

**Increasing Women's Involvement in the Agile Community**

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## **Abstract**

Women have long been the minority among professionals in software development (Adams & Weiss, 2011). Agile software development, a set of principles and values for the discipline and process of software development, is no exception to this gender disparity (Judy, 2007). I have observed lower levels of involvement and representation among women in Agile community activities, including conference proposal submissions, article and blog publication, user group participation, and conference attendance. Efforts to increase and sustain female involvement have been limited and largely ineffective. The purpose of this research is to identify what prevents female Agile professionals from reaching higher levels of involvement in the Agile community and to identify strategies to boost their involvement. I used two research methods: interviews with women with various levels of involvement in the Agile community, and surveys with Agile industry participants designed to validate the interview results.

Initially, I had no reservations when I submitted my first article for publication. As an experienced Agile practitioner, I had valuable insights to share, but was not completely confident that anyone would publish, let alone read, my opinions about Agile practices. I did not tell anyone about the submission for fear of rejection and embarrassment. I was pleased when my first article was published. Three years later, I have authored multiple published articles, launched a successful blog, and have spoken at numerous Agile events. It all started with that first risk of involvement and participation in the Agile community.

Agile software development is a nascent industry that has developed rapidly over the past 15 years. Agile, a term referring to a set of practices to improve software development, emphasizes certain values over others (Agile Manifesto, 2006). It focuses on customer value and working software delivery early and often. Agile encourages constant inspection and adaption of practices to improve teams, learn continuously, and adapt to change. Agile development is different from traditional “waterfall” development, in which the project moves from one stage to the next without retrospection, flexibility, and frequent software (value) delivery. Unlike Agile, waterfall development delivers working software only at the end of the project preventing customers from realizing value earlier. Agile development, in contrast, offers numerous opportunities for expert practitioners to share knowledge through networking and involvement.

For this research, I define involvement to include the following activities:

- Conference attendance
- Conference presentation submissions
- Article publication
- Blog publication on Agile topics

- User group membership and participation
- Certification in advanced Agile methods

As I have increased my involvement in the Agile community, I have observed the absence of female practitioners participating in these activities. As a female in the Agile and software development industries, I am a minority and continually work hard to find and define my place. There have been many efforts to diminish the gender gap in these fields, but they have yielded little success. Continued approaches to narrow the gender gap will need multiple focuses, which include recruitment, support, and encouragement of women in these fields. I chose to limit my research to the encouragement and support of current female practitioners achieving higher levels of involvement in the Agile community.

### **Purpose Statement**

There have long been efforts to promote female involvement in STEM (Science Technology Engineering and Math) disciplines due to the constant gender disparity in these fields (Drury, Siy, & Cheryan, 2011). Factors contributing to this inequality include gender stereotypes, differing gender mindsets, and women's lack of awareness that jobs in these technical disciplines are available to them (Adams & Weiss, 2011; Etzkowitz, Gupta, & Kemelgor, 2010). While efforts have been undertaken to decrease gender inequality, software development fields still fail to close the gender gap (Drury et al., 2011). Studies cite diversity as an enormous benefit to idea generation and organizational performance (Ridley & Young, 2012), and the Agile and software development industries face a significant skill gap when women are not present or involved.

As a recognized female leader in the Agile community, I often face occupational barriers due to my gender and receive limited support in overcoming these obstacles. I am involved in some grassroots efforts to encourage and provide women opportunities to share their contributions. However, the efforts do not address reasons for the lack of female involvement. Instead, the efforts treat the symptoms of lower involvement using avenues to limit male participation in certain websites, groups, and activities to promote diversity quotas. These limiting efforts do not address the underlying problems that largely are impeding women's involvement. As a result, the efforts yield limited success to create lasting change.

The goal of my research was to identify actions that the industry can use to inspire established female Agile professionals to aspire to higher levels of involvement and investment in the Agile community. Though the expansion of female recruitment in the field is important, the research focus was to identify the reasons that prevent established female Agile practitioners from achieving higher levels of involvement and contribution of their experiences to the Agile community. My research identified strategic actions to address reasons for women's lower levels of involvement, in order to drive greater involvement and support for women's contributions in the Agile community.

