the US workforce indicates the country's increasing reliance on them for its rapidly growing S&E needs.

Typical Asians in the US are likely to be foreign-born, educated in S&E, employed as scientists or engineers, economically well to do, and law abiding. Such attributes have been used to portray them as a "model minority" or "model immigrant." The word "model" implies that Asians should be viewed as an ideal example for imitation by those groups who are yet to be successful. US popular media has portrayed Asians in America with catchy titles such as: "Asian Americans: A Model Minority," "A Drive to Excel," "A Formula for Success," "America's Super Minority," and "Those Asian American Whiz Kids." The 2003 *CBS 60 Minutes* story "Imported from India" reported: "the United States imports oil from Saudi Arabia, cars from Japan, TVs from Korea, and Whiskey from Scotland. So what do we import from India? We import people, really smart people." Thomas Friedman (2007), a political commentator and three times winner of Pulitzer Prize wrote: "it seemed like every one of the newly minted PhD's at Rensselaer (Polytechnic Institute) was foreign-born. For a moment, as

the foreign names kept coming Hong Lu, Xu Xie, Tao Yuan, Fu Tang, I thought that the entire class of doctoral students in physics were going to be Chinese…" Amy Chua (2011) in her memoirs describes how it is better to raise kids the Chinese rather than the Western way in the US and elsewhere. A recent poll found that Americans view Asians as smart/intelligent, hard-working, and kind/nice (LAAUNCH, 2021).

What could be wrong to be portrayed as a successful group? Historian Vijay Prashad (2000, p. vii) asked: "how does it feel to be a solution?" Prashad has argued that the concept of model minority was deployed as a weapon to fight against Blacks in the light of the Civil Right Movement of fifties and sixties. The model minority myth overlooks many socio-cultural complexities, peculiarities, and nuances of the Asian experience (Ngo & Lee, 2007). In reality, the makeup of Asians is exceedingly complex; they come from more than 20 countries. Culture, language, religion, colonial history, education level, economic status, reasons for immigrating, and duration of presence in the US—all of these are points of divergence among Asians rather than a convergence. Despite being viewed, Asians in the US are not a monolithic group.

Though the model minority myth has been studied for Asians (Poon et al., 2015), and Asian scientists and engineers (Sabharwal, 2017), there are few studies focusing on women. Most importantly, the enterprise of S&E is distinctive in its norms as the dominant ideology holds that S&E discourse ought to be independent of culture, gender, nationality, politics, and race/ethnicity, and supposedly relies solely on meritocracy (Merton, 1973). In such context, Asian women scientists and engineers are presumed to receive treatment similar to their White male, White female and Asian male counterparts. However, the reality for Asian women scientists and engineers is different than the prevalent ideal norms of S&E (National Academies of Sciences, Engineering and Medicine, 2021). Asian women scientists and engineers face the double bind, a term coined over 40 years ago by Malcom et al. (1976). Since then, multiple things have changed and now women of color face new challenges (Ong et al., 2011). Asian women scientists and engineers confront multiple layers of discrimination associated with both racism and sexism. They remain concentrated at lower ranks, and do not climb to senior positions in academia, high-technology industry and national laboratories.

This paper presents Asian women scientists' and engineers' unique situations within the United States. It focuses on their identities and socio-cultural categorizations mostly in high-technology companies where most of them are employed. The paper is based on scholarly literature and reports. The author of this paper is an Asian Indian immigrant woman, who has been studying Asian immigrants in S&E organizations since 2002 (Varma, 2007). So far, she has conducted in-depth interviews with over 350 Asian Indian immigrant scientists and engineers working in academic institutions, high-technology companies, and national laboratories in the US, and with those who moved back to India to work. In their recent study on the return migration from US high-technology companies to India (2017–2019), Varma and Sabharwal conducted in-depth interviews with eight women out of 50 participants who returned to work, and 12

women out of 40 participants currently working in the US. Findings from these 20 women are reported in this paper.

I Am a Scientist/Engineer

How are scientists and engineers defined? One of the main indicators to identify a scientist or an engineer is attainment of expertise stemming from a prolonged specialized education (bachelor or higher) in an S&E field (such as biology computer science, engineering, physics, mathematics, and psychology). Then there are those who may not have a degree in an S&E field, but have a training and expertise, and thus are employed as a scientist or an engineer. Recently, National Science Board (2020) expanded this definition of scientist and engineer to include those who do not have a bachelor's degree in an S&E field or employment as a scientist or an engineer, but are performing work in S&E–related fields such as S&E managers, health care workers, computer programmers, and technologists. With the new definition, scientists and engineers are about 23% of civilian labor force. Asian scientists and engineers are primarily driven by their representation among S&E workers with a bachelor's degree or higher.

