

ASIAN ENGINEERS IN THE U.S. ENGINEERING WORKFORCE:

Data from SWE's 1993 Survey of Women and Men Engineers

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Abstract — In 1992, the Society of Women Engineers surveyed the members of 22 engineering societies in the United States. Data was collected on demographics, education, employment, salaries, family status, satisfaction with job, education, advancement opportunities, and perceptions of equitable treatment of women and minorities. Analysis of the responses to open-ended questions about career achievement and greatest obstacles to success reveal interesting differences not only between male and female, but also between Asian respondents and the overall engineering population. In general, the survey data show that young women and men start out their careers at parity in terms of salary and responsibilities, but within ten years the men begin to pull ahead of the women, and the gap continues to widen throughout their careers. Sufficient data were collected on Asian American engineers to perform analyses and comparison of the experiences of Asian Americans with the majority population.

Index Terms — Asians, demographics, engineering workforce, survey, women.

INTRODUCTION

Several years ago, the Society of Women Engineers conducted a national survey of men and women in the profession in the United States. [1] SWE's study contains data for a representative sample of the entire U.S. engineering workforce, using a stratified sample of members of 22 professional societies. The project conforms to academic standards for survey research and its data has been used as a basis for at least one PhD dissertation, at the University of California at Berkeley. A summary of the survey findings is found on SWE's home page. (www.swe.org)

Upon analyzing the data, out of a total of 1,743 cases, exactly 100 classified themselves as having Asian ethnic origins. Although the number of Asians is relatively small, differences between Asian Americans and others in the engineering workforce can be examined. We have evaluated the data as reported by the survey participants who self-identified their ethnic origin. The term Asian is defined as that used by the U.S. Census bureau during the time the

survey was conducted in the early 1990's and includes Chinese, Filipinos, Indians, Indonesians, Japanese, Koreans, and many other nationalities. For this project, analysis has been limited solely to those who identified themselves explicitly as "Asian/Pacific Islander."

METHOD

Most statistical computations using data from the SWE project must be weighted to allow for deliberate over sampling of women, because the survey was originally designed to measure gender differences; when weighted data are used, the count of Asians drops slightly to 97.6.

The Asian group, albeit small can be used to analyze simple comparisons of overall percentage differences between Asians and non-Asians with a 95% confidence level.

DEMOGRAPHIC CHARACTERISTICS

There are no significant differences in the relative number of women engineers in the Asian American population (8.2%) compared to the females in the overall engineering population (7.7 %).

The demographics of Asian women engineers in the U.S. are striking. The Asian female respondents are generally younger than the non-Asian women in the profession (mean age 30.5, compared to 33.9 for women engineers in general). Over half of the Asian women —54.0 %—are under the age of 30, compared to 34.6 % of all women engineers. This greater youthfulness of Asian women in engineering may explain some other differences, including a lesser tendency than the non-Asians to be married.

Not surprisingly, Asian American engineers tend to live on the West Coast of the U.S.: 35% of the men and 62 % of the women are located in the Pacific states; compared to 17 % and 25 % for all U.S. engineers.

Asian women engineers are less likely to be married than other women engineers (45 %, versus 61 %, respectively). This may be partially due to the fact that the Asian women as a group were younger than the other women responding to the survey. Of those Asian women who are married, roughly 30% have children. This is about the same as the

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non-Asian women engineers. However, Asian women are much more likely to place their children in a private home for day care than other U.S. women engineers. Asian family members, including siblings, grandparents and other relatives often provide day care for children of similar ages simultaneously. This practice eliminates the costs of caring for young children and also draws the family closer together. The sharing of parenting responsibilities continues through grade school in that relatives help in transporting children to after school and weekend activities. With this type of support, male Asian American engineers are also more likely

than their non-Asian peers to have children (65 %, compared to 47 % of the non-Asian men in the SWE survey).