### **Analysis of Conceptual Context**

There is considerable research regarding women's involvement in software development, though there have been few studies addressing women's involvement in the Agile community specifically. Women are active in software development, though in far fewer numbers than men (Etzkowitz et al., 2010). Three main topics are present in the literature related to women's presence and involvement in software development: the barriers to gender equality in software

development fields; factors that prevent retention of women in software development fields; and the patterns of women's involvement online. These topics formed the background for my research and informed the questions I developed for the in-person interview method (Appendix B).

### **Barriers to Gender Equality in Technology Fields**

It is neither new nor shocking that software development fields underrepresent women. When examining barriers to eliminate the gender gap, it is vital to identify why the lack of diversity is a problem and the reasons it exists. Often the disparity begins in early childhood, when girls are commonly told they lag behind their male counterparts in the areas of math and spatial reasoning. The disparity perpetuates itself as women avoid computer science related degrees and fields (Adams & Weiss, 2011; Jones, 2010).

This lack of diversity was essential to my research question, because if women are not present in software development fields, they will not be present in the Agile industry and therefore will not be involved in the external Agile community. Though my study's focus was not on recruitment, I can better understand the software development field's barriers to entry through this research. I applied this knowledge and adjusted my interview and survey methods to address these entry barriers.

**Problems that result from a lack of diversity in the technology workplace.** Women represent over half of the labor force in the United States but comprise only 27% of science and math related careers (Adams & Weiss, 2011). In fact, according to Ridley and Young (2012) participation of women in the software development fields has actually declined in the United

States from 36% in 1991 to 26% in 2008. This gender inequality is problematic and results in a lack of diversity in the software development workforce.

Pless and Maak (as cited in Ridley & Young, 2012) state, “Redressing the gender imbalance in the IT industry is motivated by social inclusion reasons and to achieve better business outcomes” (p. 356). Studies by McLean, the National Science Foundation, and the Society of Human Resource Management (all as cited in Wentling & Thomas, 2009) also found that companies need diverse workforces to maintain competitive advantage in the national and global economy. Businesses and industries frequently tout diversity as an asset but do not often state what diversity will improve. What specifically do women bring to the software development industry it lacks?

Pro-diversity studies address the stereotypical social skills that women demonstrate more competently than their male counterparts do. One example is women’s ability to work better with people (Adams & Weiss, 2011; Jones, 2010). Adams & Weiss (2011) state a change is evident in the corporate needs of today’s technology employee and leader, whose role is converting into one that requires change agent thinking and business expertise over technological acumen. “Women bring different life experience and a different life perspective to the innovation process, and diversity in innovation leads to the design of products and services that benefit a broader range of consumers as well as business organizations” (Wentling & Thomas, 2009, p. 27).

Finally, software development roles will continue to be in high demand. The U.S. Department of Labor Statistics (as cited in Wentling & Thomas, 2009) states, “Three of the 10 fastest growing-occupations between 2004 and 2010 are computing-related” (p. 26). This demand will continue to increase the gender gap and lack of diversity in the software

development industry as women leave the computer science major, earn fewer undergraduate degrees in computer science, and abandon the field altogether (Jones, 2010; Wentling & Thomas, 2009).

**Reasons for a diversity shortage in technology.** There are no shortages of theories, reasons, and excuses for the lack of gender diversity in software development fields. Some are common knowledge while others seem obscure and only apply to a few individuals, but most have some basis in truth. The most prevalent reason cited in the research stems from stereotypes about women's abilities and intelligence, which cause inequality throughout academia and the workplace (Jones, 2010).

Society views women as less gifted in areas requiring spatial visualization skills but as more talented socially and in working with people (Jones, 2010; Adams & Weiss, 2011). Predictably, these and other erroneous assumptions limit women's ability to advance in the software development field. These assumptions not only insult women's intelligence but also demonstrate discrimination in their abilities (Adams & Weiss, 2011). Therefore, it is not surprising that many women perceive IT as an unwelcoming and hostile environment (Wentling & Thomas, 2009).