Prior to 1950, immigration from Asia was either banned or restricted with a series of Acts such as the Chinese Exclusion Act of 1882, the Gentlemen's Agreement with Japan in 1907, the Barred Zone Act of 1917, and the Oriental Exclusion Act of 1924. In this period, Asians who did enter the US were mostly male manual laborers to work on railroads, agricultural fields, and manufacturing plants (Kim, 1999). They were viewed as the "yellow peril" who threatened both White Americans' jobs and their women (Pfaelzer, 2007). The 1965 US Immigration Act replaced immigration based on the color of skin to skill and family reunification. It gave preference to "professionals, scientists, and artists of exceptional ability" and "skilled…workers in occupations for which labor is in short supply" (Varma, 2007, pp. 20–21).

Since 1965, a large numbers of Asian students have begun to migrate to the US. Typically, they enter the country for a master or doctorate in S&E fields after attaining a bachelor's degree from top universities in their birth counties. American universities would not admit students from Asia unless they have a degree from a reputable university, and have obtained high marks. Though initially most Asian students were male, now female students from Asia are joining S&E departments in US universities. Because of under-representation of women in computer science, engineering, and physics, Asian female students have become valuable in universities' admission selection. After graduating from US universities, they find employment in academic institutions, high-technology companies, and national laboratories. With the sponsorship of their employing organizations, they get their student visas converted into work visas and eventually into permanent residencies. The 1990 US Immigration Act opened door to temporary "specialty occupation" workers to enter under the 3-year renewable H-1B visa to fill jobs requiring a bachelor's degree or equivalent work experience. Within 6 years after H-1B visas are issued, Asian scientists and engineers

get their temporary visas converted into a permanent card with the sponsorship of their employing companies (Varma, 2020). It should be noted that not all Asian scientists and engineers seeking to change their temporary status to permanent, are successful.

Because immigration of Asian scientists and engineers increased after 1965, and accelerated in 1990s, a large majority of them are either born in Asia or have immigrant parents. The prevalent value system in Asian countries is that they must do well in mathematics and science education to succeed in life. Asian parents pressure their children to become doctors, scientists or engineers (Varma, 2011). In Asian countries, S&E professions are highly regarded as they ensure high paying jobs. The education system in these Asian countries is of high standards (Rohaidi, 2016). After school, students spend most of their time doing mathematics exercises and science homework since they have to score high on the entrance examinations of high-end S&E institutions and medical schools. They are drilled to digest and remember tremendous amounts of information. S&E departments in Asian universities rely on Western curricula and standards, use Western textbooks, and even hire faculty trained in Australia, Europe, and North America. The medium of instruction in schools tend to be a combination of English and a local language, or English is taught as a compulsory subject. In most accredited universities, S&E education is often delivered in English or a mixed English/local language. Asian scientists and engineers are educated to be articulate, mathematically minded, analytical, good at diagnosing technical problems, and able to solve such problems very quickly (Varma, 2011). They transfer such values to their children.

In addition to formal education and training, scientists and engineers are also expected to hold guiding norms of science which Robert Merton (1973) outlined in 1943. According to the Mertonian norms, all scientists and engineers can do S&E regardless of their gender, ethnicity/race, and nationality. They ought to pursue S&E knowledge for its own sake, and not for self-interest and personal gain. They should examine their own S&E activities critically and subject them to rigorous tests. Their findings should be subject to verification before they are accepted by the S&E community. All S&E claims must be held to objective criteria, and they should not be influenced by bias, personal interests, and value judgments. With such process, S&E knowledge generated is common property to the community thus it must be publicly shared. It should be noted that these norms describe the ideal S&E community; in reality, scientists and engineers may fall short of such ideals.