EDUCATION

Asian men engineers are much more likely than others to hold advanced degrees, as shown in Table 1. Fully 82 % have an advanced degree; almost 40 % of the Asian men have doctorate degrees. This proportion is almost three times that of the rest of the male survey respondents. Asian American women engineers resemble other women engineers in education level as seen in Table 1.

Table 1: All Engineers And Asian Engineers, By Gender: Academic Degrees

(Note: Percentages total more than 100 % because many persons hold more than one advanced degree.)

	All Engineers	All Asians	All Men	Asian Men	All Women	Asian Women
Average Number of Degrees Earned	1.6	2.2	1.6	2.3	1.5	1.4
Average Number of Advanced Degrees	0.6	1.2	0.6	1.3	0.5	0.4
B.S. Only, No Advanced Degree	55%	22%	54%	18%	62%	64%
Engineering M.S. Degree	32%	69%	32%	73%	26%	27%
Other M.S. Degree (Except MBA's)	6%	11%	6%	11%	6%	8%
MBA Degree	7%	3%	7%	4%	8%	(None)
Engineering PhD Degree	10%	30%	11%	33%	4%	4%
Other PhD Degree	3%	5%	3%	6%	2%	(None)

PROFESSIONAL CHARACTERISTICS

In the SWE survey, 37 % of the respondents noted that they chose engineering because they were “good at math and science.” The next highest reasons for becoming an engineer were “fun, interesting, enjoyable,” at 22 %; “career opportunities,” at 16 %; “challenges of the work” which tied with “family influences,” at 9 %; “encouraged by other people,” at 8 %; and “good salary prospects,” at 6 %. Among Asians, however, the importance of being good at math and science is the primary reason for going into an engineer: 57 % for Asian men and 63 % for Asian women. Asians cite “Fun and enjoyment” much less frequently (8 %) than the overall engineering population (22 %).

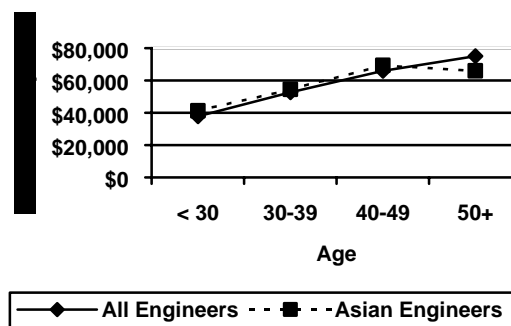
Asian American engineers are more likely to be university professors than the average U.S. engineer. (17 % for Asians, versus to 8 % for all engineers). As such, they view research and development as critical (41 %, compared to 16 % for all). They cite task or project management, administrative duties, personnel management, or cost control as less important to their jobs.

SWE found that most engineers, including the Asian men, believe that their skills are appropriately used. Asian women are even less sure about use of their abilities (67% for Asian women versus 81% of all women).

COMPENSATION

Asian engineer salaries are plotted with those of all survey respondents in Figure 1.

FIGURE 1. ENGINEERING SALARIES: ALL COMPARED TO ASIANS



Asian American engineers generally do better than their colleagues except for the most mature age group. This may be due to two things: older engineers may be experiencing compression of the lower salaries of 20 years ago; and/or we may be seeing the effects of the glass ceiling for Asians.

Managers tend to earn higher salaries than their counterparts, including professors, and Asians hold relatively few management positions in high-tech companies and in government.

EQUITABLE TREATMENT

When Asian American engineers are asked about equal treatment of men and women, their responses mirror those of all engineers: men typically say that both sexes are always treated equally, while only a quarter of the women concur. But when the question of equitable treatment of different groups outside of gender is asked, specifically related to ethnic origin, nationality, race, or religion, Asians see a different picture than the overall engineering population. Fully 61% of those responding to the SWE survey said that all ethnic groups were treated equally. Only 35 % of the Asians concur. When asked whether women or minorities have been overlooked for choice job assignments or promotions, 13 % of all U.S. engineers report discrimination against minorities compared to 48 % of the Asians.