In academia, these beliefs may contribute to at least some of the unequal gender distribution in STEM degrees. Implicit biases, which regard intelligence and skill, certainly affect the college experience for women. Women have "concerns about not being taken seriously, exclusionary social dynamics, dependence on hostile colleagues or seniors, pressure to emulate the male model of doing science, and the requirement to fulfill the role of the token women on committees" (Etzkowitz et al., 2010, p. 84). The consequences are that "women

constituted only 7% of undergraduate computer science majors and were almost twice as likely as men to leave the major” (Jones, 2010, p. 61).

The women who do make it through the challenges of academia face new challenges in the corporate world. The stereotypes continue to follow them but change slightly. Instead of the intelligence battle in academia, the new work-life balance battle emerges. Etzkowitz et al. (2010) state that women miss promotions because they choose to place their families and child-rearing goals before career goals, which leads to a lack of mobility. Another reason women do not rise in leadership ranks is women’s interests and personalities do not align with the career goals of like-minded and aged men (Adams & Weiss, 2011).

While the stereotypes mentioned may be true for some women, they certainly are not the rule. Studies show that this “marginalization, rejection and diminishment produce an anticipatory state of vigilance, compelling women to work harder to prove themselves” (Etzkowitz et al., 2010, p. 84). Additionally, women hold themselves to higher standards than men and their confidence levels are more realistic. This realism keeps women grounded in their abilities, sometimes to their own detriment (Jones, 2010). An example of women’s realism toward their ability presents itself when women and men are applying for jobs. If men meet 60 percent of the qualifications they will apply for the position where as women usually do not apply unless they meet 100 percent of the qualifications, causing women to miss opportunities men actively seek (Sandberg, 2013).

The high standard women hold themselves to, with limited recognition, can also contribute to a lack of retention and involvement of women in the software development fields. Judy (2007) states that 54% of women leave the software development field mid-career, which is



a much higher rate than that of men. I needed to conduct further research on retention and involvement factors to understand the problem causing this high cost of attrition.

### **Themes Influencing Involvement**

To increase participation and involvement of women in software development, women must first be present in the field. Numerous studies acknowledge women are more likely than men to leave computer science majors, software development positions, and leadership appointments (Etzkowitz et al., 2010; Jones, 2010; Ridley & Young, 2012). Though this study was not related to retention of women in software development fields, I leveraged research about retention to supplement lacking research on involvement trends.

Reasons women leave the software development field may relate to reasons they are less involved. Similarly, strategies to keep women retained in software development fields could also help to increase their involvement. The main trends related to retention and involvement of women include stereotypes that affect their mindset toward their abilities, and women's involvement levels in and outside of work through role models and mentorship (Jones, 2010).

**Stereotype threat.** A trend related to involvement, confidence, performance, and retention in STEM fields is the women's mindset in comparison to stereotypes. Jones (2010) cites a study where girls with a growth mindset are less likely to believe the skill-inferiority stereotype threat. The study discusses how female students were taught: Either they had to study in one prescribed way to succeed, or they would study and learn from their mistakes as part of the learning process. The latter group learned from their mistakes, improved with practice, and saw their grades increase. The former group succumbed to the stereotype threat of a single learning style for success, and their grades did not improve.

The above study is relevant to women in software development because one of the main stereotypes pertains to women's intelligence in the field. If women believe they can succeed and learn from mistakes rather than being forced to work in one certain "male" way, the probability of their success, confidence, and intelligence increases (Jones, 2010). Through the growth mindset women do not perceive mistakes as failure, are more likely to learn from their mistakes, and readily seek feedback to improve themselves. Women can apply the growth mindset to their Agile community involvement as well. If they had a bad experience submitting an article or engaging in a discussion, they can learn from it and try for success differently the next time. In this way, retention and involvement can benefit from women's learning and thinking shift.

