Women, Innovation, Entrepreneurship: Essays on Designing and Improving Education

by

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Abstract

Entrepreneurship and Entrepreneur are not gender-neutral concepts.[1] In the United States, men are twice as likely to be involved in entrepreneurship than women. Women have founded or led only 11% of venture capital backed US firms. Moreover, women-led firms have received only 7% of venture capital.[2] Clearly, there is a serious dearth of women in entrepreneurship. Research has shown that education can have an impact on gender segregation of aspirations, and that it acts as a barrier for women to move into historically male-dominated roles with higher earning potential. In higher education, gender segregation results in a variety of disciplines including entrepreneurship.[3]

In this thesis, we examine the problem and recommend solutions to improve entrepreneurship and innovation education and entrepreneurial opportunities for women. We look at Science, Technology, Engineering, Mathematics (STEM) programs focused on increasing participation of women in STEM and map them to entrepreneurship.

Furthermore, we discuss the programs and resources available to women entrepreneurs. We recommend designing new programs and investing in resources for women innovators and entrepreneurs.

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To Tuhin and Mom:

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Chapter 1 - Overview

1.1 Introduction

According to Theresia Gouw, a venture capitalist in the Silicon Valley, women are subject to "pattern recognition" – a wonky term that basically means that investors are less likely to bet that a woman will be the next Mark Zuckerberg because she does not look like Mark Zuckerberg.[4] Women receive only 7% of venture funding and only 4% of VC partners are women.[5] Recent research shows that investors prefer pitches by male entrepreneurs than pitches by female entrepreneurs, even when the pitch has similar content. [6]

Our society faces a serious problem – the dearth of women entrepreneurs. Female entrepreneurs comprise of only 1/3 of entrepreneurs worldwide.[7] There are many studies and impressive statistics to show the career and entrepreneurial potential of women indicating that they are an underserved business opportunity for investors. In 2000, the Global Entrepreneurship Monitor recommended increasing the participation of women in entrepreneurship as a necessity for long-term economic prosperity.

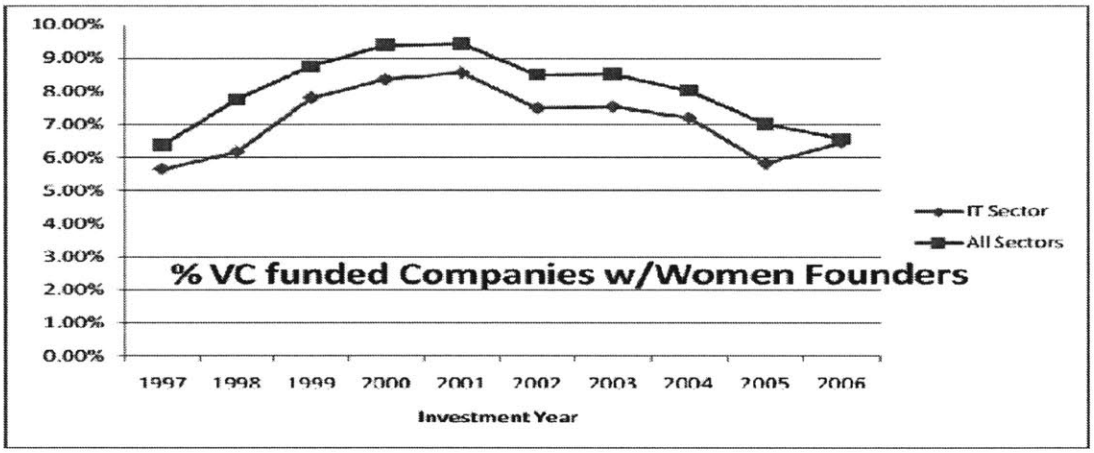
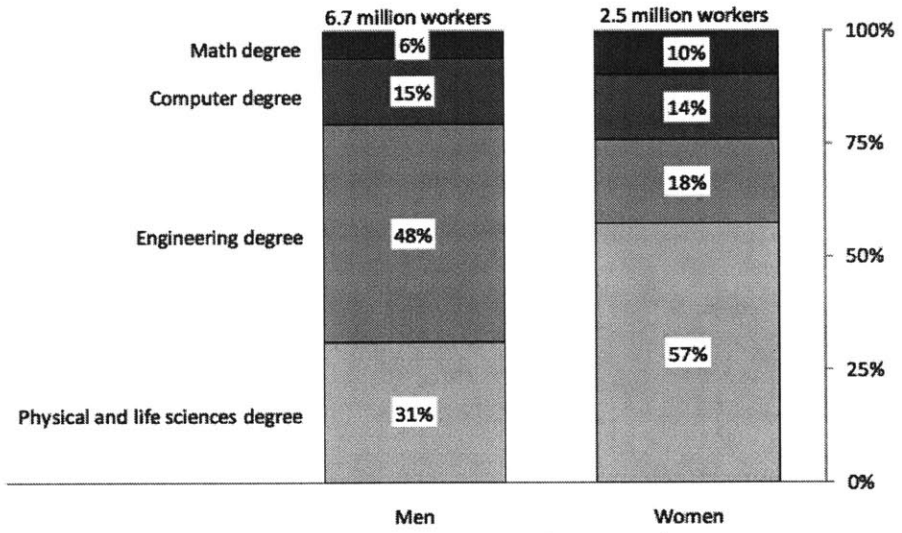


Figure 3 Venture Investment in Women Led Companies since 1997

1.2 Motivation

There have been several successful Science, Technology, Engineering, and

Mathematics programs designed for girls. These programs try to eliminate the lack of female role models and gender stereotyping. There still exist a gender bias in STEM, and a recent Harvard Business Review article enlists the 5 biases that pushes women out of STEM.[8] According to a report by the US Department of Commerce, men outnumber women in sheer numbers in STEM majors. However, 57% of female STEM majors study physical and life sciences, while only 31% of men choose these fields. The share of women choosing math majors is also higher than men: 10 percent versus 6 percent. Equal shares of male and female STEM majors choose computer science. 48% of men choose engineering, which is two and half times the share of women who choose engineering. Even though the overall number of women STEM workers is less than men, the numbers are better than what we see in entrepreneurship.



Source: ESA calculations from American Community Survey public-use microdata.
Note: Estimates are for employed persons age 25 and over. The shares for men and women do not add up to 100% due to rounding.

Figure 4 College-educated Workers with a STEM degree by Gender and STEM Degree Field, 2009

STEM programs have resulted in motivating and encouraging women to pursue a career in STEM. There is a lack of such programs in innovation and entrepreneurship. Entrepreneurship faces similar gender equity problems as STEM.

The programs and initiatives for women that have worked in STEM can be mapped to innovation and entrepreneurship to increase the participation of women.

1.3 Problem Definition

Between 2004 and 2007, research has found that women founded only 3% of technology firms and 1% of high-tech firms. The Clayman Institute conducted a study to understand the subtle biases that impact venture capital funding. They tested two hypotheses: women are seen as less technically competent and women entrepreneurs need networks more than their male counterparts. For the study, identical executive summaries of a high-tech start-up seeking venture capital funding were created, and only the gender and education for the "entrepreneur" was changed. Participants rated the venture's potential for success, impression of the entrepreneur, and influence of social networks. It was found that having a technical degree leveled the playing field as female and male technical entrepreneurs were rated similarly. In addition, women non-technical entrepreneurs received significantly lower ratings than non-technical men. In fact, a non-technical degree can raise the ratings for male entrepreneurs, while they are detrimental to women. Finally, for all women entrepreneurs, strong network ties are critical for success. Having strategic connections helps women entrepreneurs, more than men, when it comes to Venture Capital decision making [9]

Another study states [10] that increasing woman's social networks and that training adolescent girls before they enter the labor market have shown success in increasing women's entrepreneurship.

In the US and Developed Europe women are 18% less likely to perceive they have the capability to start a business. While the difference is less for developing economies, in every economy women have lower perceptions of their capabilities, showcasing the enormous opportunity for an enabling environment, which would boost entrepreneurial activity rates.[11] However, there has been a prediction of a rise of global women entrepreneurs, whom we will need to provide with the right education and skill sets.

Figure 5 Male and Female Regional Entrepreneurial Activity

It is not true that women entrepreneurs are deficient than their male counterparts. When defining innovation as "offering products that are new to some or all customers" in some regions — including the U.S. and developed Europe — women entrepreneurs have higher levels of innovation than their male counterparts [12] Recent Dow Jones research on venture-backed companies in the U.S. found those that were successful had twice the number of women on the founding team. Controlling for firm characteristics, research suggests that women-owned firms outperform those owned by male counterparts.

A 2010 study by the Kauffman Institute, examined women entrepreneurs and how they differed from their male counterparts. [13] The findings were incredible to some, but obvious to others. Men and women were the same in almost every aspect studied – they shared similar motivations, types of funding sources, entrepreneurial challenges, and much more. The study suggested that both men and women could become successful entrepreneurs under the same conditions. However, that is not analogous to the situation in the real world. [14]

Unable to explain the dearth of women entrepreneurs, Vivek Wadhwa interviewed women in Silicon Valley to learn what is holding them back. He spoke to about 300 women in technology and found out that they're lacking role models, they're lacking funding, and there are some really unreasonable VCs out there. [15] Katlyn Grasso, who launced GenHERation, a female empowerment network for high school girls, in March 2014 to instill confidence in young women wanting to pursue leadership positions had a hard time finding a female business role model. [16]

The state of affairs is especially dismal in technology entrepreneurship. 78% of Y-Combinator startups, a startup accelerator of choice among technology entrepreneurs, have no female founders. [17]

A January 2015 study by Viktoria Tsukanov, one of the executives at predictive marketing company Mintigo, seemed to show that large companies with female CEOs "achieve up to 18% higher revenue per employee than male CEOs."[18] However, this could be a case of correlation and not causation. Unfortunately, the analysis shows that only 17% of the companies have female CEOs. [19]

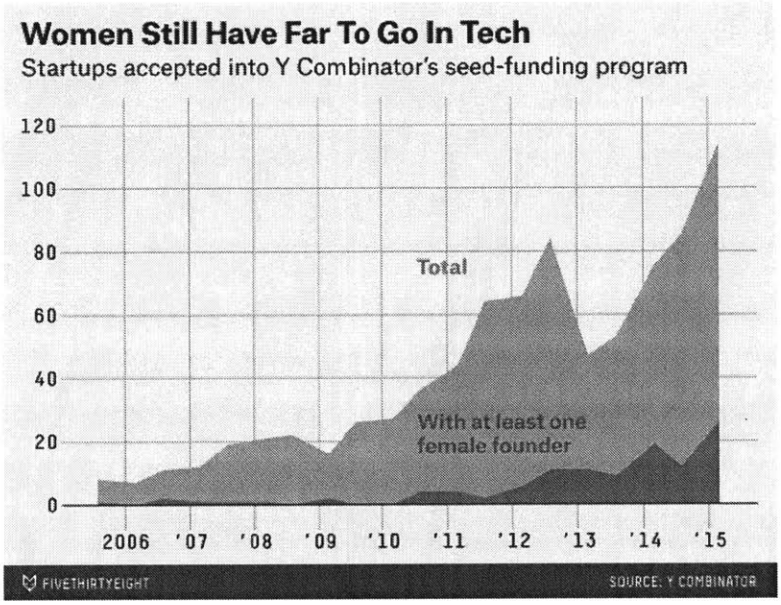


Figure 6 Female founders in Y-Combinator

In addition, there exists a paradox when it comes to women entrepreneurs. Between 1997 and 2013, the number of women-owned businesses increased by 59

percent; this is 1½ times the rate of U.S. businesses overall. In the last 16 years, employment by companies owned by female entrepreneurs was up by 10%; their revenues grew by 63%. Both of those increases exceed those of all but the largest publicly traded firms. Today, more than 8.6 million U.S. businesses are owned by women. They generate more than $1.3 trillion in revenues and employ nearly 7.8 million people. However, there is not so good news. A woman-owned business employs, on average, just one person in addition to the owner; the typical privately held business (where the gender of its owner or owners isn't broken out and the company's shares are neither traded on public exchanges nor issued through an initial public offering) employs two people apart from the owner. Also the study notes that women-owned businesses have average annual revenues of just under $155,000, far less than the $400,000 figure of the typical privately held business. The researchers have also found that women-owned businesses frequently face difficulties growing when they have five to nine employees and their annual revenue is in the $250,000 to $499,999 range. [20]

Another recent report on women entrepreneurs by the Kauffman Foundation identified the chief challenges to female entrepreneurship. Researchers interviewed 350 female entrepreneurs, and most cited "lack of available advisers" at the top of their list. We are in dire needs of training women entrepreneurs to create role models. [21]

1.4 Research Questions

Research has shown that the dearth of female entrepreneurs could be due to the lack of female VCs. Lakshmi Balachandra, a professor at Babson College, thinks the explanation might lie in the fact "that venture capitalists tend to invest in people who are similar to them—and all but 6 percent of VCs are men". Apparently, investors spend hours coaching their charges; they do this to prioritize the type of fraternal chemistry that results from interacting with someone of the same sex. "A VC will say, 'I only want to invest in someone I can have dinner with,'" Balachandra said. Also female entrepreneurs often pitch businesses that appeal more to women than to men and male

VCs are not bothered to understand them. Balachandra says one solution is to breed more female venture capitalists—and keep existing ones from quitting. [22]

The questions we discuss in this thesis are do we need to train more women venture capitalists? Is one pipeline feeding the other? Can we map STEM programs for girls and women to entrepreneurship programs for girls and women? What can MIT and other top business schools do to educate and increase the participation of women entrepreneurs?