The U.S. Commission on Civil Rights (USCCR) noted that Asian Americans face a number of barriers in their careers, notably a glass ceiling. USCCR reported that the number of Asian Americans in the executive suite is a mere 0.1% of the Asian population, even though the average education level for Asians is much higher than the national average. [2] Asian American engineers, both foreign and U.S. born are much less likely to be managers. They believe that discrimination is the root cause for this. Since promotion decisions are subjective, it is hard to prove that discrimination is a factor. USCCR suggested employment discrimination regarding Asian Americans merited serious research; however, such research has not been conducted.

ACCOMPLISHMENTS, CAREER OBSTACLES, AND OTHER EXPERIENCES

The SWE survey explicitly asked for comments regarding career obstacles and educational deficiencies. The vast majority of survey respondents noted that their biggest training deficiency was a lack of exposure to “real-world, practical” engineering problems in their academic training. The Asian American respondents agreed with this view; however, the Asian American view of career obstacles was very different from the overall U.S. engineering population.

Survey participants were asked to identify the greatest obstacle in their careers. A striking finding was that men typically identified factors that were beyond their control. U.S. male engineers overwhelmingly identified issues related to the economy as the primary factor holding them back from promotion. U.S. women engineers, on the other hand, tended to identify personal deficiencies as their obstacle. Women often stated that they needed more training, better time management skills, and to figure out

what they wanted to do in order to move ahead. This suggests that women are either not as secure or confident in their abilities, or are not comfortable in acknowledging that their lack of advancement may be beyond their control.

Many Asian American engineers cited discrimination as a barrier to job advancement (note that immigration related issues were *not* counted as discrimination issues). Asian women cited both gender and racial discrimination as significant issues. Male Asian engineers tended not to cite discrimination as an obstacle until they reached the age of 40. At that point, comments on racial barriers became more common. No Asian males cited gender discrimination as a career barrier, instead, they identified a variety of issues, including insufficient funding, the state of the economy during the survey, management practices, and others.

OVERALL SATISFACTION WITH ENGINEERING WORK AND CAREERS

To summarize respondents’ experiences, the survey included a set of the usual Likert-scale satisfaction questions (with choices like “Very Satisfied,” “Satisfied,” “Neutral,” “Dissatisfied,” etc.). Responses to these items were scored to convert results into single “satisfaction scores” which could vary between plus or minus two: plus two for perfect satisfaction, zero for neutrality, and minus two for complete dissatisfaction. Such items were asked about a number of dimensions of work and about general overall reactions to the respondents’ engineering careers.

Regarding general reactions to their work, male Asian American engineers’ satisfaction levels were comparable to those of all U.S. men engineers. Female Asians were significantly less satisfied than other women engineers. However Asian American engineers are less satisfied than the overall U.S. engineering population with a number of issues. Specifically they express dissatisfaction with equitable treatment on the job and with their immediate supervisors. Male Asian American engineers, but not females, are significantly less satisfied than others with their compensation and benefits. Female Asian American engineers are less satisfied than other women with their support facilities and advancement opportunities. However they are more satisfied than other women engineers with the overall management of their companies.

U.S. engineers are very pleased with their academic training. Asian American respondents express a higher level of satisfaction with their academic training than the overall U.S. engineers. Engineers are also fairly well satisfied with their own career accomplishments; male Asian Americans are somewhat more satisfied than others, female Asian Americans somewhat less satisfied. While still positive, satisfaction levels are slightly lower for engineering employers, supervisors, and career prospects.

In the case of supervisors, Asian American women are significantly *less* satisfied than either Asian men or other

women engineers. A number of Asian American females noted that their supervisors were insensitive and tended to overlook them when assigning prestigious projects.

CULTURAL ISSUES

The Asian culture is a close knit one and great emphasis is placed on education and family. In many cases, the in-laws, siblings and even cousins will help raise the children, often alleviating the need for daycare outside the family unit. Many families also vacation as a group, bringing the family members even closer together.