Imposter syndrome is an additional mindset that emerges from stereotypes (Sandberg, 2013). Women that lack confidence because of common stereotypes referring to their knowledge, skills, and profession, may feel like an imposter when they are trying to contribute. They are afraid of being "found out" as incompetent and are afraid of being wrong. This also causes women to feel the need to ask for permission when men are encouraged to take risks and instead ask for forgiveness. By addressing and changing the mindset around imposter syndrome, women will be more confident taking risks to become involved.

**Women as role models and mentors in social networks.** Other retention and involvement strategies cited mentorship activities, involvement in social networks, and support groups among women. Many women utilize mentorship activities to help themselves and other women develop professionally (Adams & Weiss, 2011). Mentorship can help women feel greater involvement and investment in their careers, ultimately increasing retention (Jones, 2010).

Stereotypes and barriers still exist, but for many women, “female role models inoculate women who are highly identified with STEM against the harmful effects of such negative stereotypes” (Drury et al., 2011, p. 265). The support of other successful women who have faced the same challenges gives women a sense of belonging and the confidence to become more involved (Drury et al., 2011).

It is not only the presence of a mentor, but also the gender of the mentor that contributes to their success. In studies where women mentored other women, success was more apparent. “Women who were highly identified with math performed better on a math test when they encountered a female role model (i.e., a woman who was portrayed as highly competent in math) than when they encountered a male role model” (Drury, et al., 2011, p. 265).

Connections and similar experiences are important in forming relationships and in nurturing involvement and acceptance. In fact, “in the absence of a constructive environment, women’s networks and support groups may partially replace the interpersonal interactions lacking in the broader organizational structure.” (Etzkowitz et al., 2010, p. 84)

### **Women’s Involvement in Online Activities**

Many studies about gender differences online investigate usage levels and those activities for which men and women use the Internet. Most of the activities I define as involvement for women in the Agile community require Internet access, usage, and a level of proficiency. I examined a number of factors to understand women’s Internet habits and how these contributed to their involvement in online Agile community activities. The literature identified these factors as the following: gender and demographic numbers; Internet usage and activities; the online climate; and the barriers to women online.

**Gender and demographic differences in Internet usage.** In the 1990s, there was a significant difference in Internet usage by gender (Hargittai & Walejko, 2008). Men were far more likely to use the Internet for various types of activities. One contributing factor was the lack of Internet access. Currently in developed countries, we see no difference in Internet access by gender (Haight, Quan-Haase, & Corbett, 2014). Some researchers theorize age to be a factor in levels of Internet usage. According to a study of students and faculty of all ages, this age gap now closes as skill levels increase (Ruleman, 2012). I investigated further research of Internet usage patterns and the roles of access, age level, and gender.

Women use the Internet in similar numbers as men. In the United States, 50.4% of the Internet population is women over the age of 18 and who average 38 hours per month online (Judy, 2007). As early as 2001 women outnumbered men on the Internet in both the United States and Canada (Marcella, 2002). One study from Canada shows statistically significant evidence that men complete more, different online activities than women (Haight et al., 2014).

**Women's Internet activity patterns.** Many studies show that women spend more time than men on interactive social activities online (Haight et al., 2014; Klenke, 2011; Ruleman, 2012). In this context, I define social networking as a set of certain sites or activities that include but are not limited to Twitter, Facebook, LinkedIn, Google+, blog writing, and online chats via instant messaging or message boards.

We see this social networking trend domestically and abroad. Haight et al. (2014) discusses "Canadian born women perform fewer online activities than men...but are more likely to use social networking" (p. 503). A study of Greek high school students stated that men more frequently use the Internet for content creation and recreational activities, but the study also cites

the gender gap is closing on social networking usage among men and women (Haight et al., 2014). In other studies of students, this finding was apparent as females accessed Facebook, while males were more likely to select LinkedIn (Ruleman, 2012). Both Facebook and LinkedIn are social networking sites each offering different services.