1.5 Research Approaches

The approach taken in this thesis combines some in-person interviews with literature review. Furthermore, it recommends entrepreneurship programs for women. Over two months the author interviewed founders of non-profit organizations that promote women in STEM. Concurrent with these interviews, literature was sampled with a focus on gender segregation in technology and entrepreneurship.

A review of STEM programs for girls was conducted. Lastly, we looked into existing entrepreneurship programs and resources for women.

1.6 Organization of Thesis

The thesis is organized as follows.

Chapter 1 provides an introduction to the problem of the dearth of women entrepreneurs and the motivation for studying and researching this topic.

Chapter 2 reviews the literature as pertains to gender segregation in STEM, innovation, and entrepreneurship. In addition, we look at the history of women entrepreneurs.

Chapter 3 presents a detailed study of STEM programs and resources for girls and women.

Chapter 4 describes how we can map the STEM programs to innovation and entrepreneurship programs for women to increase their participation. Furthermore, we discuss entrepreneurship programs and resources for women that exist at various universities, corporations, and non-profit organizations.

Finally, in Chapter 5 we provide recommendations to the Massachusetts Institute of Technology for providing programs and resources for women entrepreneurs. We conclude by enumerating some points that can help increase women innovators and entrepreneurs. Moreover, we also discuss some challenges that women innovators and entrepreneurs face.

Chapter 2 – Literature Review & History

2.1 Literature Review

This work [23] experimentally evaluates a model, which describes the constraining effect of cultural beliefs about gender on the emerging career-relevant aspirations of men and women. This model establishes the conditions under which gender status beliefs elicit gender-differentiated double standard for attributing performance to ability, which differentially biases how men and women appraise their own proficiency at tasks that are relevant to their careers, controlling for actual capability. Furthermore, the model suggests that, if men and women assess their own capabilities at career-relevant tasks differently, they will also form different desires for career paths and activities that require proficiency at these tasks. This model is supported by data from the experiment. In a particular condition, male and female undergraduates finished an experimental task after they were disclosed to a belief that men are better at this task. Even though both males and females were given the same scores, males appraised their task ability higher than females. "Males in this condition also had higher aspirations for career-relevant activities described as requiring competence at the task." [24] In another condition, in which men and women were exposed to a belief that men and women have equal ability at a task, gender differences were noticed neither in assessments nor in aspirations. "To illustrate the utility of the model in a "real world" (i.e., nonlaboratory) setting, results are compared to a previous survey study that showed men make higher assessments of their own mathematical ability than women, which contributes to their higher rates of persistence on paths to

careers in science, math, and engineering." [25]

Another study [26] demonstrates a supply-side mechanism regarding how gender related cultural beliefs differentially impact men's and women's early career-relevant decisions. "Cultural beliefs about gender are argued to bias individuals' perceptions of their competence at various career-relevant tasks, controlling for actual ability." [27] Men and women thus act on gender-differentiated perceptions when making decisions related to their careers; cultural beliefs about gender route men and women in considerably different career directions. "The hypotheses are evaluated by considering how gendered beliefs about mathematics impact individuals' assessments of their own mathematical competence, which, in turn, again leads to gender differences in decisions to persist on a path toward a career in science, math, or engineering." [28]

Research has noted that stereotypes discourage women from choosing and attaining technology related jobs. Nevertheless, present efforts and policies mainly focus on filling the pipeline with more women and presume the negative effects of stereotyping will disappear once women gain access to these careers. In another recent study, Wynn and Correll [29] argue that stereotypes continue to affect women even after they enter technology careers. Moreover, they used a unique survey of technology employees in the Silicon Valley and found that men had a higher likelihood than women to believe that they have the stereotypical traits and skills of a successful tech employee. The study examines how these gender gaps that are termed as "cultural" and "skill" fit affect work outcomes. Wynn and Correll conclude that cultural and not skill based perceptions of fit provide a better explanation of gender inequalities in work outcomes. "Because women are less likely than men to believe they fit the cultural image of successful tech workers, they are less likely to identify with the tech field, more likely to consider switching career fields, and less likely to report positive supervisor treatment." [30] The results indicate the emphasis of cultural images. Finally the authors conclude that if the cultural image of a successful technology worker can be broadened, women may be more likely to feel like they fit in technology environments; this would

increase the identification of women in the technology arena and retention of women in technology jobs.

In detail the work examines the existence of gender differences in perceptions of cultural and skill fit for men and women working in STEM related jobs. Furthermore, the work examines whether there is a relationship between cultural and skill fit and work outcomes such as identifying with the technology discipline or perceptions of treatment by supervisor. As mentioned earlier, the authors find that women are less likely than men to believe they have the skills of a successful technology worker. As noted previously, "because women are less likely than men to believe they fit the cultural image of successful tech workers, they are less likely to identify with the tech field, more likely to consider switching career fields, and less likely to report positive supervisor treatment." "Given the current policy emphasis on improving women's technical skills and confidence, it is surprising that perceptions of skill fit are far less predictive of whether women tech workers identify with or remain in their fields than are perceptions of fit with the cultural image of a successful tech worker." [31]

The limitation of the work is the relatively low response rate of the sample examined. The data is collected from seven companies in the Silicon Valley. Even though this region has a large population of technical workers, it is unclear how the results would vary in other regions. However, according to Wynn and Correll, this is the only dataset of its type from a sample of men and women who actually hold STEM jobs. "Prior work on STEM pipelines has focused almost exclusively on middle school, high school, and college students who have not yet entered tech careers." [32] This study examines a very unique data of real technology workers and hence it has the ability to gain novel insights into how stereotypes affect men and women when they start working in a STEM field. "Given the increasing importance of technical work for today's economy and the continued dearth of women in these fields, understanding how stereotypes affect the identification and intentions of women who are in these fields is of crucial importance." [33]

"The main implication of this study is that if we want to increase the

representation of women in STEM fields, cultural fit matters. Current policies focus primarily on generating young women's interest and skills, thereby hoping to slot women into STEM majors in college, and eventually into STEM careers. Such policies neglect the fact that stereotypes continue to hinder women as they progress in their careers. Simply filling more jobs with women, while helpful, will not solve the gender problems in STEM fields. As long as cultural stereotypes continue to make women feel like they don't fit in, women will be less likely to identify with their professions. Unless we reshape the cultural images surrounding technology and technical work, women will continue to leave tech jobs in higher numbers than men. In addition, policies that aim to increase women's human capital by improving their training, restructuring school programs, and targeting women's quantitative and analytical skills cannot solve the problem by themselves. Even when we compare men and women who have equal perceptions of skill fit, a cultural divide between the stereotypical view of women and the stereotypical view of successful tech workers disadvantages women, especially at the early stages of their career. Widespread assumptions about who succeeds in tech companies—the masculine-typed geeky coder— continue to proliferate." [34]

Wynn and Correll believe that policies that broaden the cultural image of a successful technology worker might help retain more women in STEM related disciplines. Such a change was noticed at Carnegie Mellon University where in 1995, 7 out of 95 students in Computer Science were women. That number increased by 42% in 2000, when 54 out of 130 students entering computer science were women. "The researchers found that the stereotype of computer science majors as geeks "myopically obsessed with computing" discouraged women. Carnegie Mellon broadened the picture of a successful computer science student by encouraging faculty and students to discuss multiple valid ways to be a computer scientist and emphasizing computing's real-world value and connections to other disciplines. By changing the cultural image of the computer science major (along with several other changes), Carnegie Mellon succeeded in increasing the representation of women." Similarly, technology companies can retain more women by changing the cultural image associated with a technology worker. In

another study [35] Cheryan and et. al. ran a controlled experiment, in which they changed the objects in a computer science class from masculine to gender neutral objects; this piqued women's interest in computer science. "While it is hard to change widely shared cultural stereotypes, it is possible for local organizations, such as universities and individual workplaces, to change the images that are present in their environments. Doing so might be especially useful for retaining women in the early stages of their careers."[36]

"Changing the cultural images of tech work can help increase the persistently low representation of women in STEM fields. By making the image of success more inclusive, we can do more than put women into tech jobs—we can keep them there and enable them to advance." [37] Similarly, cultural images of entrepreneur can be changed to attract, motivate, and retain more women in entrepreneurship.

Women have structural disadvantages in acquiring the resources relevant for successful business ownership, and the gender gap in entrepreneurship has been understood through this. Similar to Correll, in this study, [38] Thebaud develops resource-based approaches to investigate the effect of cultural beliefs about gender on the process by which individuals initially come to identify entrepreneurship as a viable labor-market option. "Drawing on status characteristics theory, this study evaluates (1) how cultural beliefs about gender and entrepreneurship influence self-assessments of entrepreneurial ability, and (2) the extent to which such assessments account for the gender gap in business start-ups." [39] According to Thebaud, women have a considerably lower likelihood to perceive themselves as entrepreneurs compared to men in similar situations. Furthermore, women also hold themselves to a stricter standard of competence. The gender gap in entrepreneurship can be explained by the difference in how men and women assess themselves. "Additional analyses reveal that significant gender differences in self-assessed ability persist among established business owners." [40]

"Sociologists have largely understood gender differences in business start-ups and success by examining how gendered patterns found in the paid (employee) labor

market map onto the experiences of the self-employed. First, women tend to have, on average, less workplace and managerial experience, which is often relevant for successful start-ups."

Additionally, there is a significant amount of gender segregation by industry and even more so by occupation. These patterns can thus be observed in entrepreneurship, because women entrepreneurs are seen more in low profitability, female-dominated industries such as retail, food service, and interpersonal care. [41]

The mediating effect of network structures and thus paid labor market experiences may also affect entrepreneurship. "Larger, more heterogeneous business discussion networks have been shown to increase the likelihood of business start-up. Time spent in paid labor and higher occupational statuses are related to more diverse network structures; a high level of education is an additional asset, given that it is positively related to network size and the use of cross-sex ties." [42] Women tend to have more kin and homogeneity in their networks than men do. Hence women's labor market interruptions, lower occupational status, relative lack of managerial experience on average, and relatively more homogeneous networks give them a disadvantage to access information and recognize business opportunities. "Men entrepreneurs also have particularly gender homophilous discussion networks, which may add to women's network disadvantage." [43] Nonetheless, fledgling and established men and women business owners have similar levels of heterogeneity in their networks and the same numbers of network ties to whom they could turn for specialized advice.

"While a lack of business contacts and connections to other entrepreneurs may put women at a general disadvantage for recognizing business opportunities, there have also been studies on the mechanisms that lead men and women toward entrepreneurship. For example, women are much more likely than men to be "pushed" into entrepreneurship as a result of work/family conflict and gender discrimination in traditional work environments, however, there are findings that these push factors vary according to professional status. While non- professional women are likely to enter entrepreneurship for family-related reasons, women in the professions are more likely

to follow a careerist strategy. Discrimination in the labor market can also have an indirect effect on self-employment outcomes, as people who seek refuge from discriminatory experiences via self-employment may also be disadvantaged in terms of managerial experience and network diversity. Taken together, these studies suggest that women's structural disadvantages regarding human, network, and financial resources in the overall population indeed contribute to their lower likelihood of starting a business. However, because most studies have focused on individuals who are already interested in entrepreneurship or who are entrepreneurs, there is a relative lack of understanding of the earliest stage of nascent entrepreneurship; that is, how do individuals come to recognize that starting a business might be a viable option for work in the first place? Specifically, individuals who were initially steered away from entrepreneurship due to lack of information and biased or incomplete perceptions are not present in the sample. This is particularly problematic for the question of gender, since the design masks implicit incentives embedded in the cultural environment that lead people toward entrepreneurship in the first place. For example, it is not clear why women who have adequate structural advantages to start a business are less likely than men to do so. In this study, Thebaud addresses this limitation by analyzing a sample of the U.S. adult population. She proposes that gender-differentiated self-assessments of competence at the task of entrepreneurship, which stem from and are supported by shared cultural beliefs about gender, place constraints on men's and women's choices to pursue entrepreneurship as a career." [44]

"Sociologists increasingly understand gender as a multilevel structure, which includes cultural beliefs and distributions of resources at the macro level, patterns of behavior at the interactional level, and roles and identities at the micro level. Because processes at each level simultaneously reinforce each other, the gender structure is an over determined system that powerfully reinforces inequality. In this analysis, Thebaud focuses specifically on shared cultural beliefs about gender that prescribe different expectations of competence for women and men (or gender status beliefs) in the area of entrepreneurship, and analyze the implications of those beliefs for women's career

choices. I do this by first examining the degree to which self-assessments of entrepreneurial ability may be gender-differentiated, and then evaluating the extent to which this difference accounts for the gender gap in the pursuit of entrepreneurship." [45]

Studies have been developed, in which men are widely thought to be more capable and more competent than women. Researchers have found that people surveyed from different areas in the United States typically rated men higher in competence than they rated women, regardless of age. "Experimental research corroborates this finding: People tend to expect more competent task performances from men than from women, except in cases where the task being performed is particularly "feminine", such as a nurturing task. Importantly, scholars have noted that it is particularly in contexts where the task in question is male-typed when gender beliefs about competence become linked to performance evaluations and ability assessments." [46]