For the first and second-generation children, the need to bring honor to the family unit is a high priority. Offspring are encouraged to pursue their education as long as possible in an effort to obtain a respectable job, such as one in the medical, scientific or engineering professions. This is demonstrated by the tendency of Asian men to acquire doctoral degrees and to become university professors - a highly respected occupation in the Asian community.

Asians are seldom told how their early job choices affect their overall careers. In fact, anecdotal evidence suggests that they are generally encouraged to pursue technical issues, as opposed to learning how to manage projects. Many are promoted up through the technical ranks quickly. However in the United States, university professors, and even highly respected scientists and engineers, do not necessarily get the higher salaries.

As Asian workers mature in their careers, they become increasingly aware of the salaries associated with corporate management positions. By this time, many Asians have established their career as technical experts or as a tenured professor. The Asian mantra of "Work hard, and you will be rewarded" is a cultural myth. Technical experts and university professors typically do not learn or develop communication or business skills both of which are essential in management. Therefore, few Asians are selected for management positions.

Although this appears to be discrimination, it is unclear if it can be considered to be discrimination. Some would say that Asians choose their career path; others claim that corporate management exploits them. As usual, it depends on whom you ask.

For Asian women, the cultural pressure to have children and to help with the care of the extended family is an added burden. Cultural expectations combined with the stereotypic view of Asian women as quiet subservient creatures may have a significant adverse effect on an aspiring engineer. Asian female engineering students anecdotally report that professors of Middle Eastern descent actively discourage them from pursuing engineering careers. Frequently, these women have difficulty finding support groups to cope with the discouragement from both home and school. There is little research on the trends in Asian female enrollments in engineering or science curricula; however, there are few Asian female managers in corporate America.

CONCLUSIONS

The data reveal a classic portrait of high-level employment discrimination against Asians. The data verify a number of commonly held beliefs about Asian American engineers, including the tendency of Asian men to become engineering professors. The item of note, however, is one of inequitable treatment on the job.

The high education levels of Asian American engineers lead employers to welcome them as entry-level workers, to retain them when company shakeups occur, and to pay them well—up to a point. The data suggest widespread prevalence of glass ceilings—a phrase used by Asian men as well as women—which form serious barriers to advancement into the management positions that are the culmination of engineering careers. These types of evidence include compensation trends, increased feelings that one is not a participant in management, and significant increases in awareness of inequitable treatment.

What is unclear is whether Asian Americans want to go into management. Many Asians tend to pursue research and development activities and other highly technical jobs. Such pursuits do not naturally lead to management positions. The view of Asians as a generally intelligent, introverted, and inarticulate group may also hinder promotions into the executive suite. This is more pronounced for Asian women.

Regarding compensation, it is possible that the drop in salaries reported for the most experienced Asian engineers is a phenomenon of the 1990's that may not be repeated in the future. But to assume that this explanation is sufficient is to ignore a long, well documented history of such glass ceiling effects in the cases of many groups, including women, other races, and religious minorities. Therefore, the salary data may be an indication of discrimination. The historical record of discrimination up through the 20th Century against Asians in the United States, which is extreme, supports this. [2]

Asian American women engineers appear to be a particularly dissatisfied group. They are much less likely than others to feel that their skills are well utilized; they are much less satisfied with many aspects of their work and their supervisors.

The SWE 1992 survey data not only demonstrated notable difference between male and female engineers, it also demonstrates the glass ceiling encountered by Asian American engineers. Examination of differences between Asian Americans and others in engineering is feasible because, unlike other ethnic minorities, Asians are not underrepresented in the profession - quite the contrary. This analysis makes one curious about the current status of Asian American engineers. Much has changed since 1992. The increased number of high technology companies, including the ".coms", and the subsequent economic recession has done much to affect the demand for engineering talent. By

now, the Asian women who responded to the 1992 survey are in mid career- if they remained in the profession. A follow-on survey effort is needed to determine whether the glass ceiling for Asian Americans persists.

REFERENCES

[1] "A National Survey of Women and Men Engineers: A Study of the Members of 22 Engineering Societies," Society of Women Engineers, 1993

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