Ruleman (2012) discusses higher demographic variation in the use of Twitter over other social sites. Klenke (2011) challenges this by stating, “Women are avid bloggers and are represented on social network sites such as Twitter and Facebook” (p. 36). The research agrees the main aims of women’s use of social networking avenues are interactivity and involvement.

**Examples of the online climates created by women.** In their quest to communicate socially and make connections online, “women have been using the Internet to break down barriers, exclusions, and silences” (Klenke, 2011, p. 36). This is apparent in several examples of how women use the Internet to provide climates that are hospitable and allow for communication among colleagues in ways they deemed comfortable (Marcella, 2002).

Two examples include a menopause discussion group and a website created by faculty members (Marcella, 2002). The menopause group allowed women to discuss their personal experiences openly with one another through the Internet as a medium. The website allowed female faculty members who were in the minority an avenue to “overcome feelings of isolation and to communicate as scholars” (Marcella, 2002, p. 82). I investigated reasons this level of involvement may not cross over into the Agile community involvement.

**Barriers to women’s contributions online.** One reason women create their own social spaces is to avoid hostility they often face in public forums. Internet hostility can affect anyone,

but research suggests hostility toward women online re-engages the stereotypes discussed earlier (Marcella, 2002).

Research states males have different communication patterns and can be more hostile online, which may inhibit online opportunities for women (Marcella, 2002). One statistic from Herring details, “when women contribute more than 30% of conversation in usenet groups they are perceived by the online community to be ‘dominating’ the discussion” (as cited by Marcella, 2002, p. 83). Herring also comments, “Men post longer messages online, arguing those who speak most and most frequently are perceived to be the most powerful and are given credit for the ideas that emerge” (as cited by Marcella, 2002, p. 83). This male bias and double standard is still apparent in online communities.

### **Summary of Analysis of Conceptual Context**

The research and analysis of the conceptual context identified three main themes related to my research question: barriers to women’s entrance into software development fields; factors that help or hinder their involvement; and patterns of women’s online usage and activities. These themes and their accompanying sub-themes fit into three broader perceptions of women: individual perceptions, societal perceptions, and Agile community and industry perceptions.

The factors influencing these three types of perceptions of women related and influenced one another. Societal stereotypes affect what women think their priorities must be at an individual level, for example, family. Additionally, in society, male dominated environments such as Agile, can be hostile and widely held perceptions negatively can affect women’s individual mind-sets about themselves. Individually, women are looking at involvement as competing with their other priorities and are holding themselves to very high standards for

sharing their expertise by being involved in the Agile community. However, the Agile culture embraces traits that society perceives women as more skilled at, for example, relationship building, collaboration, facilitation. While each of these perceptions influences each other, the purpose of this research was to find the convergence of all three and determine how to address them strategically to increase involvement and address perceptions.

### **Research Question**

My project endeavored to answer the research question: What are the reasons that prevent female Agile practitioners from achieving higher levels of involvement in the Agile community, and what strategies can overcome them? It is important to note that the intent of this project was not to increase the number of women in the Agile and software development industries, but rather to engage the talent of women already present in the industry through increased levels of involvement.

### **Method**

The purpose of this research was to determine what prevents female Agile practitioners from achieving higher levels of involvement in the Agile community. I gathered this information through interviews with female Agile practitioners. The conclusion of this research identified the most significant reasons for lack of involvement among women. The research established strategies to increase women's levels of involvement in the Agile community and discussed implementation actions. I hope an increased level of involvement results in more women contributing through content creation activities, including blogs, articles, and conference submissions. The research results also endeavor to inspire more invested Agile community members through increased levels of inclusion.

I utilized interviews with established professional women working in the Agile industry, and a survey of men and women in the broader Agile community as my research methods. I conducted these methods sequentially, and the interview data and analysis fed the content and questions contained in the survey.

## **Interviews**

I identified seven women currently working in the Agile industry who have various levels of involvement in the Agile community to interview (Appendix F). I constructed a matrix of involvement, which helped classify the diversity of involvement levels of these women (Appendix C).