"Research widely confirms that entrepreneurship is one such male-typed activity. In a study of business students in the United States, India, and Turkey, researchers demonstrated that respondents in all three contexts strongly associate entrepreneurship with stereotypically masculine characteristics. Another study similarly found that American loan officers rated women as significantly less like "successful" entrepreneurs on the dimensions of leadership, autonomy, risk taking, readiness for change, endurance, lack of emotionalism, and low need for support when compared to equivalent men. More generally, scholars have argued that entrepreneurship is an activity that involves a sense of dominance tied to notions of masculinity within modern capitalist cultures." [47]

"The financial risk-taking that is often associated with entrepreneurship also adds a prescriptive edge to the stereotype that entrepreneurship is a male-typed activity. Indeed, studies in the fields of economics and psychology have shown that women are, on average, more financially risk averse than men. Some explanations for this finding include men's less emotional reactions to uncertain situations,

overconfidence in the likelihood of positive outcomes, and greater tendency to view risky situations as challenges rather than threats. However, the willingness to take risks has also been documented as an important component of prescriptive stereotypes about agentic, masculine behavior. Because women are expected to be more communal than men (i.e., women should be kinder and more sensitive to others), women who display agentic traits are often penalized for being insufficiently feminine. Therefore, when men become entrepreneurs, they fulfill the prescriptive stereotype that they should be agentic risk takers; by contrast, when women become entrepreneurs, they implicitly violate prescriptive stereotypes about feminine behavior." [48]

"Notably, this masculine stereotype of entrepreneurship has been shown to have a strong impact on women's intentions and experiences. For example, when women are exposed to the masculine stereotype about entrepreneurs, they are much less likely to demonstrate entrepreneurial intentions. Women entrepreneurs in the United States and Europe also report that they often perceive that they lack credibility because of their gender when they seek funding." [49]

"In a study, Thebaud developed and empirically tested the theoretical argument that widely shared cultural beliefs about men's and women's abilities in the area of entrepreneurship (i.e. "gender status beliefs") systematically influence the social interactions during which an entrepreneur, particularly an innovative entrepreneur, seeks support and legitimacy from stakeholders for his or her new organization. To evaluate this argument, three experimental studies were conducted in the United Kingdom and the United States in which participants were asked to evaluate the profiles of two entrepreneurs and to make investment decisions for each. The studies manipulated the gender of the entrepreneur and the innovativeness of the new organization. The main finding is consistent across studies: gender status beliefs generally disadvantage women entrepreneurs during their search for support and, as a result, distort perceptions of the viability and investment-worthiness of an innovative idea. However, the salience of these patterns varies depending on the national cultural context, as well as the industry context, of the new organization in question. Findings

indicate that gender status beliefs can be understood as an important mechanism contributing to the high degree of gender inequality in entrepreneurship rates at the aggregate-level and a key factor that influences the rise of new and novel organizations." [50]

Role models can improve women's education and participation in entrepreneurship. Significant research has been conducted to observe the influence of role models in female STEM participation. Apparently, women underestimate their performance in STEM when they haven't entered those fields. It is also known that female role models improve women's beliefs that they can be successful in STEM disciplines. [51] A study by Cheryan et. al. tested this assumption. "Two experiments varied role model gender and whether role models embody computer science stereotypes. Role model gender had no effect on success beliefs. However, women who interacted with nonstereotypical role models believed they would be more successful in computer science than those who interacted with stereotypical role models. Differences in women's success beliefs were mediated by their perceived dissimilarity from stereotypical role models. When attempting to convey to women that they can be successful in STEM fields, role model gender may be less important than the extent to which role models embody current STEM stereotypes." [52]

In a recent research published by UC Santa Barbara sociologist Sarah Thébaud, she didn't doubt that women are at a disadvantage when it comes to establishing their own business enterprises—plenty of evidence proves that to be the case—but she wanted to find out whether or not people are systematically biased in favor of male-led businesses, and if so, why. It turns out they are, and the reason comes down to stereotypical beliefs about men's and women's traits and abilities. The assistant professor of sociology at UCSB conducted three experimental studies and found across the board that people are likely to systematically discount the competence of female entrepreneurs and the investment-worthiness of their enterprises. However, she also found that this bias is somewhat mitigated when women pitch a particularly novel business idea. Her research was recently published online in the journal *Social*

Forces. "I looked at two different types of businesses, one in what I'd call a gender-balanced retail industry and the other in a high-tech industry," Thébaud said. She asked participants in the study to review and rate business plans for their investment-worthiness. The plans were identical, but she manipulated the first names of the entrepreneurs. "Most businesses tend to replicate others that are similar—one pizza place may be a little different from another, but basically they're all serving the same thing," Thébaud continued. "For those types of businesses, I found the participants systematically rated women-led businesses to be less investment-worthy and less likely to be successful." [53]

The participants also rated women to be less skilled and less competent as entrepreneurs than their male counterparts, regardless of the industry of their start-up. According to Thébaud, that was the reason they found the women's businesses to be less investment-worthy. "I did look at other possible explanations," she said. "For example, did they think women are less committed and would put out less effort and that's why they discount their businesses? And I didn't find evidence of that." She also looked into whether women are less likeable because as entrepreneurs they may violate feminine stereotypes. "And I didn't find evidence of that," she said. "The pattern of bias in favor of male-led businesses really boils down to the stereotypical belief that men are more likely to possess the types of skills and competence needed to make a new venture successful." But then Thébaud added a twist. She adjusted the business plans so the venture was particularly innovative. "Each participant rated two businesses—one that was standard run-of-the-mill and one that was introducing a brand new product or service to the market," she said. "Interestingly, innovation in the business plan didn't have a systematic effect on the ratings of men's businesses—they were largely idiosyncratic to a participant's tendency to tolerate risk. However, when a woman was pitching an innovative plan, she was systematically rated to be more competent or skilled and more worthy of investment than her non-innovative female counterpart." So why the switch? Thébaud suggested that when female entrepreneurs propose innovative business ideas, they signal traits that characterize society's stereotype of

what an entrepreneur is supposed to be: aggressive, ambitious, independent, creative, a risk-taker. "When a woman starts a business, people are likely to question whether she has those traits. But when a woman introduces something particularly innovative, she is able to dispel those doubts, at least to some degree, because she appears to be more authentically entrepreneurial," said Thébaud. By pitching an innovative idea, she continued, a woman demonstrates the characteristics of the "ideal" entrepreneur. "It signals to people that she is, indeed, aggressive and outgoing, willing to take risks and push barriers, which is what people often think women might not be willing to do," she said. That might be considered a small comfort, however. "People's expectations start women off at this lower baseline," Thébaud noted. "And so innovation simply mitigates the disadvantage they might otherwise experience."

Thébaud added that she wasn't surprised to find biases in favor of male-led firms. "This follows a lot of what we know about gender biases in managerial contexts," she said. But the innovation component was a bit counterintuitive at first. "The common wisdom is that if you're an entrepreneur and you're doing something novel, it is harder to get support because there is a higher risk of failure," Thébaud explained. "So innovation could have worsened the penalty for women: if people are prone to doubt a woman entrepreneur's competence and then she is also presenting a business idea that's particularly risky, it might further undermine her ability to gain credibility and support. But instead, innovation signaled possession of the stereotypically 'entrepreneurial' traits and abilities women are otherwise perceived to lack." Thébaud's study derives from her interest in the factors that block progress toward gender equity in certain segments of the economy. "We've seen this leveling off in terms of gender equality in recent years, and we see it especially in certain areas," she said. "STEM (Science, Math, Technology and Engineering) fields are an example."

Thébaud added that this project aligns with broader literature about unconscious bias. Most of the time, she noted, these perceptions—or misperceptions—are unconscious and unintentional. "They are often minor and hard to detect, too. Individuals are only subtly discounting women's businesses. But that slight disadvantage

accrues over time. So if a woman encounters one, two or three people who question her abilities or competence, that could mean the difference between persisting on that track and leaving, or getting funding and not getting funding," she said. Female entrepreneurs may be able to mitigate the disadvantaging effects of bias by explicitly emphasizing the innovative aspects of their business plans, Thébaud added. "However, my research shows that the source of this disadvantage in the first place lies in the fact that people tend to automatically associate entrepreneurship with men and steoreotypically masculine characteristics," she said. "This cultural conception identifies entrepreneurs as 'lone warriors' who are working on their own and are exceptionally prone to taking risks," she continued, "even though this stereotype isn't actually true in practice. So to solve the problem of gender bias in entrepreneurship more generally, we need to figure out how to change this cultural image." Raising awareness about bias and recognizing that it is often unconscious and unintentional provides an opportunity to remind young women in particular that they do indeed, possess the abilities and skills to be successful entrepreneurs, Thébaud concluded. "Also, by raising awareness, we can offer ways to advise women on how to mitigate the possible damaging effects of these stereotypes," she said, "and, at the same time work on countering and dismantling these stereotypical beliefs at a broader level.

Lakshmi Balachandra recently conducted a study that echoed Thebaud's findings. For her research, which is currently under review for publication, Balachandra examined how venture capitalists reacted to one-minute pitches from male and female startup founders in various industries. The main factor that determined whether the entrepreneurs were successful, she found, was how stereotypically "masculine" they behaved. The entrepreneurs—male and female—who were confident, stern, strong, and bold were much more likely to win funding for their ventures. The ones who were more stereotypically female, which to Balachandra's team meant they acted happier, kinder, and more excited, tended to lose. Importantly, there was no gender gap: The manly women performed better than the effeminate men did. [54]

"For decades the symbol of women entrepreneurship has been, to many, the Avon lady. On its website, Avon describes this amalgamation of past Avon representatives, who made their livings selling the company's beauty products, as "one of the most enduring and iconic images of women's entrepreneurship." The icon reinforces the picture research has painted of female entrepreneurs. Some studies suggest that women work less and earn less than male entrepreneurs. Others suggest that women are inferior networkers to men, relying too much on friends and family and not enough on a broad network of contacts. Picture a female entrepreneur and you might imagine a woman at the helm of a small business, perhaps in a female-focused industry such as cosmetics or childcare. Perhaps your imagined entrepreneur got there after hitting a glass ceiling, or maybe she struck out on her own as a way to gain balance between household duties and work responsibilities. But Tulane's Jennifer Merluzzi, who earned a PhD from Chicago Booth, is unsettled by these descriptors, which she considers broad and often inaccurate generalizations. She says the studies behind them are limited by their approach and end up either producing a universal definition of the female entrepreneur that lacks nuance or drawing conclusions about female entrepreneurs only as they relate to their male counterparts. "The comparison should not be men versus women or entrepreneurs versus not. There are lots of shades of gray," Merluzzi claims. Her ongoing research about women entrepreneurs with Ronald S. Burt, Hobart W. Williams Professor of Sociology and Strategy, contradicts these conventional views. Using a proprietary data sample, the two researchers craft a more detailed picture, not simply of female entrepreneurs, but of a variety of women who move in and out of the labor market at various points in their careers. Harvard Business School acknowledges that only 8% of the case studies used in its MBA courses have women protagonists, while Ernst and Young's Entrepreneurial Winning Women Program is in its sixth year of identifying female entrepreneurs who need to "think bigger," with the aim of helping them do that. It begs the question, in the Decade of the Women Entrepreneur (so named by the Ewing Marion Kauffman Foundation), what do we know about today's women business leaders, and what do we only think we know?