Unless Asian scientists and engineers directly come from their countries of birth to work in US technology companies, they are socialized in the US as S&E students. In the US institutions of higher education, Asian students learn how to collect data, conduct experiments, interpret results, develop explanations, evaluate their own work and others' work, and interact with their peers (Sabharwal & Varma, 2017a). Most Asian students receive graduate assistantships which train them in teaching and research. They internalize the expectations and standards of the American S&E system. Through the socialization process, Asian students become proficient in the knowledge, skills, norms, and values of their selected field (Braxton & Baird, 2001). This suggests that Asian scientists and engineers are likely to converge to a common standard of US

scientific norms. Those scientists and engineers who come directly from Asia to work in the US are likely to be less Americanized, at least initially. It is worth pointing out that employers and peers expectations of scientists and engineers coming directly from Asia may be different from those with degrees from US institutions.

But, I Am an "Asian" Scientist/Engineer

Asian scientists and engineers who are US-born are unlikely to face additional challenges in finding suitable jobs. However, if they are foreign-born, despite the fact they have a degree from an US institution, they face some difficulties with finding quality positions of employment. It is mostly because of political pressure to hire US citizens, and employing organizations have to bear cost and administrative work associated with the visa work (Varma, 2020). Because of needed technical skills to remain competitive in the global market (Gjelten, 2015), Asian scientists and engineers are recruited regardless of their ethnicity, nationality, or skin color. It has been argued that by having Asians, tech companies present themselves as supporting workplace diversity (Hekman et al., 2017). Their presence gives an image of a diverse workplace; because they are non-White (yellow or brown), it makes White dominance somewhat unclear.

Asian scientists and engineers work hard, get the job done, put in long hours, and are reliable. Because of their desire to get organizations' sponsorship to get their temporary visa status converted into permanent, as well as political environment that immigrants take skilled jobs away from American citizens, a competitive work environment is created for Asian scientists and engineers. They do whatever it takes to accomplish a given task. Failure is not an option for them since they may not get another opportunity. For many, it means working late after scheduled hours and on weekends (Varma, 2020). Asian scientists and engineers take such inconveniences as a part of their path to success. They believe that they must out-perform their White peers to be at par.

Though Asian scientists and engineers have attributes and qualifications like what is considered to be in a scientist or an engineer, after recruitment, they are seen distant from prevalent American organizational culture. Social psychologist Geert Hofstede (1980) identified four dimensions—power distance, individualism versus collectivism, masculinity versus femineity, uncertainty avoidance—on which employees from different national cultures differ. Based on such dimensions, organizational cultures of American and Asian are differentiated on being egalitarian versus hierarchical, individualistic versus collectivist, competitive versus consensus-oriented, and risk-tolerant versus risk-averse.

Once employed, prevailing view on organizational cultural differences of Asian scientists and engineers from White peers, which were silent during hiring, become visible (see Varma, 2007). Asian scientists and engineers are seen as putting excessive emphasis on personal relations, and regarding work interactions from a personal rather than from a professional perspective. It is believed that they do that above their own interest. In addition, Asian scientists and engineers are seen as holding allegiances to

those who occupy a higher rank based on age, gender, occupation, social status, and wealth due to the cultural tradition of deference to people above them. Instead of being assertive about the quality and quantity of their accomplishments, they let them to speak for themselves. Typically, having such attributes should not matter significantly in S&E work; however, such perceptions work against Asian scientists and engineers. Either they take longer to join the high-ranking technical and managerial positions, or do not get promoted to such positions.

Since economist Herbert Simon (1997) separated programmed from non-programmed decision making in 1947, this classification has been widely used. Programmed decisions are routine, well-structured, learned in advance, and lend themselves to solution by organizational structure; in contrast, non-programmed decisions require judgment, intuition, creativity, innovation, and imagination. Asian scientists and engineers are regarded to be good at programmed decision, but not at non-programmed decisions. Accordingly, they are deemed to be more competent at "technical work" than "management work" (Tang, 2000; Varma, 2007, 2021; Woo, 2000). They are considered to be imitating what they have learned than being innovative. It is believed that they tend to be too conservative and do not take risks.

Though only good at the technical work is the subjective perception of employers of Asian scientists and engineers, language skills are visible attributes. English is not the first language of Asian scientists and engineers who were born outside the US. They may be educated in the English medium prevalent in their countries of birth. Most have attained their degrees in the US institutions of higher education in English. Still, they meet some language hurdles. Overall 72% of all Asians living in the US are "proficient" in English, meaning they either speak only English or speak the language very well. Nearly all US-born Asians (95%) are proficient in English, compared with 57% foreign-born Asians (Pew Research Center, 2021). Even when they speak English well, Asian scientists and engineers, who were not born in the US, have an accent, which remains as an obvious marker that separates them from White Americans. English with accent is often interpreted as Asian scientists and engineers have poor communication skills (Sabharwal & Varma, 2017b). This perception reinforces that they can be responsible for the technical work and not for the managerial work.