I received assistance to identify these women through referrals from my professional network. If I did not know them personally, the initial communication was an introduction from the referrer, usually through email. I chose to limit the scope of the interviews to only women because as the focus of the research question, they are the most qualified to provide relevant answers.

The women selected for the interviews needed to meet a set of criteria before participating. They received a brief email that explained the research project, and detailed my background in the Agile industry. Additionally, this email message included a consent and confidentiality statement, and gauged the respondent's interest in greater involvement through her willingness to participate (Appendix A).

After I identified candidates at the appropriate experience levels and they provided their electronic consent through their email agreement response, I scheduled one-on-one interviews with each. I asked questions related to their background and experience with Agile practices,



their current level of involvement in the Agile community, the reasons they are less involved in the Agile community, and actions that could encourage them to become more involved (Appendix B). The interviews each lasted one hour. The interviews were semi-structured; in other words, I posed a base set of questions concentrated on the above topics, but kept the flexibility to delve into answers with follow up questions when appropriate (Appendix B). This method allowed similar experiences and formats for all the interviewees and accommodated further discussion and exploration when it was prudent.

I conducted the interviews in-person as all the women were local interviewees. I requested consent to record the interviews for reviewing and transcribing purposes, which assisted in my analyses. While my goal was to schedule each interviewee once, I obtained consent for subsequent contacts if I required further clarification.

**Interview analysis.** To prepare for the data analysis, I immediately sent the audio recordings of the interviews to a reputable, confidential service for transcription. I noted observer comments about body language, tone of voice, pitch, and inflections to better capture the emotional state and tone of the interview. I also documented any feelings or assumptions during the interview through personal memos to identify a potential bias that may have affected the interview or the interpretation of the results.

I analyzed the transcribed interviews to identify patterns and then classified the data into organizational categories, such as “reasons for non-involvement” and “support strategies for more involvement.” I used a coding strategy to categorize the data into themes and assigned numbers to all portions of the interview notes. I placed these numbered answers into both organizational categories and substantive categories. This served as the initial categorizing

strategy (Maxwell, 2013). I based the organizational categories on similarities and differences in answers related to reasons, barriers, actions, experiences, and strategies that I established. The substantive categories were new ideas that emerged from the content of the interviews including key reason and strategy themes (Maxwell, 2013).

These substantive categories were primarily descriptive and included “participants’ concepts and beliefs” (Maxwell, 2013, p. 108). In addition to these categories, I utilized “open coding” to generate new ideas (Maxwell, 2013, p. 107). I recorded these categories into a spreadsheet matrix and analyzed the items in each category against each other and eventually the survey results.

I utilized connecting strategies after coding to analyze relationships among the categories. I identified the most significant six categories, reasons for women’s lower involvement levels, which served as the basis for drafting questions for the secondary research method: the survey.

## **Surveys**

I created a survey to target the entire Agile community: men and women of any experience level. This convenience sample method produced useful data because those who responded likely were individuals already involved in the community (Fink, 2013). The intent of the survey data was the validation and refinement the involvement categories that emerged from the interviews and the identification of additional reasons individuals have for involvement and strategies to promote greater involvement.

I used the online tool SurveyMonkey to write and distribute the survey. I copied the link provided from SurveyMonkey and distributed it via LinkedIn, Twitter, Google+ and my blog site multiple times over a four day period. I used the hashtag “#WomenInAgile” to index the survey

on social media sites to achieve higher levels of participation. I also relied on snowball samples, where those who took the survey refer and identify others to participate (Fink, 2013). This strategy helped the message to be retweeted over 30 times to the Agile community and I achieved my goal of 100 participants in less than a week.

The entry page of the survey contained a background research statement, a brief personal introduction, and a consent statement to which the participant agreed to in order to continue. The consent statement detailed my plan to use, secure, and destroy the information (Appendix D).

The first section of the survey collected demographic information. This included gender, age, job title, and years of experience in the Agile and software development industries (Appendix E). I used this information to establish a base profile of participants, which yielded valuable data for the data analysis (Appendix F).