In some cases, studies about female entrepreneurs rely on small, homogenous datasets of a few dozen women in a single location. Other research relies on large datasets—from census surveys, for example—that can wipe out nuances. Merluzzi and Burt, by contrast, use data that offers a sufficiently big but also detailed look at the career choices of working women. The sample includes 814 respondents from their 20s to their 80s. Some are entrepreneurs; others are not. They have two things in common: they are women, and they have MBAs from Chicago Booth. The source is a 1998 Booth alumnae survey Burt conducted, to coincide with the school's 100th year. In an effort to learn more about women graduates and their engagement (or lack thereof) with the school, he mailed a 31-page questionnaire to every living female MBA alumna who had graduated since 1937. It took as long as two hours to complete and asked about the alumna's household, current job, network of contacts, values and opinions on work, and barriers to women in business. About one in five returned the survey. Burt shared the survey with the school's leadership and then put it down to focus on other research, much of it about social networks. Years later he offered it to Merluzzi, his former PhD advisee, whom he knew had an interest in women entrepreneurs. What sets these survey data apart, says Merluzzi, is the chance they offer to look at women entrepreneurs, as well as the many more graduates who chose other routes. Investigators can compare career women to each other, not simply to men. It also allows them to consider female entrepreneurs in the context of their labor-market counterparts and of women who chose to leave paid employment. One in four women in the survey became an entrepreneur at some point, the data show, though entrepreneurship right out of school was rare: 97% of the 814 respondents went straight from graduation to working for others. But the entrepreneurial bug took hold in time—eventually 15% of the group left employment to strike out on their own full-time, and 9% more went on to build side businesses of their own, while continuing to work as employees. The researchers find some clues as to how and why some women become entrepreneurs while others do not. Many who became entrepreneurs experienced major life events, such as divorce or parenthood, just as they started their own

ventures. Earlier entrepreneurial research credited women's struggle to balance home and work obligations as a major cause of their striking out on their own, but Merluzzi and Burt find evidence that those women were going to become entrepreneurs anyway. "Over the course of their lives, entrepreneurs and nonentrepreneurs are equally likely to be married, have children, get divorced, or remarry," they write. "However, as a woman goes through one these events, the odds of her becoming an entrepreneur go up. In some window of time around the event, a woman predisposed by other factors to become an entrepreneur in fact makes the transition." Family seems to predict when, not whether, a woman becomes an entrepreneur. Another factor is the field in which a woman works. Women in service industries were more likely to try part- or full-time self-employment than those in other industries. The size of an employer mattered too, as did career progression. Graduates who started out working at large organizations were far more likely to stay employed by others than those in smaller companies. Women who reached the senior management ranks in any organization were unlikely to then strike out on their own—they were already running their own businesses inside a larger corporation. Using the data Burt gathered, Merluzzi and Burt categorize female entrepreneurs into three groups rather than one homogenous set. "Primary entrepreneurs" work for themselves full-time. "Interrupted primary entrepreneurs" go from full-time entrepreneur, to employee, and back again. "Secondary entrepreneurs" work full time as employees in a firm, but also run their own ventures on the side. All three groups are represented among the 23% of graduates surveyed who took a job after graduation, but later started their own business. The Booth alumnae most likely to become primary entrepreneurs, according to the report's analysis, were employees below senior rank in small consulting service firms. Joan Treistman, a survey respondent from the class of 1969, is an interrupted primary entrepreneur. When Treistman suggested she and two colleagues offer to buy the company they had been working for, "it was a gut reaction," Treistman explained recently. In four decades as a marketing researcher and consultant, she has variously worked for other people and herself. Most comfortable making decisions on her own, she has sometimes needed the resources a

larger firm can offer. Among all the female entrepreneurs who responded to the survey, on average the women became entrepreneurs in their mid-thirties, and their first solo venture lasted an average of eight-and-a-half years. Their firms had an average of seven employees, including the entrepreneur herself, and recorded peak gross income in the firm's best year of between $322,000 and $14 million. Almost all of the entrepreneurs, 96%, started service businesses of some kind, including investment advisory firms, marketing and management consultancies, and professional offices such as legal and medical practices. One woman started a health-care services company that had 600 employees at its peak. But while many worked with colleagues and employees, 61% worked alone, many as consultants. When the researchers look only at firms owned by full-time entrepreneurs, and exclude those run by interrupted primary entrepreneurs and secondary entrepreneurs, they find that firms owned by full-time entrepreneurs were generally larger, employing an average of a dozen people, and ringing up gross income in their best years of between $580,000 and $14 million. Secondary entrepreneurs mainly ran project-based side businesses, often consulting projects in their fields, which were most typically education, law, medicine, or scientific research. Merluzzi and Burt discover that success means something quite different to an entrepreneur than it does to her counterpart employed by a business. For an entrepreneur, success is defined as having a wide network of relationships and control over her life. Senior managers, on the other hand, measure success by recognition and a wide sphere of influence, factors that were at the bottom of the list for entrepreneurs surveyed. This tradeoff between independence and recognition is typically cited when comparing male and female entrepreneurs, and the same tradeoff arises when comparing women on separate career paths.

For secondary entrepreneurs, the most important dimension of success is security. Although entrepreneurs such as Treistman describe their work as sometimes stressful, they appreciate the control it gives them over their lives—and according to Merluzzi and Burt's research, entrepreneurs are the happiest with work of all the alumnae surveyed. Some 20% of women graduates who moved in and out of

entrepreneurship described themselves as "completely satisfied" in their current or most recent full-time jobs. Primary entrepreneurs, who stuck with self-employment, were the happiest with work, with 36% describing themselves as completely satisfied. Both were happier with work than their employee counterparts. Among those working for an employer, the happiest were those who had risen to senior positions. Some 18% of that group described themselves as completely satisfied. Those in more junior positions were far less happy, with only 9% saying they were satisfied with their jobs. Unfortunately, two-thirds of entrepreneurs who eventually returned to employment did so below senior rank, where job satisfaction was much lower. Across all groups, the women least satisfied with work, or who at least had the most unhappy memories of it, were those who had left the labor market. In keeping with their different career paths, entrepreneurs and employees voiced concerns about different career issues. Entrepreneurs were most troubled by conflict between their personal and professional values, and the stress of work. Full-time managers voiced concerns about the lack of women with senior experience. They listed among their tradeoffs for success: personal time, a balanced life, and meaningful relationships. Entrepreneurs put this at the bottom of their list—their work is inherently personal. Merluzzi and Burt's research debunks a long-held belief that women have weaker networks and rely excessively on family and friends to build their business. The entrepreneurs surveyed reported broad networks. When asked about key client contacts, graduate school contacts, and their most valued contacts for career advice and support, entrepreneurs of all stripes reported high numbers of contacts beyond family and work, consistent with the kind of broad network believed essential to entrepreneurial success. Full-time entrepreneurs, whether primary or interrupted, had the broadest networks, which reached distant contacts. Secondary entrepreneurs had networks similar to nonentrepreneurs, reporting a greater concentration of family and work contacts. The women most reliant on family and friends were those who were no longer in the paid workforce. Booth alumna Mary Moosbrugger built her network and a successful market research firm, which caters to academic medical centers and pharmaceutical companies,

largely by word-of-mouth recommendations from customers. "One client would recommend me to another. I didn't try to develop it except by doing a good job," she now says. Moosbrugger worked for eight years for large firms including Leo Burnett, Booz Allen, and Sara Lee. After adopting two children and freelancing for several years, she went back to school for her MBA and then launched a firm that she ran for 35 years. At its height, the firm had billings of $1 million a year and a staff of ten people. "At the time I was doing it, I was having a ball. I liked creating something from nothing. I liked being the boss," says Moosbrugger. She says the 80-hour weeks and administrative responsibilities were stressful, but she achieved what she had wanted when she started the business, including flexibility and the control that comes with being the boss. Now retired and living in the foothills of the Great Smoky Mountains in Salem, South Carolina, Moosbrugger finally has a chance to slow down, her days filled with volunteering and water skiing. "I was a workaholic and very good at what I did, but I didn't have a balanced life," she says. She represents another picture of female entrepreneurship—a more complete image than has existed in the past, and one that research is starting to reveal." [55] [56]

2.2 History of Women Entrepreneurs

For many decades, women's roles in business were dictated by cultural norms. The "cult of domesticity" that shaped American thought in the early nineteenth century defined that women's proper place was at home. [57] "In 1972 women owned 4 percent of all American businesses; by 1991, that figure had climbed to 38 percent. This is not a trivial accomplishment; these women-owned enterprises were responsible for $4 trillion dollars in sales and employment of 27 million workers." [58] Historically, you notice great leaps in the number and extent of women entrepreneurs that correspond to periods of peak industrial or business upheavals, notably the mid-nineteenth century explosion within the textile industry and growing industrialization; the development of the national railroad system and the telegraph from 1880-1920; and the more recent information revolution. [59]

These revolutions were all characterized by rapidly occurring change with broad impact and high stakes. In these intense times, cracks evolve and women move swiftly to enter into those cracks. In each of these periods, the American economy and society were changing and women consistently took advantage of the opportunities.

"Madame C. J. Walker is an example of an entrepreneur who took advantage of industrial change", Harvard Business School professor Nancy F. Koehn said during a 2002 panel on history of women entrepreneurs. "Walker, a creator of hair care products, built a brand and brought it to market. But she needed the creation of the railroad and telegraph to be able to communicate effectively and create the network that allowed her to become one of the most successful woman entrepreneurs of her day."

"Up through the nineteenth century, women-owned businesses primarily included taverns and alehouses, millinery and retail shops, hotels and brothels, and were often operated as a way to provide an income for women who found themselves without a breadwinning man. Sometimes, too, women inherited businesses from fathers or husbands and found themselves thrust into traditionally male enterprises. These women owned businesses in the face of prevailing social ideas that the unsavory world of business was unsuitable for women's gentle and frail natures. Business, then, in these earlier eras, was a way for a woman in potentially dire circumstances to provide for herself rather than become a social burden. Many women succeeded in any case; among them, Rebecca Lukens, who, beginning in 1825, turned her family's faltering ironworks into a thriving steel business that endured into the 21st century." [60]

"World War II brought many women into the workforce, filling jobs so men could go off and fight. That same patriotic fervor also inspired many women to consider starting businesses of their own. The Boston Globe's "women's pages," for example, featured Polly Webster's column, "War Time Wife", packed with tips for weathering the hardships of the war years—including how to generate income from home-based businesses. Webster later wrote two books based on her column. Fearful of Adolf Hitler's next moves, Pauline Trigère left her native Paris for New York in 1937, where she

started a tailoring business that would become her own high-end fashion house a few years later. Mrs. Estée Lauder was busy conceptualizing the company that would become her beauty empire, officially launching it in 1946, just a year after the war ended." [61]

"By the early 1960s, the changing social and cultural landscape provided new incentives for would-be women business owners. Divorce rates escalated during the 1960s and single mothers struggling to balance childrearing and their new roles as providers saw in business a possible solution. In 1961, Ruth Fertel mortgaged her home to buy Ruth's Chris Steak House. Other women—among them, beauty maven Mary Kay Ash and advertising executive Mary Wells—started companies of their own as a way to assert their independence in the male world of business. When America's affluent decade of the '60s gave way to the recession of the 1970s, women who had worked their way into corporate America were often among the first to be let go. Many of them used their expertise to launch businesses of their own. Patty DeDominic, for example, opened an employment agency—a growing and increasingly popular category for women entrepreneurs." [62]

"By the 1980s, the hard work of the previous decades was paying off: women entrepreneurs like Martha Stewart and Vera Bradley cofounders Patricia R. Miller and Barbara Bradley Baekgaard owned 25 percent of all US firms. What's more, the public and politicians widely acknowledged that women entrepreneurs were a vital component of the nation's economy. New initiatives, including how-to seminars and government programs, sought to ensure that women had the resources necessary to start and grow their businesses. In 1988, urged on by the National Association of Women Business Owners (NAWBO), Congress passed The Women's Business Ownership Act, which ended discrimination in lending, eliminated state laws that required married women to have a husband's signature for all loans and gave women-owned businesses a chance to compete for lucrative government contracts. Proof that women entrepreneurs were finally an accepted part of the mainstream economy: in 1989, President George H.W.

Bush appointed Susan Engeleiter as the first woman to head the Small Business Administration." [63]

"It's been a bumpy ride for women entrepreneurs in the early 21st century: on the up side, their numbers continue to grow, and Key Bank, Goldman Sachs and other institutions have increasingly launched financing initiatives targeted solely at would-be women entrepreneurs. The economic downturn of 2008—like those of the Great Depression and the 1970s—brought new challenges and opportunities. The challenges: surviving in tough times. Studies show that women entrepreneurs like Pinnacle founder Nina Vaca managed to hang in there—and even expand—by keeping their businesses lean. The opportunities: those seeking to start ventures in a difficult economy, like Nicole Loftus of Zorch, may have to work harder to find a unique niche, but once they do, thrifty consumers are proving willing to spend." [64]

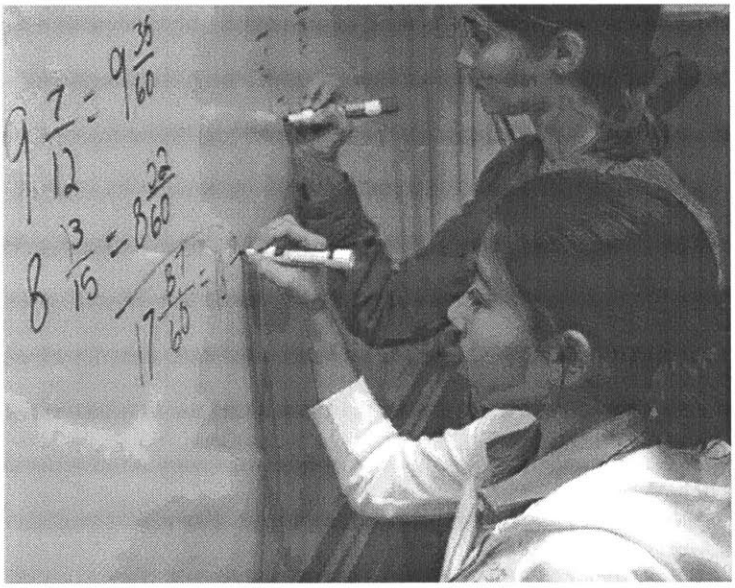


Figure 7 Girls demonstrating mathematics. Credit: US Department of Education.

