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Occupational Segregation, Lack of Diversity and Pay Gap in Computer Science Professions

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EC 6450 Political Economy of Women

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Mainstream economists have propagated the “Human Capital” theory emphasizing the link between innate abilities of the labor force and wages earned by them to justify occupational segregation between genders and the wage gap. Proponents of this theory advanced the notion that women are less likely to invest time in building skills through education and job-related training, unlike men do, because women anticipate spending more time than men do at home performing household work. In challenging this theory, feminist economist Barbara Bergamann proposed the “Crowding” hypothesis in which she argues that there are fewer female-dominated occupations than there are male-dominated ones. This leads to crowding of women into smaller pool of occupations available to them. The surplus of female workers, relative to the demand in these female-dominated occupations drive the wages down for women. ⁽¹⁾

Computer Programming was one such occupation prior to the 1960s and 1970s, in which the majority of the workforce was female. The origin of computer programming itself is attributed to an English woman and mathematician, Ada Augusta Lovelace. Her contributions to analyzing and explaining the design of Charles Babbage’s Analytical Engine is regarded as the world’s first computer program. ⁽²⁾ Subsequent generations of female programmers, throughout the 19th and 20th century, have contributed immensely to the evolution of computer programming, software development and computer science through their hard work and intellectual abilities. During the World War II, when men were away fighting the war, governments were encouraging women to perform war-time duties which involved performing complex calculations to break enemy codes and determining missile trajectories using primitive computing machines. ⁽³⁾

Essentially, with men fighting overseas wars, women constituted the labor force required for this work in their home countries. Also, since the job of configuring and programming these early computing machines involved tedious manual calculations, women were hired to do the job of writing computer programs, while the men invented machines that would execute these programs. Programming a computer requires planning, logical thinking, and attention to detail. Though intellectually rigorous tasks were undertaken by women, they neither received the recognition, nor the financial rewards that male inventors of hardware reaped. Back then, it was assumed that the computing machine itself cracked the code or calculated trajectories. There

was a big collective failure, at the time, to recognize that a computer is only as good as the computer program or the software that enables it to use its computational power, optimally.

This early history of computer programming serves as an example of “gender devaluation theory”. Computer programming was an occupation dominated by women and was viewed as lowly routine clerical work, which did not require advanced skills to accomplish the task. Hence, this occupation was devalued creating a gender wage gap. According to research, feminine occupations pay less than occupations with higher percentage of male workers because skills associated with women are valued less than the skills required by masculine occupations. This devaluation has more to do with gender stereotypes than with skills or educational qualification of women. ⁽⁴⁾ In the field of computer programming, some of these underpaid and undervalued women included computing pioneers whose early contributions to the field of programming and computer science are regarded as significant milestones in the field even today.

By the 1960s, as the complexity of computer hardware increased, so did the complexity of programs that were executed on them. The nature of electronic computer market changed too and relatively low-cost electronic computers were built for commercial, personal and business usage, thereby increasing the demand for talented programmers and driving up their wages. There was a new-found appreciation for computer programmers as people who were capable of solving complex and varied set of problems that new applications of computers demanded. Men were attracted to programming and the feminized nature of this occupation changed.

This female-dominated occupation of computer programming and software development started developing a gendered characteristic of being a male domain. Nathan Ensmenger, a computation historian, says, the most observable attribute of “computer nerd” stereotype is gendered, i.e., he is a “he”. Ensmenger notes, “This is not, of course, to suggest that women do not program computers; in fact, women played an unusually prominent role in the history of computer programming, especially in its earliest decades, and yet computer programming today is both male-dominated and hypermasculine.” ⁽⁵⁾

Male computer programmers were able to transform this occupation presumed to be “routine and tedious” into a well-paid and respectable occupation by engendering an identity of a male “computer nerd” who, supposedly, is ruggedly individualistic, somewhat of an artistic genius, and socially maladjusted, yet endowed with logic and single-minded focus to pursue mastery over arcane computer technology by writing computer programs. A subculture around this male persona began to grow. This stereotype was also perpetuated by popular culture and media in the 1970s; a pseudo culture that glorified the so-called quintessential male “computer nerd” or “hacker” as harbinger of technological revolution. The birth of Silicon Valley at around the same

time, with a burst of activity in the field of computer and technology, saw the arrival of tech entrepreneurs like Bill Gates of Microsoft and Steve Jobs of Apple on the scene. These men further reinforced the “male computer nerd/genius” stereotype. In the computer software development industry, a reverse of “gender devaluation theory” took place after males started dominating the occupation. Software industry began to create many of the highly paid jobs. ⁽⁶⁾

In the words of Nathan Ensmenger, “Computer programmers might be predominantly male, but the masculinity of the computer nerd is hardly that of the police officer or the football player—or even that of the engineer or scientist.” This statement alludes that there is not one uniquely masculine quality that can justify the authority of males in the software industry at the cost of “crowding out” women in an occupation which was feminized from its origin. Women who were the first computer programmers had offered their labor at a low-wage to build early computational systems back then. Now, at the turn of 21st century, women still remain in a position of economic disadvantage due to being crowded out of the software industry.