The next section was a series of questions related to the level of involvement the participant had in the Agile community. Questions served to establish a baseline involvement level in the types of activities identified for this research: blogging, writing publications, attending conferences, submitting presentations, speaking engagements, Agile certifications, and user group membership and participation. This baseline determined an involvement level based on the tiers in Appendix C. The survey also had questions related to the participant's satisfaction with their current job and position, and the duration of time the participant was employed at their current job and position (Appendix E, F). This information showed who took the survey and their background.

The final section included questions derived from the interview data results surrounding involvement reasons and actions to increase involvement. Some questions were multiple-choice

and some were short-answer. There was also a comment field at the end of the survey for participants to add any other information they believed might be useful (Appendix E).

The survey will have taken no more than 15 minutes to complete and was a one-time interaction. The participants did not need a SurveyMonkey account to take the survey. It could be taken only once from each Internet protocol (IP) address to ensure participants did not access it multiple times.

**Survey analysis.** I closed the survey access after it recorded more than 100 responses. SurveyMonkey exported the data into an Excel spreadsheet. The data was already in a matrix from SurveyMonkey. The next step was to assign codes to the non-numeric categorical data (Saunders, Lewis, & Thornhill, 2009). I coded all categorical answers numerically and executed statistical tests where appropriate.

I calculated a sample size of at least 100 survey participants from the Agile community was necessary for significant results. To determine this sample size, I calculated a confidence interval of .098 ( $\pm 9.8$ ) and a 95% confidence level using an online calculator (Creative Research Systems, 2012). The confidence interval (margin of error) is “an estimate of a population parameter described within a range” (Fink, 2013, p. 126). The confidence level was 95%, explained as 95% of the data fall in the confidence interval range; that is the mean  $\pm 9.8$  (Fink, 2013).

Excel descriptive statistics generated mean, median, mode, range, variance, and standard deviation for the relevant demographic categories (Fink, 2013). A few key characteristics measured included age range, mean age, and mean experience level of participants (Appendix F).

I also used this data to determine proportions, for example, the proportion of men who took the survey versus women.

With the involvement data, I grouped the clusters of participation scores into the involvement tiers in Appendix C. The Data Analysis add-on formulas in Excel executed quantitative analyses such as analysis of variance, and t-tests on the coded variables.

I used paired t-tests to evaluate differences between the variables' means to determine if the differences were due to chance or were statistically significant (Fink, 2013). I used a null and research hypothesis for each of these tests to indicate the difference in means I validated. To classify a t-test as statistically significant, the one-tailed p-value needed to be less than the .05 alpha to indicate statistical significance at the 95% confidence interval (Appendix F).

I was aware of the errors I may have encountered with these tests because of inconsistent or blank data and hypothesis errors. I conducted a thorough scan of the data when I coded it, and I removed all completely blank records at that time. I accompanied each of the previously listed statistical tests with a null and research hypothesis, the null hypothesis representing no significant difference in the means and the research hypothesis representing a significant difference in the means (Appendix G).

If I mistakenly rejected the null hypothesis when it was correct, a Type I error occurred. This could have happened five in 100 times, or 5% of the time (using a 95% confidence level) (Fink, 2013). I was cognizant of this and disclosed the confidence level and error probability here. A Type II error is the opposite case, when I accepted the null hypothesis when it was incorrect and the difference between groups was statistically significant (Fink, 2013). I used

higher power values in the statistical tests (a setting in Excel) to mitigate the probability of a Type II error (Fink, 2013).

For the final section of the survey, the questions were either multiple-choice or short-answer. I used descriptive statistics and other T-tests to code and analyze the multiple-choice questions. I used content analysis to code and categorize the short-answer questions to “find common themes in open ended survey questions” (Fink, 2013, p. 116). I used the same categories that emerged from the interviews where possible but added new categories as the data warranted. I organized the data in tables to observe the frequency distribution of answers (Saunders et al., 2009). To help mitigate my research bias, my classmates helped derive themes from the data for comparison with my analysis.