The end result is that Asian scientists and engineers are well-represented in technical positions but under-represented at management and executive levels (Sabharwal & Varma, 2017b; Tang, 2000; Woo, 2000; Varma, 2007). According to a report by Reveal of 177 Silicon Valley companies data for 2016 EEO-1 shows that Asians are well represented in professional positions but under-represented at management and executive levels. In 2015, Asians made 37.5% of professionals, 25.4% of managers, and 20.5% of executives; corresponding figures for Whites were 52.5%, 64.7%, and 73.3%, respectively (Ranjarajan, 2018). This suggests that Asian scientists and engineers are recruited to work mainly in those S&E roles that are non-competitive with White Americans. Such occupations concede Asian scientists and engineers a higher socio-economic status. But, key positions of leadership remain reserved for White

Americans. Because S&E claim to be objective and the label of model minority, structural barriers faced by Asian scientists and engineers are rarely acknowledged.

If Asian scientists and engineers come directly from their country of birth to work in technology companies on H-1B visa, they are exploited in finding desired employment (Ontiveros, 2017; Varma, 2020). Even if they are hired by big US technology companies, Asian scientists and engineers have to go through recruiting agencies in their home countries. These agencies charge for their services of finding employment in the US and processing visa-related paperwork; such charges are illegal under US laws as they are companies' business expenses. Increasingly, Asian scientists and engineers are hired by Asian companies who do contract work for US companies on the US soil. These Asian scientists and engineers have limited mobility, choice of work, and little possibility for permanent immigration in the US. Finally, there are small body-shopping firms mostly headed by Indians in the US who recruit Asian scientists and engineers for a wide-ranging clientele base. Upon arrival, they perform a series of short-term jobs only when they become available; sitting on a "bench" and wait for a job to arrive without getting paid is illegal under US laws.

Depending on for whom they are working, these Asian scientists and engineers experience varying degree of exploitation. Below are some famous cases involving mostly scientists and engineers coming from India on H-1B visa to work in the US. In 2006, Siebel Systems settled for $27.5 million for making its 800 H-1B software engineers overwork which resulted in their sleep deprivation and health problems (Hogarth, 2006). In 2013, Tata Consulting Services settled for $29.5 million for failing to pay H-1B employees promised wages, and forcing them to sign over their tax refund checks to the company (Economic Times Bureau, 2013). The same year, Infosys paid $34 million for making H-1B employees with low qualifications and low salaries to perform high-qualified jobs (US Department of Justice, 2013). In 2011, the Lambents Group was told to pay its 10 H-1B employees a total of $185,241.81 in back wages (US Department of Labor, 2011). In 2018, Cloudwick Technologies was found guilty of paying merely $800 per month to its H-1B employees who were promised salaries up to $8300 per month (Bhattacharya, 2018). The same year, Divensi and Azimetry companies were charged of getting H-1B visas approved for projects that did not exist, and charging their H-1B employees' substantial fees for visa applications (Lerman, 2018).

Irrespective of whether Asian scientists and engineers were born or migrated to the US, they are viewed as "outsiders" in the US. Ethnic relations in American society have been defined "who we are" versus "who they are." They are regarded as "foreigners," who lack allegiance to the United States and are loyal to their birth countries. It does not matter that they have settled permanently in the US, changed their citizenship, have children born and being raised in the US, and have no plans to return to their birth countries. Since President Donald Trump, US–China relations have grown tense, US government has begun racial profiling of scientists and engineers of Chinese descent. They are more likely to be suspected of spying for China simply because of their ethnicity and national origin (Hadhazy, 2021). Since the COVID-19 pandemic began in March 2020, violence against Asians has increased; the Associated Press (2021) has

reported more than 9000 anti-Asian incidents. In 2017, a White man shot two Asian Indian engineers, Srinivas Kuchibhotla and Alok Madasani, after shouting ethnic slurs (Eligon et al., 2017). In other words, Asian scientists' and engineers' success is only appreciated when it serves American goals.