"The last century of women's entrepreneurship is not simply a tale of triumph or of an incomplete revolution. It is a story of risks and rewards, of women who had an idea and so believed in the possibilities that they battled obstacles and gender bias and forged networks to make it a reality. Together, their singular efforts combined to stake a claim for women in the world of enterprise. Not all of them made it; not all of those who

did saw their ventures become major corporations. But small and big, women's ventures came to comprise 30 percent of all U.S. businesses—many of them today in categories that were once men's alone. The lesson they teach is the power of possibilities and passion to transform lives. The next century promises to be even brighter for women's entrepreneurship. New technologies emerge daily to make business ownership more affordable and easily managed while new financing opportunities are increasingly available. Experts predict that by 2018, women's businesses will create more than half of the new small business jobs and a third of the nation's total new jobs. Beyond that, anything is possible." [65]

Chapter 3 – Women in STEM Programs

3.1 SHINE

SHINE is an after school math and dance program, which is designed to inspire success and confidence in middle school girls. Dance, in addition to classroom experience, is combined with a math curriculum. The math program covers all of the national middle school math standards. Mentors lead the sessions, and the students learn through kinesthetic techniques and team problem-solving sessions. The program has a custom online system through which students submit homework. In order to reinforce each lesson's concept the girls complete homework assignments after every class. [66]

"The dance component helps to explain math concepts through motion and improves the students' self-confidence, teamwork, and discipline. The choreography is designed for students of all skill levels, and is performed for parents at an end-of-program recital. SHINE dance mentors are formally trained in contemporary, jazz, and ballet dance styles."

Students demonstrate improved participation and achievement in class, homework, and math teams after completion of the program. "SHINE is for girls of all

backgrounds and skill levels, whether they are having trouble in math class, looking for more of a challenge, want to dance more, or want to build their self-confidence."

According to Emily Benz, the SHINE coordinator at MIT, the program is a great way to push the girls out of their comfort zone. It breaks the barriers to learn mathematics. It also teaches the girls that mathematics can be fun, creative, and can improve confidence. SHINE conducts pre and post test and confidence assessments. So far, they have seen 100% improvements in scores. Out of a group of 35 students, only 1 did not show improvement.

Each SHINE branch has its own choreographer and a new dance every semester. The dance is a combination of jazz and hip-hop. At MIT, the math teachers are the MIT student mentors. They are all qualified as they go through a SHINE training lesson and are MIT students, so they have deep understanding of the mathematical concepts the program teaches. In their Boston branch, SHINE has 6 executive board members and 7 mentors.

SHINE mentors coach the girls during a session that starts with the girls tackling a challenging mathematics problem. The girls do a warm up and practice individual dance moves after a word problem game gets the group thinking analytically. In the second half of the dance lesson, the students work on choreography. There is a final performance, during which each girl performs a solo for family and friends. Mentors start a rapid-fire question round and movement combinations in order to transition to mathematics. These could include directions to turn to different angles or to spin while reciting multiplication tables. [67]

According to Kirin Sinha, the founder of SHINE, "Dance was a natural pairing with mathematics for girls since, aside from providing physical activity, it requires dedication, attention to detail, and confidence to succeed. These same tools enable the girls to excel in mathematics." [68]

When asked about mapping such a program to entrepreneurship, Emily Benz said "It could work. However, mathematics is more concrete. It is something the girls have to do it in school."

3.2 MAGIC

The main objective of MAGIC [69] is to expose middle and high school girls to various disciplines in Science, Technology, Engineering and Mathematics (STEM) through 1-1 mentoring with women having successful careers in STEM, thereby encouraging them to consider STEM careers for themselves. The mentoring session lasts for three to six months, and consists of weekly one hour meetings between a mentor-mentee pair. Each pair works on STEM projects during these sessions; in addition, the mentees learn soft skills such as time and project management, presentation skills, and also talk with their mentors about contributions of women to the STEM field, the life of a woman with a STEM career and related items.

MAGIC's vision is to be a world class resource for guiding & assisting young women seriously considering studying one or more STEM areas. The program's mission is to focus on providing middle and high school girls, seriously considering studying a STEM area, with a knowledge of tools and resources available to help them start down the STEM path successfully. This will be done during the specified mentorship period.

Mentees need to fill out an application form that is reviewed by their school and a MAGIC core team member. They then have to go through a short interview process, after which they are selected and paired with a mentor with similar interests and matching availability. To get the most of the mentoring, each mentee is expected to devote 2-3 hours per week on their MAGIC projects, including an hour long meeting with their mentor.

Mentors are required to go through a rigorous selection process that involves filling up a qualification form and submitting it in with their resume, going through a phone interview with a MAGIC core team member, a background check and reference checks. They are provided with training materials before they start their mentoring process.

MAGIC was launched at the Grace Hopper Celebration for Computing in 2007. MAGIC was incorporated as a 501c(3) non-profit organization in the state of California in early 2009. It has completed six years of mentoring, providing mentoring to about 100

middle and high school girls to date. The mentors of MAGIC reside in various parts of the United States, providing face to face or remote (if they are not co-located with their mentees) mentoring. 40% of the mentoring in MAGIC is remote. The mentees have been from ten schools in the San Francisco Bay Area, Los Angeles, San Diego, and Cambridge, MA.

The program has had significant impact. More than hundred middle and highs school girls have been MAGIC mentees. The % of mentee-mentor pairs that did not complete a session is less than 5%. Every mentee, who has graduated from high school, is majoring in Computer Science, Computer Engineering or some other form of engineering in top universities in the US including MIT, Stanford, and University of California, Berkeley. Every year, about 10% of the mentees express a desire to do another session of MAGIC. The percentage of mentors returning year to year is higher than 80%. Two of the MAGIC mentees, who also happen to be the senior most mentees, have come back to the program as mentors in 2015.

The Computer Science department chair and MAGIC coordinator the Girls' Middle School in Palo Alto, CA reviewed the MAGIC program and said "At this point, MAGIC has matched nearly 50 young women from my school with female mentors who share their STEM interests. What a gift to those girls! The value of the 1-to-1 mentorships cannot be overstated. Though our school already has a strong math, science, and technology focus, this program has given an extra boost to girls who have a hunger to 'go deeper' and who crave the specialized knowledge that a professional in the field has to offer. Year after year, I see our MAGIC students thrive on the relationships they build through the program and develop technical talents beyond what could usually be expected from a middle schooler. The individualized direct support of programs like MAGIC is the best way overcome the sense of exclusion from the STEM fields that so many women feel." [70]

According to Ira Pramanick, the founder of MAGIC, the program can be mapped to entrepreneurship. She said "Yes, I think that the MAGIC model can be mapped to entrepreneurship and innovation. The 1-1 mentoring will have the same benefits if not

more in this space. The "project" that the mentee would work on would need to be modified, of course, for the domain, and might need more of a "field trip" nature to it. The mentee might need to spend more of the "mentoring meeting time" shadowing the mentor (vs writing code or some hands-on work for a typical MAGIC project). This might make is harder to do remote mentoring in some cases, and in other cases, the remote aspect will actually help because it will place more responsibility on the mentee as a participant in the project and additional responsibility on the mentor to come up with appropriate projects for their mentee."

3.3 Technovation Challenge

Technovation is a technology entrepreneurship program and competition for young girls, which was launched in San Francisco, California. The girls go through an intensive 3-month, 50-hour curriculum. Teams of young girls work collaboratively to imagine, design, and develop mobile apps. Thereafter, they pitch app ideas to judges.

Almost 3,000 young women from 28 countries have created mobile apps through Technovation. The program has dedicated volunteers globally. The program is free to all participants, and no programming experience is required for students, teachers, or mentors. [71]

"Technovation's mission is to motivate and educate girls and women to solve real-world problems through technology, inspiring girls to see themselves not just as users of technology, but as inventors, designers, builders, and entrepreneurs in the industry."

"The girls are taught life skills such as how to identify a problem, design and test a solution, collaborate with a team, and communicate to different audiences. It reinforces the following academic concepts: digital representation of information, algorithmic thinking and programming, and the societal impact of information and information technology."

Technovation is one of the few programs that combines STEM with entrepreneurship as girls learn market research, competitor analysis, requirements

gathering and revenue generation among other things. Teams are guided by teachers and mentors from high tech industry, who act as role models.

"Technovation coaches coordinate teams of up to five (5) young women to work with female mentors to come up with an app idea, conduct user research, create a business plan, design an app, and develop a prototype. Leaders from the technology and business sectors judge the apps and provide feedback to the teams."

According to Tara Chklovski, "I was struck by how, in the US, you have women who don't see themselves as inventors and problem-solvers," she said. "Women don't see science and engineering as fields that are accessible to them." [72] She also added that she believes the technovation program is a hybrid between meetups and Massive Open Online Courses (MOOCs).

"In 2013, for example, the program challenged more than 100 teams of girls to create a mobile app that solves an issue in their community. Some of the finalists, who pitched their ideas to judges from Google, Dropbox, and the Office of Naval Research, included an app that pairs nonprofits and volunteers and a mobile service for school attendance taking. The top team won $10,000 and support to bring their app to market." [73]

3.4 Girls Who Code

Launched in Spring 2012, Girls Who Code is a nonprofit organization that is working to close the gender gap particularly in the technology and engineering. "With support from public and private partners, Girls Who Code works to educate, inspire, and equip high school girls with the skills and resources to pursue opportunities in computing fields." [74]

In its 2014 year end report, the organization founded by Reshma Saujani has seen incredible growth. Since the program was launched, Girls Who Code has reached 3,000 high school-aged girls. They have been provided with computer coding skills that has helped them develop functional code-based products, such as mobile video games and other software applications. The organization has also expanded its programs to 24 cities and seen a huge jump in the number of girls participating in its programs from

2013 to 2014. The program started in 2012 with 20 students. Girls Who Code's two-week Summer Immersion program had 152 participants in 2013 and 375 in 2014. Its after-school club programs are also receiving lot of popularity. About 2,200 girls participated in 2014 and 600 in 2013.

Girls Who Code raised more than $7.7 million in 2014; it received about $1.2 million in 2013. Investors of the program include The Knight Foundation, Amazon, Google, Twitter, Facebook, GE, EMC, AT&T, Oracle, MasterCard, Microsoft, Intel.

"According to the year end prospectus, the impact of Girls Who Code is also pretty astounding. A recent study by the organization found that 100 percent of its Summer Immersion program alumnae are either majoring or are planning to major in computer science or mechanical/electrical engineering in college. Of that group, 88 percent have plans to major in computer science and named Girls Who Code as their motivation for doing so." [75]

"Currently, there are more than 150 Girls Who Code clubs nationwide that teach concepts such as robotics, web design, and mobile app development. The goal of the program is to get more than a million girls to code over the next 10 years." [76]

3.5 Girls Inc.

Girls Incorporated is a nonprofit organization that focuses on instilling confidence in girls. The program has chapters all over the United States, and some of these chapters provide STEM programs for girls.

"The Eureka science, math, technology, and sports summer program at Girls Inc. of Lynn provides rising seventh, eighth, and ninth grade girls the opportunity to develop the "I Can Do It! Attitude" by challenging their minds, bodies and spirits, in and out of the classroom." [77] Eureka is part of Operation SMART (Science, Math And Relevant Technology); it is an intensive six-week full day summer program focused on science, math, sports, career, and personal development. The girls participate in various classes during which they explore mathematics and science concepts through hands-on activities and group projects that enforce collaborative learning.

Rising seventh grade girls attend classes in patterns & problem solving and STEM. Rising eighth grade girls attend classes in design; these focus on architecture, engineering, and technology. Rising ninth graders participate in Beach Sisters. Beach Sisters is a marine science class. Additionally, they attend A.C.E. (academic & career exploration class) that prepares the girls to transition to high school.

Every day the girls participate in not only personal development class but also sports and swimming classes. "Once a week the Eureka girls go on expeditions to enhance and expand on the learning that takes place in their classes. Expeditions include visits to the Museum of Science, the Northeastern Marine Science Lab, MIT, a ropes course, canoeing, and Lynn Woods for an orienteering activity." [78]

In the final year, the rising ninth graders get the opportunity to do paid internships. These internships place them with women in non-traditional fields. Moreover, the girls are required to attend a professional development class at Girls Inc. The internships last for six weeks. While providing real world experience, the internships provide leadership skills.

3.6 Science Club For Girls

"Science Club For Girls fosters excitement, confidence and literacy in STEM for girls from underrepresented communities by providing free, experiential programs and by maximizing meaningful interactions with women mentors in science, technology, engineering & mathematics. The organization was founded in 1994, and it Science Club for Girls (SCFG) has strived to provide the very best in girls-specific programming, by connecting girls in K-12 grades, especially those from underrepresented groups, with female mentor-scientists through free science and engineering programs in a fun, nurturing, interactive environment. The leadership program for teenage girls gives them the opportunity to be role models, teach young children science, learn life skills, conduct outreach, and explore careers in science and technology. More than 1,000 girls participate annually in SCFG programs that take place in five cities in eastern Massachusetts (Cambridge, Lawrence, Boston, Newton and Fitchburg), and previously in Pokuase, Ghana."

"With fully 80% of the fastest growing jobs in the next decade requiring capabilities in science, technology, engineering and mathematics, our efforts to increase interest and promote career awareness in these fields are essential to ensure the economic security for underrepresented groups and their communities. Out-of-school-time programs like Science Club for Girls are incredibly important to narrowing the achievement gap and to assuring the long-term economic competitiveness for the state and the country, as outlined in the MA Governor's Plan for Excellence in STEM Education and in President Obama's Educate to Innovate campaign, including the Change the Equation initiative." [79]

In terms of scope, SCFG currently serves nearly 1,000 girls in grades K-12 in 17 sites across eastern Massachusetts, including Boston, Cambridge, Newton and Lawrence; the program is provided primarily through volunteers (many of whom are working scientists in academic or corporate settings), and SCFG has about 200 volunteers involved at varying levels of program delivery.