The far-reaching effects of de-feminizing software development profession is apparent in the tech industry and academic settings. Lower enrollment of female students in STEM (Science, Technology, Engineering and Mathematics) education, of which Computer Science is a part, is an indication that women and girls are socially conditioned to not pursue STEM fields. By the time girls reach high-school their interest in STEM education fields and computer programming starts to diminish and research shows it is mostly caused by the social attitudes towards women pursuing STEM education or STEM careers. Interestingly, in earlier childhood years, interest in computers among boys and girls is the same. Stereotypes based on gender in Computer Science, in both academia and in the software/information technology industry, contributes to the decline in interest of girls to pursue programming.

Code.org, a non-profit organization aimed at increasing awareness of Computer Science education conducted an online study called “Hour of Code”. In this study, students were exposed to concepts of computer programming for one hour and later assessed for their interest in pursuing computer programming and ability to comprehend concepts of computer science. The outcomes of this study showed that female participants were better able to comprehend computer programming concepts than their male peers after one hour of exposure to programming, despite the fact that male students had more experience with computers before they enrolled to participate in the study. The goal of the study was to encourage female students to take up computer science careers as there is a projected shortage of programmers in the labor market. ⁽⁷⁾ Gender-based devaluation of skills and occupational segregation favoring males in tech industry have the potential risk of producing unfavorable labor market outcome.

Women are underrepresented minorities in the tech industry comprising only about 25% of the labor force.⁽⁸⁾ Women have reported having to work in unsupportive, male-dominated, and toxic work environments within the tech industry. Male attitudes towards women have not evolved beyond looking upon women as mothers and wives, although technology has evolved by leaps and bounds creating more jobs than the current male-dominated labor force can handle. Women tend to report abusive behaviors from their male counterparts and superiors that go unaddressed or gets brushed under the carpet. Bullying and workplace harassment are commonplace. This includes sexual harassment and sexual advances towards women from their male colleagues. While companies claim to have strict diversity policies and claim to hire more women to improve gender diversity, lack of strict policies around treatment of women tends to make women quit their jobs in the tech industry. This contributes to the under representation of women in computer programming professions. When women decide to cut their careers short by quitting their jobs due to undesirable male dominance, there are hardly any women with experience left to rise up to the level of executives and leaders in the tech industry.

Pay gap between men and women is another issue plaguing the tech industry, like most other industries. [Kate Moussouris](#), an ex-Microsoft employee and founder of her own company, filed a law suit against Microsoft in 2015 alleging that she and other women in Microsoft earned less than men. Her law suit alleged that Microsoft is a 'boy's club' that promotes men to higher position randomly at the cost of opportunities that can be given to women who are much more capable. Her case evolved into a potential class action with 8,600 women coming forward with complaints of disparate incomes.⁽⁸⁾ Google, another tech giant, was also sued by three women, who were ex-employees, for paying female employees less than men. Recently, when Google was forced to make its pay data public, it became apparent that women employees were grossly underpaid. Women in tech industry often complain that they were hired at a lower tier position justifying their low pay to begin with, while men start their career at higher tier positions that justifies their higher pay. Without addressing this glaring difference in pay and hiring practices, there is little hope that gender diversity can improve in the computer programming occupation.

As women hold a minority position in the computer programming/information technology industry, a discussion on multiple and intersectional discrimination⁽⁹⁾ is necessary to fully understand the challenges of women in this occupation. Since many multi-national technology companies of USA have outsourced a lot of their work to developing countries like India, they contribute to employment in a society where the status of women is determined by patriarchal norms of the society. Indian society tends to view men as leaders of the community, head of households and views women as subordinate to men. When these attitudes flow from Indian homes and communities into workplace, there is a persistence of traditional gender hierarchies and expectations in the workplace as well.⁽¹⁰⁾ Women in Information Technology occupations in

India not only deal with gender biases associated with this occupation, but also struggle to have a voice and for survival in an inherently patriarchal workforce.

Being a part of a well-paying outsourced technology industry enhances earnings of women in developing countries like India, but not their political and social status. This does not contribute to achieving equality and socio-economic liberation of women in a meaningful manner. In this respect, the experiences of Indian women in computer programming industry are unique, and can offer case studies to gain insights into the nature of the outsourced information technology industry in the developing countries, viewed within the social and political context of the respective countries. Gender stereotypes, occupational segregation and gender wage gap exist in computer programming occupations everywhere. However, in countries and societies, where women have fewer social liberties, social and political factors also contribute to similar labor force and economic outcomes.

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