Then Again, I Am an "Asian Woman" Scientist/Engineer

Historically, girls were deprived from science and mathematics education in most countries. Often, biological differences between girls and boys were used to claim that girls/women were incapable to study/do science. For instance, in 2005, president of Harvard University, Lawrence Summers, suggested that innate differences in sex may explain why fewer women succeed in science and mathematics careers (Pollack, 2015). Since World War II, women have increased their representation in S&E education and occupations in the US. National Science Foundation (2021) data shows that of all S&E degrees awarded in 2018, women earned about half of bachelor's degrees, 44.7% of master's degrees, and 41.2% of doctorate degrees. However, the proportion of degrees awarded to women varied by field—female S&E degree holders were most prevalent in social sciences, biological sciences, and agricultural sciences and the least prevalent in physics, computer sciences and engineering. In 2019, only 16% of women worked in S&E occupations and 37% in S&E–related occupations.

Why are so few women becoming scientists and engineers? Scholarly studies show that women face a number of barriers in S&E fields. Among scientists and engineers working full time in 2019, women had lower annual salaries than did men in most broad occupational groups. Overall, women's median annual salary was $70,000, whereas the median salary for men was $95,000 (National Science Foundation, 2021). There is a subtle gender-based socialization in the US (and elsewhere), which results from cultural perceptions that women's place in S&E is secondary to men. Such view shapes expectations of parents, teachers, and students themselves that S&E are for males (Hill et al., 2010). A solid background in mathematics has been considered a prerequisite for students in taking S&E paths in college. The prevalent stereotype is that women lack preparation and proficiency in mathematics (Chipman et al., 2014). Even when women score high, they lack confidence and hold less positive attitudes toward mathematics (Kay & Shipman, 2018). In addition, many S&E fields convey that they are for strong men who wish to have a close encounter with powerful machinery (Leslie et al., 2015). Moreover, S&E fields with male cultural norms become "chilly" environments for women who do join these fields (Britton, 2016). Women face inappropriate comments, sexist jokes, insults, and even open harassment (Barthlemy et al., 2016). The end result is that women continue to be precluded from the S&E fields which remain within male domain. The male mindset has been written into the norms of S&E. For instance, in electrical and mechanical engineering, male connector is a plug with a solid pin and a female connector is a jack with a hole to accept the male pin. In information technology, fingering as a computer command and internet penetration are likely to embarrass women. One has to wonder why give S&E products and processes a gender.

A recent survey of almost 3000 Asian women conducted by the *Atlantic* shows that they face multiple hurdles to advance in S&E in the US (Williams et al., 2018). At work, Asian women scientists and engineers do not fall in the same category as their Asian male peers of being smart, and good at science and mathematics. It seems the stereotype that Asians are good at mathematics and science helps Asian women to get admission in S&E departments in US universities. However, once they start to work, their male peers do not view them as competent in S&E work as themselves. Asian women scientists and engineers have to work hard to show their skills. The *Atlantic* survey found "prove it again" bias against them. They are no longer viewed as Asians who are competent in S&E, but more as women who are not good in S&E. As one interviewed participant said: "You have to prove yourself to everyone all over again…You have to work hard to show that indeed you are good. I have held other jobs and this has been the case in all jobs." Another said, "It is automatically assumed that I do not know anything….It could be unconscious bias or it could be a conscious thing." This one resented, "If a project requires a lot of work and is repetitive, they will give that to me. But, if it is a high impact project, they will make sure that I am not a part of it."

Asian women scientists and engineers have to figure out how to achieve a balance between being feminine and masculine at the same time. If they only act like feminine, they are liked as being good colleagues, but not respected as competent in S&E. If they only act like masculine, they are respected as being competent in S&E, but not liked as colleagues. The *Atlantic* survey found that Asian women scientists and engineers are supposed to "work hard, keep their heads down, avoid confrontation, and let others take the lead" (Williams et al., 2018). It should be noted that they will not be able to advance in their careers without advocating for themselves. As one interviewed participant said, "We are supposed to listen a lot, but not talk a lot. We are supposed to volunteer ourselves to work which other gives, but not promote our results." Another believed that "as an Indian women, I am not supposed to display my accomplishments…White women can stand up for themselves but not me….If I do, it will not be appreciated." This one resented, "It comes in very subtle way. Extra work would be given to me but not to others. It is expected that I should do whatever I have been told. They have right to give me whatever they feel like because I am here at their mercy."