"In the past eight years, 92% of high school juniors and seniors who have participated in Science Club for Girls have gone on to college, with 55% of them majoring in science, engineering, or allied health. By comparison, only 22.5% of MA high school seniors who take the SAT intend to study STEM in college."

"SCFG has designed K-5 programs that develop the curiosity of young children. SCFG believes that it is never too early to connect and inspire them with role models who are excelling in these fields and help young girls dream big dreams."

"Forty-seven percent (47%) of alumnae said SCFG was their primary introduction to STEM careers. Forty percent (40%) said SCFG was a very strong influence in their decision to take more challenging science or math courses in high school. A recent survey of girls in 4-6th grade suggest that those who have participated in Science Club for Girls for two years or more are more interested in science class, and more aware of and interested in careers in science and engineering, than their peers who have just joined." [80]

According to Lonsdale G. Koester, Executive Director of SCFG, whether the program can be mapped to entrepreneurship and innovation, she says "Yes, absolutely, I do believe our program could be mapped to entrepreneurship. Especially given that one of our focus areas is on confidence. It's one thing for a program to assist girls with technical skill development; but for girls to become women who pursue their own ideas/products/services as entrepreneurs rather than going into supportive, background roles in larger, pre-existing contexts, we have to have an extra layer of confidence that our ideas are worthwhile and world-class and that we are capable of bringing them to fruition."

3.7 Girls Develop It

Girl Develop It is a nonprofit organization that is targeting women who want to learn web and software development. Women belonging to diverse backgrounds are helped to achieve technology goals and build confidence through classes and support.

"The vision is to create a network of empowered women who feel confident in their abilities to code and build beautiful web and mobile applications. By teaching women around the world from diverse backgrounds to learn software development, we can help women improve their careers and confidence in their everyday lives. Girl Develop It is committed to making sure women of all races, education levels, income and upbringing can build confidence in their skill set to develop web and mobile applications. The organization's goal is to provide powerful hands-on programs to women seeking professional help in software development and create basic to advanced web and mobile applications." [81]

""Girl, Develop It!" began as a call to action for women, by women who were tired of the low representation of women in tech, and wanted to make a difference. The organization was founded in New York City in 2010 by Vanessa Hurst and Sara Chipps. Today, Girl Develop It chapters are building strong, empowered communities in 46 cities, representing 35,000+ members nationwide who are changing their lives through learning to code with us." [82]

Women have been able to make career switches after taking Girls Develop It classes. "Cassandra King, felt that she was becoming irrelevant in her field. She had been a webmaster at Widener University for a decade. It was a job that had once challenged her, but after a certain point, she just felt stuck. That was when she decided to start taking classes with Girls Develop It. King, a South Philly resident who grew up in Puerto Rico, took every class. She even repeated some. After she participated in a Ruby on Rails/Girl Develop It apprenticeship last spring, she felt ready to make the career switch. Last September, King joined Old City ecommerce company Weblinc. She said she couldn't have done it without Girl Develop It. "Girl Develop It empowered me," she said. "It gave me confidence."" [83]

3.8 Black Girls Code

Black Girls Code (BGC), promotes STEM programs and provides opportunities for women of color in technology. Currently, Black Girls Code has programs in Atlanta, New York, Memphis, Detroit, Chicago, Las Vegas, Los Angeles, Washington D.C., and Johannesburg, and South Africa.

"The vision of BGC is to increase the number of women of color in the digital space by empowering girls of color ages 7 to 17 to become innovators in STEM fields, leaders in their communities, and builders of their own futures through exposure to computer science and technology." [84]

"Kimberly Bryant, an electrical engineer working in biotech for over 20 years, founded Black Girls Code in 2011." [85] "BGC offers weekend workshops and summer camps in programming, robotics, web design and mobile app development to girls as young as 7. At first, most of the girls didn't know what computer science was. "They all have cellphones, perhaps a tablet or a notebook that they do homework on," says Bryant. "But most of them don't have a background in being a creator or an innovator." She aims to change that with free and low-cost workshops that range from a single day to a few weeks. The sessions are run by volunteer mentors from the group's sponsors—Google, Oracle and Microsoft, among others. Tapping away on computers at local colleges or tech companies, the girls work in pairs or small teams to solve real problems.

At one recent "hackathon," they built mobile apps designed to combat teen domestic violence. Some coders are newbies, but others are advanced, returning for workshop after workshop. A few even boast their own apps on iTunes and the Google Play store. "We're creating this new breed of techies who are going to be the ones starting the tech companies of the future," Bryant says. She has an audacious goal for what she likes to call "the Girl Scouts of coding": reaching one million girls by 2040. The group has already trained 3,000 girls and now has seven chapters across the United States—and one in Johannesburg, South Africa. It plans to expand to eight more cities by the end of 2015." [86]

3.9 Engineer Girl

www.EngineerGirl.org is a website developed by the National Academy of Engineering (NAE) to attract middle and high school students especially girls to engineering. The website provides the girls with an understanding of engineering, in addition to ways they can explore engineering careers. This is part of NAEs commitment to increase diversity in the STEM workforce and improve the technological literacy nationwide. [87]

Chapter 4 – Mapping STEM programs to Innovation & Entrepreneurship and Programs in Entrepreneurship

4.1 Mapping STEM Programs to Entrepreneurship

Just like STEM, it is essential to design and develop entrepreneurial programs for girls and women. Similar to SHINE, there could be entrepreneurship programs that can mix creative processes such as dance and ballet with entrepreneurship for girls. Dance requires creativity, structure, and discipline and so does an entrepreneurial mindset. Silicon Valley's all-girl Castilleja School during Computer Science Education Week in December 2014 featured a bubble sort dance. [88] Students from several universities have danced to sorting algorithms. Perhaps dance could teach the steps required for entrepreneurship too.

An article in Huffington Post states that women in STEM must begin with girls in STEM. "There is an issue with trying to determine why STEM (science, technology, engineering and mathematics) is still a four-letter word to women: We're asking the wrong question. We should be asking instead, Why is STEM still a four-letter word to girls? Representing women in technology and science begins with raising girls to become a part of those fields.[89] Similarly women in entrepreneurship must begin with girls in entrepreneurship. A recent book Kidpreneurs teaches children, however young, about the building blocks of discipline, structure and planning that build a foundation of entrepreneurship. [90] It is a book that stokes a child's desire to get involved in business early by fueling their curiosity in simple, engaging, creative and safe ways. The goal with Kidpreneurs is to outline some basic tools and strategies kids can use to gain some valuable experience in starting, managing, and growing a successful business venture. [91]

To encourage girls in entrepreneurship the first step is to provide absolute positivity about women in entrepreneurship and about the entrepreneurial capabilities of women in general.

We could start purchasing toys and games for girls that encourage entrepreneurship and innovation. American Girl and other firms have recently designed toys for young girls that tap into the appeal of owning a business. [92] Furthermore, we should encourage group activities and competition among girls that are related to entrepreneurship and innovation.

Another step could be to incorporate successful female entrepreneurs and innovator role models in the lives and education of young women. Similar to programs like MAGIC, Girls Develop It, etc. we need to develop and design programs for girls in which female entrepreneurs mentor the girls.

Women in entrepreneurship and innovation must share their stories. We must advocate for the innovation and entrepreneurship in the education system. The education system is focused on standardized tests. Moreover, it tries to build and develop skills that are directly involved with the testing categories. If we want more

women in entrepreneurship and innovation, we need to be teaching these skills at a younger age to all children.

We need to drive the conversation about girls and women in entrepreneurship and innovation. The first step to accomplishing any kind of change in this world is to start the discussion. We know for a fact that the fields of entrepreneurship and innovation are achieving remarkable feats. We also know that there are less women contributing to those successes than there are men. Every following generation of women has more of an opportunity to thrive in male-dominated careers and the potential of today's young women is unprecedented. We just need to start recognizing the importance of cultivating their potential. We want to create a world where men and women can equally contribute to entrepreneurial and innovative advancements not only for the future of women, but for the future of humanity in general. Encouraging entrepreneurship and innovation for young females is beneficial to young males as well. It's positive for all of us and that's the point. A world in which both genders work together to create, innovate, build entrepreneurial ventures, and discover will be able to accomplish extraordinary thing.

Similar to trying to improve science education for girls, we need to figure out ways to improve entrepreneurial and innovation education for girls too. In addition, there must be conscious efforts to invest in women entrepreneurs. Jesse Draper, the daughter of VC Tim Draper and former Nickelodeon star, runs an angel fund to support women entrepreneurs, has vowed to make female guests at least half of the interviewees on her TV show and has started an organization for women in business. [93]

Golden Seeds is focused on investing on women-managed businesses. [94] Since 2005, the fund has invested $70 million in more than 65 women led companies. According to Stephanie Newby, founder of Golden Seeds, "I care most about ensuring that there is a female voice involved in the creation of company culture. That's why we back diverse leadership teams, and the best leaders embrace it anyway."

LinkedIn is partnering with Lean In, the Anita Borg Institute, and Facebook to launch the Computer Science & Engineering (CS&E) Chapter — a global network of Lean In Circles that will provide women at colleges and universities a way to network with peers who are also studying, interested in, or already working in the fields of computer science and engineering. [95] Corporations, non-profit organizations, and universities could partner to create similar Lean In Circles focused on entrepreneurship and innovation for women at universities.

"For Inspiration and Recognition of Science and Technology (FIRST) is an international youth organization that operates the FIRST Robotics Competition, FIRST LEGO League, Junior FIRST LEGO League, and FIRST Tech Challenge Competition. Launched in 1989 by Dean Kamen and Woodie Flowers in 1989, its expressed goal is to develop ways to inspire students in engineering and technology fields. It is noted for its philosophy of cooperative competition or coopetition." [96] What is required is design of similar games and challenges in entrepreneurship and innovation for girls.

"Minority Introduction to Engineering and Science (MITES) is a free rigorous six-week residential academic enrichment program for promising high school seniors – many of whom come from underrepresented or underserved communities – who have a strong academic record and are interested in studying and exploring careers in science and engineering. This national program stresses the value and reward of pursuing advanced technical degrees and careers while developing the skills necessary to achieve success in science and engineering. In 2014, MITES served 72 students hailing from 38 states, Washington, D.C. and Puerto Rico. Students take one calculus course, one life sciences course, one physics course a humanities course and an elective course. Girls Introduction to Innovation and Entrepreneurship (GIIE) could be designed on the lines of MITES." [97]

4.2 Entrepreneurship and Innovation Programs

MIT Launch is a 4-week entrepreneurship program for high school students, it teaches students entrepreneurship and how to launch their own businesses. Students tend to start real world companies after completion of the program. Participants do

rigorous coursework, collaborate and network with peers and mentors, and take advantage of the multitude of resources available to them at MIT to realize how to launch entrepreneurial ventures. The program is built around the principle of MIT moto mens et manus – mind and hand. [98] MIT Launch is part of the Martin Trust Center for MIT Entrepreneurship. "For each of the students, the program instills a self-starter mentality, teaches tangible, practical business skills, and introduces entrepreneurship as a career path. MIT Launch aspires to create students with more adaptability and resourcefulness geared towards the real world, develop and inspire more makers and innovators, and generate more demand for entrepreneurship education in schools." [99] The program also demonstrates interest from female students. 47% and 31% of Launch participants in 2013 and 2014 respectively were women. So far in 2015 there are about 35% of women.

The Center for Women's Entrepreneurial Leadership (CWEL) at Babson College has been started to educate more aspiring women entrepreneurs. The center educates, inspires, and empowers women entrepreneurial leaders in order to reach their full potential, thereby creating economic and social value for themselves, their organizations, and society. Apart from innovative education programs and events, the Center supports and disseminates research about women entrepreneurs. "Additionally, CWEL supports and advances gender equality as a growth strategy for individuals and for organizations of all sizes, everywhere in the world. It is a learning laboratory at the intersection of gender and entrepreneurial leadership. CWEL provides Babson undergraduate and graduate students, as well as alumni access to education, engagement with role models, opportunities to experiment." [100]

The Athena Center for Leadership Studies at Barnard College provides support and resources for burgeoning women entrepreneurs. [101] It combines the resources available at Barnard College and the venture community at Columbia University. Moreover, it is located in New York City, which is a growing center of entrepreneurial activity. All the above uniquely position Entrepreneurs@Athena to provide the necessary education to underrepresented and highly capitalized women entrepreneurs.

In addition, the Center is developing a unique and innovative program, geared towards women, that can serve as a model that can be replicated nationwide. The Center offers support and mentoring for young women entrepreneurs.

Athena Mastermind if a program that pairs promising Barnard students, who are actively involved in startups, with experienced women entrepreneurs. The first Mastermind cohort, launched in 2012, has already resulted in the acquisition of a student venture by a Silicon Valley startup and other promising successes. In addition, Athena holds regular office hours for student entrepreneurs. "Drawing upon successful women entrepreneurs, Barnard alumnae, parents, and program staff, these one-on-one sessions provide mentoring and support for Barnard students and provide information on available resources such as workshops, brainstorming labs, pitch-fests, competitions and hack-a-thons offered by the Columbia Venture Network and the New York startup community. Each year, the Athena Center offers 40 – 50 Leadership Lab workshops to Barnard students on a wide range of leadership skills, from financial literacy to effective negotiation to story telling and communication. Ranging from two-hour to full-day sessions, the workshops are taught by experienced trainers and professionals and feature interactive, hands-on components. Among the offerings is a special series designed for young entrepreneurs. Taught by experienced entrepreneurs and angel investors, these workshops help Barnard students learn the basics of starting their own businesses, strategies, project management and team building that are necessary for successful startups. In collaboration with Barnard's Office of Pre-College Programs and leading business and STEM educators, Athena has launched an intensive 10-day summer program for female high-school students called Entrepreneurs-in-Training. Launched in Summer 2013, participants in the program design businesses, pitch their plans to respected investors from the startup sector, and are exposed to core entrepreneurial concepts. The program fosters the confidence and develops skills young women need to launch their own ventures." [102]

"Women Founders @ Columbia (WFC) is a curated network of highly motivated, women entrepreneurs affiliated with the 21 schools at Columbia University. The

network believes in tapping into the deep expertise and innovation coming from all sectors of the university, with the explicit mission of women supporting women. Spearheaded by the Athena Center for Leadership Studies, in collaboration with the Eugene Lang Entrepreneurship Center and Columbia Journalism School Women in Media, this initiative is a way for women entrepreneurs to be connected and united across and beyond campus. WFC was created in line with the mission of Entrepreneurs@Athena, to provide resources, research & advocacy to level the playing field for women entrepreneurs. It provides a network and support system within the greater Columbia community of innovative and engaged women founders. It requires participation in a group of ambitious women that are devoted to the betterment of women founders and their ventures." [103]

Stanford Graduate School of Business (GSB) offers a very popular course on female entrepreneurship. Garth Saloner, now Dean of Stanford GSB, started Entrepreneurship from the Perspective of Women ten year ago as a two-week seminar. Today, a prominent female VC teaches the course, and it is so popular that it has a waiting list, and the school decided to turn it into a full, quarter course, beginning in 2015, according to Saloner. Fern Mandelbaum, managing partner at Vista Venture Partners, became the class instructor last year after having been a guest speaker in the course for five years. She dubs the course "You Can Do It" because "that's really what the class is all about," she says. [104] Fern cites confidence as the biggest challenge for women entrepreneurs. According to Fern, "So many women wrestle with confidence, from the time they're little girls until the time they're my colleagues. It comes up all the time in my class. But if you don't believe you can do it, how will others believe?" VLAB, the San Francisco Bay Area chapter of the MIT Enterprise Forum, a non-profit organization dedicated to promoting the growth and success of high-tech entrepreneurial ventures by connecting ideas, technology and people holds events for women entrepreneurs. [105] In January they showcased businesses run by women entrepreneurs under 30 at Stanford. [106] Stanford recently hosted the Women in Entrepreneurship Summit, which gave participants the opportunity to interact with

successful female entrepreneurs. Participants expressed appreciation for the format of the event, particularly the opportunity to interact personally with the speakers. There was great student feedback. "It was comforting and inspiring to hear from and get to know women who have become successful in such a male-dominated industry," said attendee Andrea Wenrich. "The workshops allowed us to get to know these incredible women on a personal and intimate level." "As one of 10 students at a table with a successful startup founder, I was able to hear everything from her day-to-day challenges to her long-term goals," said Ali Eicher. "By getting to speak to these entrepreneurs in a more personal setting, I learned what it would take to get my own business up and running." [107]

In 2012 Harvard Business School organized women's forum for women entrepreneurs. [108] The founders met every other week at the Harvard Innovation Lab . They provided help to each other in evaluating and launching their ventures. The participants were students at Harvard Business School (HBS), Harvard College, Harvard Kennedy School (HKS), Harvard Graduate School of Education (HGSE), and Harvard Medical School (HMS). They were at different stages of the entrepreneurial process ranging from prototype development to idea conception to networking with venture capitalists and angel investors. Janet Kraus, a Senior Lecturer at HBS and serial entrepreneur, moderated the forums. Krauss is a champion for other women entrepreneurs.

"According to Kraus, having a cohort of entrepreneurs who meet regularly to share knowledge and help each other navigate challenges is one of the most valuable techniques for increasing the value of an enterprise. Each meeting of the Women's Founders Forums covered a key topic presented by Kraus, followed by a Q&A session and a Member Challenge, where two to three participants presented the group with an issue they are currently facing in their business development. Topics included defining a product's value proposition, determining the product/market fit, launching a lean start-up, identifying co-founders, negotiating equity splits, assessing priorities, assembling and managing a team, raising money, and building a board of directors." [109]

""One of the key benefits of the Forum for me has been the ability to learn from the successes and challenges of other entrepreneurs," said Lindsay Duncan (HBS '12). "The Forum promotes an open environment where we can candidly share the challenges we face and seek advice from each other. Since we are all at different stages in creating our businesses, we can see what challenges lie ahead." The Forum ended with four industry-specific feedback sessions focusing on fashion, consumer technology (two sessions) and healthcare/social impact. Each founder had a chance to present her business concept and model to a group of experts, who provided strategic and tactical feedback and ideas to enable the women to move their businesses forward. "It's been a pleasure to connect with other women entrepreneurs pursuing ambitious enterprises," said Annmarie Ryu (Harvard College '12). "Entrepreneurship is typically dominated by men, but in the Forum, I am surrounded by women. I think we're better able to relate to each another and are more open about the challenges we're facing. You know you won't be criticized or stereotyped because of the problems that you're facing, so you're open in discussing them. It's refreshing."" [110]

Statistics show that women entrepreneurs are more likely to attend Harvard Business School as a means for launching their own business than attending an incubator such as Techstars. [111] Jessica Bloomgarden, a former HBS student cited the reasons as HBS's environment being more female friendly, professional and gender neutral, and the incubators network more narrowly focused on male-dominated industries. Statistics also show that Harvard, Stanford, and MIT lead the way when it comes to producing female entrepreneurs. [112]

However, some other schools are not far behind. Linda Darragh, a former professor at Kellogg School of Management at Northwestern University, as Vice President of the Women's Business Development Center, she piloted innovative lending programs that created collaborations with foundations, banks and all levels of government. [113] Ms. Darragh also organized Springboard: Mid-West, a nationally recognized investor forum for women entrepreneurs, in 2001 and 2003. The forums raised more than $85 million for participants. Another outcome of Springboard was the

establishment of the Ceres Venture Fund in which she is an investor. In 1999, Ms. Darragh taught a course on female entrepreneurship 'Women and Entrepreneurship' at Kellogg.

University of California, Berkeley offers an executive education course for women executives by women executives. [114] Though the course is not focused on entrepreneurship, it focuses on women in business. This program is for high-potential women seeking new levels of success as team leaders and organizational visionaries. Interestingly, the program is based on a timely message: The world needs more women leaders. In addition, the program seeks to develop women leaders by strengthening their sense of empowerment. The program is very intensive and highly interactive. All the participants learn useful strategies ranging from how to use power effectively to gaining balance to effect change both personally and professionally.

"Tuck School of Business at Dartmouth College has partnered with Women Business Enterprise National Council (WBENC) to offer an executive program for women entrepreneurs who are certified through WBENC and have the potential to build high growth companies. It is an intensive five-day program with daily sessions led by phenomenal faculty from the Tuck. It focuses primarily on increasing the competitive advantage and robustness of the participant's own business, which is the case study. Up to 50 women form a learning community that continues to provide a source of support, expertise, opportunities, and strategic alliances long after graduation. This executive development program is designed to help Women Business Enterprises that are beyond the startup phase to assess, improve and grow their businesses. The professors engage the participants in learning and discussions specifically designed to make a difference in how owners think about and operate their businesses when they return from the program. Through collaborative learning groups, women business enterprises apply the tools they have learned to assess and improve their businesses." [115]

"University of Scranton's Kania School of Management (KSOM) has a Women Entrepreneurship Center dedicated to women entrepreneurs. It is a partnership

between the KSOM and Small Business Development Center. The center provides experienced consultants and the school carefully-selects KSOM student interns, who complete a thorough training program. The interns and experienced Small Business Development Center consultants provide women entrepreneurs with the knowledge, resources and support needed to develop and maintain successful small businesses, including special initiatives for serving low-income women. They also provide educational and certificate programs for women entrepreneurs." [116]

There are a number of initiatives in the industry that promote women entrepreneurship. *10,000 Women* is a global initiative by Goldman Sachs. The initiative fosters economic growth; it provides women entrepreneurs globally with important skills and resources including a business and management education, mentoring and networking, and access to capital. To date, the initiative has reached over 10,000 women from across 43 countries through a network of 90 academic and non-profit partners. [117]

"Goldman Sachs Foundation and IFC, a member of the World Bank Group will raise up to $600 million in capital through investments from additional public and private co-investors to enable approximately 100,000 women entrepreneurs to access capital. A wide range of surveys show access to credit is the biggest constraint on growth for all SMEs and women-owned businesses face an even larger credit gap than their male counterparts. IFC estimates that about 70% of women-owned SMEs in developing countries are either unserved or underserved by financial institutions, resulting in an estimated $285 billion credit gap for women-owned SMEs. Goldman Sachs has released new research, which demonstrates increasing female access to capital can have a tangible impact on per capita income, particularly in developing and emerging markets. According to the report, if the credit gap is closed by 2020, by 2030 incomes per capita could be on average around 12% higher across the BRICs and Next 11 countries, relative to our baseline scenario. This gain could be as large as 25-28% for Brazil and Vietnam, where the credit gaps in the formal SME sectors are currently widest. Through this partnership, The Goldman Sachs Foundation and IFC will work with

local banks in developing countries to catalyze existing capital for women-owned SMEs by addressing barriers in the lending market. Goldman Sachs *10,000 Women* will partner with IFC to create The Women Entrepreneurs Opportunity Facility, the first-ever global finance facility for women-owned SMEs. The Goldman Sachs Foundation will provide a $32 million anchor investment in order to catalyze capital from commercial investors and bi-lateral donors. The Facility will extend lines of credit and share risk with local banks in emerging markets enabling them to on-lend to women-owned SMEs. In order to spur innovative approaches to lending to women entrepreneurs, The Goldman Sachs Foundation will provide an $18 million anchor donation-$11 million of which will go to IFC, to fund capacity building support for banks and women borrowers. Capacity building support will address the barriers to banks deploying capital and women entrepreneurs accessing it. According to the International Center for Research on Women's independent assessment, graduates attribute changes in their business performance and increased confidence to *10,000 Women*. Graduates report immediate and sustained business growth. Thirty months after completing the program, 82% of surveyed *10,000 Women* graduates increased their revenue and 71% added new jobs. On average, graduates doubled the size of their workforces and revenues increased nearly fivefold. *10,000 Women* has also demonstrated that investing in women creates a virtuous cycle as women use their income and skills to support their families and communities. Nine out of ten participants pay it forward by mentoring and teaching business skills to other women." [118]

Chris Sullivan, ex-chief executive of UK corporate banking at RBS, has worked a lot for women in finance. He has supported the Focused Women network, an internal initiative set up to champion women in the business, since it was set up in 2007. The network has more than 10,000 members in 31 different countries. "The main aim of Focused Women is improving the flow of female talent through the company. Sullivan recognises that while lots of women are recruited at junior level, it is on the journey to senior and executive roles that many begin to drop out of the business. He sees female role models as the key to success in showing women what is achievable, and in

mentoring them up the ladder. The focus at RBS is helping women build small businesses, an area which has seen impressive growth in the last few years, and applying the lessons learnt so far to all areas of the business." [119]

Craig Newmark, founder at craigconnects and craigslist, has partnered with Women Who Tech to launch the first-ever Women Startup Challenge to fund women-led startups. The goal's to raise money for every women-led startup that applies and gets accepted. Startups in the Women Startup Challenge can also win up to another $50K in cash, with no strings attached, plus lots of other startup-friendly prizes, like a one-on-one meeting with one of the partners from 500 Startups, and classes from General Assembly. Craig plans to profile some of the winning startups on Huffington Post, Medium, and LinkedIn. In addition to launching the Women Startup Challenge, they released an infographic below to show just how important this Challenge is for women in startups.