In most Asian countries, social systems are largely patriarchal or patrifocal (Chowdhury, 2009; Mukhopadhyay & Seymour, 1994). Under such systems, females are subordinated to family; inheritance is patrilineal; residency is patrilocal; family roles are differentiated on gender lines; marriage is controlled by family; and women are expected to practice chastity, domesticity, and obedience. Historically, such systems have facilitated Americans to view Asian women as exotic. According to Aki Uchida (1998, p. 172), "The belief that white women are superior beings to Oriental Women enables white men to reason that the power difference between them and Oriental Women is even greater than that between them and white women, providing them the rationale for expecting a greater degree of subordinate behavior from Asian women." The cover page of *Wired Magazine* (February 2004) portrayed "The New Face of the Silicon Age." A female Asian Indian information technology worker with beautiful

eyes and gold ornaments is veiled by her own hand, which is in turn covered by henna script that encrypts a computer code. The accompanying caption states: "Kiss Your Cubicle Goodbye." With such objectifications, Asian women scientists and engineers are viewed as submissive, domestic, docile, and obedient (Patel, 2008). The *Atlantic* survey noted the stereotypes of "worker bees" and "dragon ladies" to be associated with Asian women scientists and engineers (Williams et al., 2018). As one interviewed participant said, "Americans are puzzled how we can go into arranged matrimonies. Some will fish around and ask how I met (my husband). But most will ask if my marriage was arranged by my parents." Other said, one of my colleagues asked: "What do you think about this whole Indian stigma of keeping your virginity until marriage." This one noted that "Some White women interact in very patronizing way. They feel superior to us. They think we do not value women's independence the way they do. So, they try to influence us to become somewhat feminist."

Getting ahead in S&E occupations depends on both "human capital" or what you know and "social capital" or who you know (Tang, 2000). Socializing with peers is essential for scientists and engineers to access information that is not available to others. Scientists and engineers, however, tend to socialize with those who are similar to them in terms of race/ethnicity and gender. Not only they are different from White Americans, general perception is that Asians do not assimilate into American society because of their cultural, social, religious, and political values (Varma, 2021). Though White Americans still find easy to socialize with Asian males, that is not the case with Asian females. This is mostly because of their gender. For one thing, it is not easy for a male scientist or engineer to invite his female peer to go for beer as it may be misinterpreted; it becomes even more complicated with female scientists and engineers belonging to different races/ethnicities. The end result is that Asian women scientists and engineers' human capital rests largely in their higher education, training, and technical skills (National Academies of Sciences, Engineering & Medicine, 2021). However, they have little social capital as they remain outside the "boys network." As one interviewed participant said, "I used to invite some of my American fellows, but never got invited back so I no longer do it." Another said, "We have to find out what it takes to be successful in the US. Working hard is the first thing, and combining technical knowledge with social knowledge is the second thing…Somehow, we are not a part of social groupings."

Success in S&E career does not go well with the motherhood. Typically, high-technology companies offer 2 weeks of paid leave, followed by 10 weeks of unpaid leave and a commitment that the job will be waiting for women when they return. Cultural expectations are that women should take care of children since men's S&E careers are privileged. Having children does not impact men whereas it can become a challenge for women who end up having main responsibilities of caregiving. Upon return, women encounter stereotypes about their commitment to S&E work, which demands intensive hours (Blair-Loy & Cech, 2017; Fox, 2010). Men without family responsibilities and women without children are viewed more valuable than full-time working mothers (Cech & Blair-Loy, 2014). Maternity results into gender bias and it

reinforces the masculinity of S&E fields. In Asian culture, women without children are seen as incomplete. It is, therefore, no surprise that Asian women scientists and engineers tend to have children within a couple of years of being married. It is assumed that they will devote their energies to raise children and leave their jobs. This perception creates challenges when young unmarried Asian women are looking for S&E jobs. When they are hired and have children, it is believed that they have more commitment towards family than to S&E work. Asian women scientists and engineers cope with work and family life balance through the extended family support. Typically, unpaid family support is easily available to them; and thus, they face little challenge in raising children and working full-time. As one interviewed participant noted, "I was judged as soon as I told them that I was expecting. They congratulated me and immediately asked if I would be staying or leaving the job." Other said, "my parents came to live with me and they took care of (my son) so I can go to work without any tension." One felt that her White colleague was "jealous" since she had to struggle between work and day care.