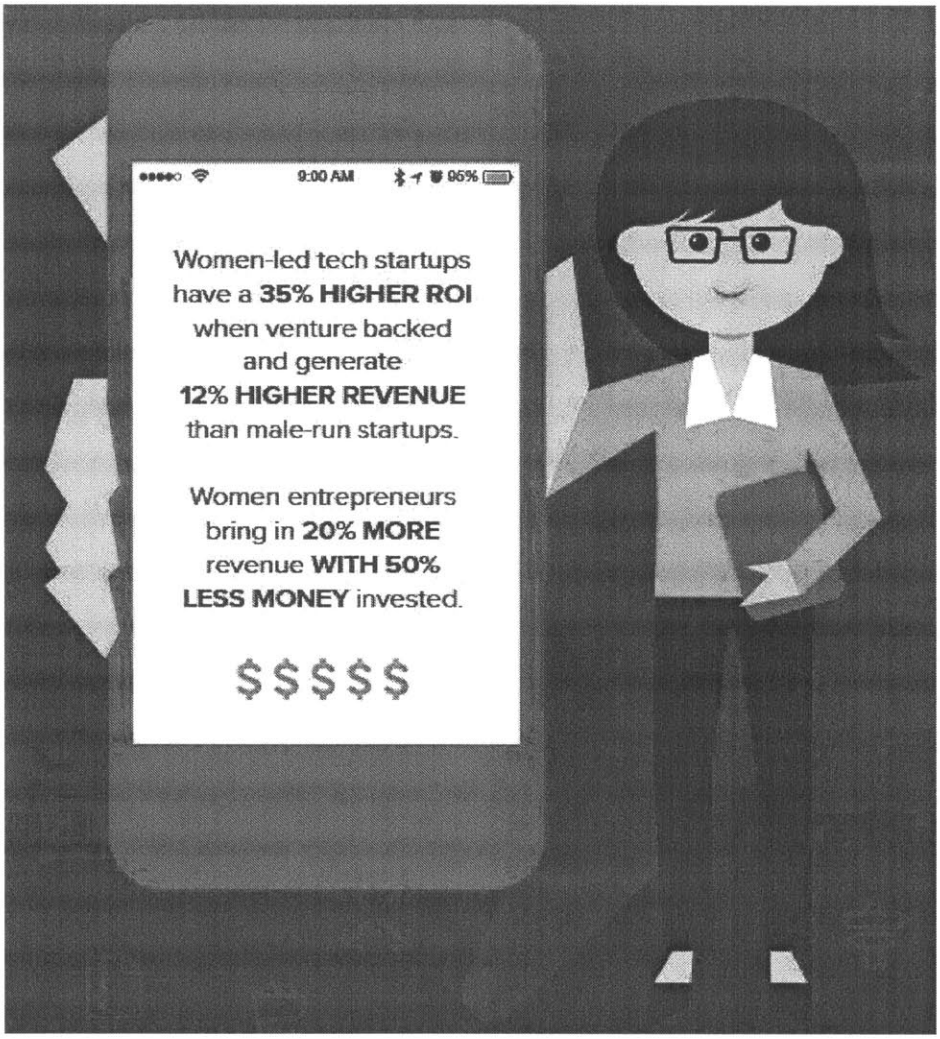


Figure 8 Infographic released by Women Startup Challenge

"Before attending Penn, Wharton senior Katlyn Grasso googled the phrase "female entrepreneurs" and found few search results. "I realized there were just so few women leading companies, so I always knew I wanted to be an entrepreneur," Grasso said. As a member of the Wharton Venture Initiation Program, Grasso interacts with other entrepreneurs on campus. VIP is an entrepreneurship educational program managed by Wharton Entrepreneurship that connects students with resources including mentors and a work space

Grasso launched GenHERation, a female empowerment network for high school girls, in March 2014 to instill confidence in young women wanting to pursue leadership

positions. "When I came to business school I saw that even though there were almost equal women, they're just not starting companies or leading companies at the same rates as men are," she said. At Wharton, 41 percent of the Class of 2018 is female. "I decided what's really important is to address girls and make them confident in their leadership abilities when they're young."

GenHERation is a media outlet that connects young girls with the opportunity to work with national corporations and nonprofit organizations, ranging from the American Heart Association to ESPN-W, the branch of ESPN that covers women's sports. Every month, GenHERation partners with a different company or nonprofit that will challenge girls to raise awareness about a social issue. Students from around the country can submit ideas to the GenHERation website, and the winner then works with the company or organization to implement her idea. Most recently, GenHeration and ESPN-W chose a young girl from the Philadelphia area to host a basketball game at her high school to raise awareness about the Women's Sports Foundation. GenHERation — whose website launched March 1, 2014 — additionally serves as an outlet for current events, tech talks, a financial literacy campaign and a "Question and AnswHER" section featuring other women entrepreneurs. Thus far, GenHERation has reached 10,000 people online." [120]

Chapter 5 - Recommendations to MIT

5.1 Recommendations to MIT

The Martin Trust Center for MIT Entrepreneurship could start providing resources that will promote female entrepreneurship. On the lines of the Stanford course MIT could offer a course on Female Entrepreneurship. The course could be taught by world renowned MIT faculty in Entrepreneurship and Innovation along with venture capitalists, angel investors, and entrepreneurs. The course could also draw in successful MIT female entrepreneurs, who are current students or alumni.

Just like Babson College's Center for Female Entrepreneurship, MIT can invest resources in developing a similar center that helps develop female entrepreneurs. It could provide resources, mentors, role models, and seminars for aspiring female

entrepreneurs. The Center could invest in special scholarships, fellowships, and award for female entrepreneurs.

Special forums could be organized for budding female entrepreneurs. These forums could be great learning and networking experiences for the women. They could meet with fellow female entrepreneurs along with investors and faculty.

American Underground, a Durham N.C. based incubator has a lofty goal, which is to become the most diverse startup incubator by end of 2016. The incubator promotes female entrepreneurs. The number of females has jumped from 23% from 6% last year. And starting last year, some female entrepreneurs also get access to an initiative called Soar Triangle. Backed by Google, the yearlong program offers tailor-made mentoring and investment opportunities for four female-led startups. [121] The incubator provides nursing rooms and events before 6pm that help the females. MIT could invest resources in an all female accelerator or the Global Founders Skills Accelerator (GFSA) could start accepting 50% female owned businesses. Moreover, GFSA could partner with corporations to provide resources for female entrepreneurs.

MIT Lab for Innovation Science (MIT LABi) is in a position to start special groups, meetings, and forums for female entrepreneurs and innovators. This could bring together an entire community of female innovators across campus. These groups would focus not just on entrepreneurship, but also innovation. It would be an excellent resource for intermixing of female scientists from engineering with female entrepreneurs from all over campus including the Sloan School of Management.

MIT BLOSSOMS, an online library of lessons for high school students, has a lesson on innovation and entrepreneurship by a female. [122] It could start providing more online lessons on female entrepreneurship. This way we would be encouraging high school girls to become entrepreneurs. MITx could start similar digital courses for female entrepreneurs. With worldwide participants, these Massive Open Online Courses (MOOCs) could start building global communities of female entrepreneurs, which could provide support, advice, and role models.

5.2 Conclusion

According to the Global Entrepreneurship Monitor, currently 126 million women are operating new businesses and about 98million are leading established ventures. Yet we face a huge equality gap. Panama, Thailand, Ghana, Ecuador, Nigeria, Mexico and Uganda are the only seven countries, in which women take part in business at rates equal to men's. There are other countries such as Pakistan, in which they barely take part at all. "Even when women are active business owners, they do not reach their potential: women own almost three in ten American firms, yet employ only 6% of the country's workforce and account for barely 4% of business revenues." [123]

"According to Tory Bursch, Chief Executive and Designer, Tory Bursch "women need entrepreneurial education." "Winning business concepts are just as likely to be conceived at the kitchen table as in the garage or at business school, but research shows women doubt their capabilities and fear failure more than men. Training can equip women with the confidence to see bold ideas through." She also adds, "the world needs women entrepreneurs, and women entrepreneurs need all of us. It is time to provide the support and tools to ensure that."" [124] Top world universities must start working on this problem. It is required that these colleges and universities provide ample support, tools and resources for female entrepreneurs.

In addition, to encourage female entrepreneurship and innovation, we need to close the venture gender gap. ""When you think of the icons of entrepreneurship in Silicon Valley, you think of Steve Jobs at Apple, you think of Sergey Brin and Larry Page at Google, you think of Mark Zuckerberg at Facebook, or Pierre Omidyar from eBay," according to Maha Ibrahim of Canaan Partners. "You can even stretch it to Seattle and think of Bill Gates. "There is no female in that discussion," she said. "But I think that once there is, the floodgate will open. It would sure be nice if we could point to one."" This is something that will require commitment from venture capitalist firms to encourage women venture capitalists and entrepreneurs. [125]

"Venture investing is very much involved in "pattern matching," said Sonja Hoel Perkins, who was investor of the year at Menlo Ventures for six of her 17 years at that

firm, and co-founded with Fonstad a group of other top female seed investors called Broadway Angels. Perkins first worked as an analyst at TA Associates before doing business development at Symantec Corp. Perkins' big hits over her years at Menlo — where she was the youngest person to make partner at age 29 — included McAfee Associates, F5 Networks and Flurry. "There are not a lot of women in the pattern and we just need to get more women in the pattern who will inspire more like them to want to be in the pattern."" [126]

"The total funding gap for women owned businesses is estimated around 290-360 billion USD according to the G20 and IFC. Well, that is nearly half the entire GDP of the Netherlands. What is more, the credit gap is not about to go away. Research by Goldman Sachs points out the enormous impact of closing the gap for women owned Small and Medium Enterprises on economic development. The researchers find a strong relationship between SME credit and income per capita growth. According to the World Bank, SMEs are the biggest contributors to employment across countries, especially in developing countries. Taking this as a starting point GS estimates that closing the credit gap for women-owned SMEs across the developing world as a whole could boost income per capita growth rates by over 1,1% on average. Depending on other factors some countries would benefit more. On the higher end are Vietnam and Brazil, increasing their per capita growth by 1,7%-1,85%. Naturally closing the gap will take time, nobody knows exactly how much. But hypothetically speaking, gradually increasing funding for female SME owners could mean Brazils per capita income would wind up 28% higher by 2030. This means everyday our economies are leaking money because companies owned by women are not capitalized to their fullest. What is even worse is that human potential, talents, and innovation capacity are being lost. Therefore, in the face of the current global environmental, social and financial challenges, we cannot afford not to invest in women." [127]

Accelerators such as Y-Combinator could provide solutions. Selecting companies with diverse leadership to fund is one of the ways to fix it. The people leading companies today are the ones who become gatekeepers in the future. [128]

Inculcating role models for young girls is essential. A recent report on women entrepreneurs by the Kauffman Foundation identified the chief challenges to female entrepreneurship. 350 female entrepreneurs were interviewed by researchers, and most of them cited "lack of available advisers" as the most important one. The scarcity of mentors for younger women is of course due to female professional attrition, but there are other reasons too. "Another is that women who work beyond their late 30s may be less subject to sexual harassment than their younger counterparts, but they are sidelined by virulent ageism in the industry that especially—but not solely—afflicts women." [129]

We need more male leaders such as Chris Sullivan of Royal Bank of Scotland. "Most business leaders today, of course, are men. It is vitally important that these male leaders become engaged on the critically important issue of gender equality, not only because it is the right thing to do but because it is the smart thing to do. Indeed, if men take up this battle, we are convinced that we can achieve the transformative change that is needed. Together, we have found that increasing numbers of male leaders in the business sectors -- particularly fathers of daughters -- are beginning to understand that there is not only a strong moral case for advancing gender equality but a strong business case as well. Gender diverse leadership simply leads to better results. Women's advancement is good for the bottom line." [130]

We need to hear more stories from successful from female entrepreneurs in media, schools, and corporations. "Apparently, minority women start new businesses in the U.S. at four times the rate of non-minority men and women. Though minority women entrepreneurs in the United States are thriving, their stories are very seldom told, and few think of minority women as successful entrepreneurs" [131] We want successful female entrepreneurs to come forward and share their story with the world.

However, we still face challenges. Recently there has been a surge in articles that talk about teacher biases as a reason behind women getting discouraged from science and math. Moreover, parents and toy-makers discourage girls from studying math and science. [132][133] Girls lack role models in those fields, and grow up with beliefs that

they wouldn't do well in them. "A new study points to the influence of teachers' unconscious biases, but it also highlights how powerful a little encouragement can be." [134]

This can have an effect on innovation and entrepreneurship especially technology. We have to overcome numerous biases for gender equality in entrepreneurship and innovation. "Girls' educational dominance persists after school. Until a few decades ago men were in a clear majority at university almost everywhere, particularly in advanced courses and in science and engineering. But as higher education has boomed worldwide, women's enrolment has increased almost twice as fast as men's. In a report published by OECD, a Paris-based rich-country think-tank, women now make up 56% of students enrolled, up from 46% in 1985. By 2025 that may rise to 58%." [135] Despite the fact that girls are outperforming boys in school and that gap is widening, girls face biases in entrepreneurship.

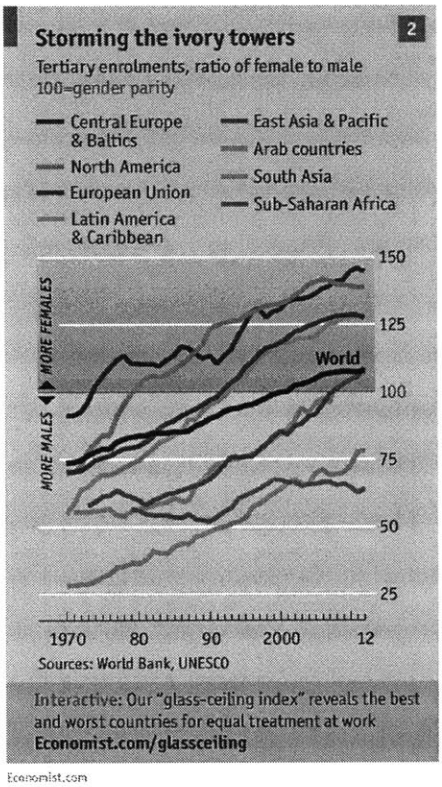


Figure 9 Tertiary enrollments of females to males

Despite challenges and biases, the essence of human life is to not give up.

Entrepreneurship can be a lonely and isolated road, and every woman entrepreneur needs inspiration.

> *"You gain strength, courage and confidence by every experience in which you really stop to look fear in the face. You are able to say to yourself, 'I have lived through this horror. I can take the next thing that comes along.' You must do the thing you think you cannot do."*
>
> *—Eleanor Roosevelt*

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