In addition to having competence and performance, scientists' and engineers' career success depends on recognition by others (Carlone & Johnson, 2007). It is their managers and peers who have to recognize Asian women scientists and engineer as competent and support their career advancement. In an analysis of occupational data from academia, government and industry, Wu and Jing (2011) concluded that "The advancement of Asian female scientists and engineers in STEM careers lags behind not only men but also white women and women of other under-represented groups." They face what has been called the "bamboo ceiling" (Hyun, 2009); they are disproportionately under-represented in leadership positions. The Ascend Foundation examined EEOC 2018 data on senior leadership in companies in all industries by race and gender. Among other things, it found (i) Asian men are 112% more likely to be executives than Asian women; and (ii) White women are 134% more likely to be executives than Asian women (Nunes, 2021). Why this is the case? The *Atlantic* survey concluded that Asian Americans have been invited into S&E workplaces, but only to play a specific role (Williams et al., 2018).

The reasons for the bamboo ceiling can be divided into two inter-related categories: (i) structural, that is, stereotyping, racial/ethnic prejudice, being outside network, working climate leading to isolation, and lack of mentoring; and (ii) cultural, that is, preference for technical over managerial work and absence of requisite qualifications. As noted earlier, cultural values for promotion end up reflecting traditional "White male" values. Asian women scientists remain invisible in high-ranking managerial positions because they are viewed as "foreigners," "inferior managers," and "exotic." They have been viewed as scientists and engineers who follow instructions instead of taking their own initiatives. Leadership is for those who are willing to stand up, speak out, and have confidence in their convictions; Asian women scientists and engineers, on the other hand, are seen as lacking assertiveness in their communication. Cultural explanations hold that because of lack of leadership qualities, communication skills, and language proficiency, Asian women scientists and engineers prefer to remain in technical domain than move to administrative positions. In other words, they are to

blame themselves for lack of career advancement than making any demand for institutional assistance. Cultural explanations ignore structural conditions that create obstacles for Asian women scientists and engineers, and thus serve the status quo. As one interviewed participant said: "My manager would not consider me to lead my group so he is not going to trust me for a higher position." Other said, "as an Indian woman, I am in a minority. Actually, as a woman I am in minority. So, I am not in their radar for management." This one acknowledged, "I compare myself with my husband more than I compare myself with others. My husband has risen much faster than I did though we started at the same time in the same company." This participant generalized, "In American eyes, we are foreigners. So they are not going to trust us beyond some technical work for which they do not have their own labor,"

It should be noted that the bamboo ceiling appears to be cracking for some Asian male scientists and engineers in high-technology industry. Since 2000, Asian scientists and engineers have emerged in increasing numbers as entrepreneurs and chief executive officers (CEOs) of high-technology companies. For instance, Parag Agrawal is new CEO of Twitter, Satya Nadella is CEO of Microsoft, Sundar Pichai is CEO of Alphabet and Google, Shantanu Narayen is CEO of Adobe Systems, Eric Yuan is CEO of Zoom Video Communications, and Jensen Juang is CEO of Nvidia Corporations. Nonetheless, this is not the case with Asian women scientists and engineers. According to a report by Reveal of 177 Silicon Valley companies data in 2015, Asian women made 11.6% professionals, 7.5% of managers, and 4.5% executives (Ranjarajan, 2018). According to the Ascend Foundation, in Silicon Valley, 1 out of every 285 Asian women and 1 out of every 201 Asian men is an executive; comparable numbers for White women and men were 1 out of 123 and 1 out of 87, respectively (Westfall, 2021). Asian women scientists and engineers remain saturated at technical than at supervisory positions in high-technology companies. It should be pointed out that Asian women are grouped together without being disaggregated by their countries of birth/ancestry; however, treating them as a homogeneous group hides progress made and challenges faced by different groups of Asian women scientists and engineers.

Conclusions

The model minority myth outshines the actual obstacles Asian women scientists and engineers face in their career advancement in S&E. Their superior academic credentials get them to put their foot inside the male-dominated S&E world. However, they face prove-it-again bias. They are viewed as passive; however, if they become assertive, they are alienated from their peers of not being feminine. They are least likely to become managers due to prevailing bias to have such positions reserved for men. Due to political and social pressure to improve gender and ethnic/racial diversity, White women and Asian men have a better chance to get promoted than Asian women. White women are considered American, whereas Asian women are viewed as foreigner. Asian men are also considered foreign, but, as men, they are viewed as competent in S&E; Asian women's gender makes them look not competent in S&E. As Asians they are

over-represented in S&E; however, as women they are under-represented in S&E. Asian women scientists and engineers face double bind, which remains hidden due to the prevailing stereotype of model minority.

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