The survey revealed statistical patterns and relationships between the reasons for women’s lower involvement levels which I had intended to validate. The survey also served as a mechanism to gather solutions and strategies to address the involvement problems. The survey revealed findings about men and women’s perceptions the interviews did not, which enriched the research conclusions.

I presented the data and test results in tabular and graphical formats in this final report (Appendix F, G, and H). I generated the main data tables initially using Excel formulas, but modified the tables to add or remove information based on relevance. I used graphics to highlight and explain the data. I utilized graphs such as pie for proportions, and bar for mean comparisons to improve readability (Saunders et al., 2009) (Appendix G).

### **Data Security and Risks**

I stored all digital media, the recordings, transcriptions, and any other notes in an encrypted folder on the hard drive. The folder and computer account are password-protected. I did not use names in the files, notes, or transcriptions and coded each interview participant with a number. I kept the key for these codes in a separate file stored on my Google drive folder in the cloud. This was also password-protected. When I referenced quotes and patterns in my analysis and report, I continued to keep the participants anonymous. No one had access to any of these files or passwords except for my advisor and me.

My SurveyMonkey account secured the raw survey data, which was password-protected. No other users had access to this password. SurveyMonkey also masked any identifying information including name, email, and IP address to prevent my knowledge of a participant's identity. When I exported the data from SurveyMonkey to run the analysis in Excel, I also kept it in a secure location on my computer hard drive.

I will destroy all confidential information at the end of the research project in June 2015. This information includes the key document, which maps the interviewees' names to their answers through the codes I generated, as well as the interview recordings and transcripts.

There are some risks associated with all studies. I determined the specific risks to the interview participants were both the revelation of confidential information and their emotional state in certain situations where they discussed involvement. To mitigate these risks, I restated the confidentiality agreement at the beginning and end of the interview to ensure participants were aware of it. My interview and survey questions were as generic as possible to limit the risk of confidential information revelation. I sent out the interview questions prior to the interview for participants to be mentally prepared for the conversation and plan their answers.

## Validity

The validity threats to this project are researcher bias and reactivity. As an invested researcher in this topic, I ensured I was cognizant of my biases so they did not affect the outcome of the research to suit my assumptions. I addressed these initially and throughout the research process.

Researcher bias recognizes the data that supported my biases and assumptions (Maxwell, 2013). It was vital that I specifically looked for data that did not parallel with my ideas. I identified the largest validity threat as my personal bias: there must be some external barriers preventing women from achieving higher levels of involvement in the Agile community. The research could have identified that women did not have the same level of interest as men in the Agile community, and that was the reason for the discrepancy in their involvement levels, which I would have needed to accept and report. There may have been additional reasons that did not align with this bias. These could have included deep emotional, societal, or personal reasons that emerged in the data. In addition to the interviews, the survey data validated interview reasons and distanced my bias from the results.

To mitigate this researcher bias, I collected rich data through the interviews and transcriptions. I adhered to the interview questions (Appendix B) as closely as possible to avoid asking leading questions and influencing the interviews with my biases. I ensured I truly listened to participants by restating their answers and asking for clarification. This prevented me from overlooking or misinterpreting information, regardless of its support of my biases. Additionally, when I analyzed the survey data, I considered all numbers and patterns that emerge. Numbers, graphs, and statistics are impartial to biases and if they were not statistically significant, I



reported that in my results. I also involved my advisor and classmates in part of my categorical analysis to mitigate my biases through triangulation.

Another validity threat is reactivity, which included how I may have influenced or led the individuals in my study toward my specific goal or bias (Maxwell, 2013). The interviews I conducted were semi-structured, so there was an expectation of clarifying questions to understand more of what the interviewee explains. I avoided questions that led the participant toward the answer I was seeking but instead asked generic questions to have them explain more about a specific situation or answer. I used response validation to repeat answers back to the participant and ensured I captured the answers as the participant intended (Maxwell, 2013). I remained cognizant of my tone and emotional reactions through this interaction as well, and did not solicit answers I may have influenced. These strategies ensured participants remained comfortable to reveal their true feelings.

I made the multiple choice and open-ended questions in the survey as close to what the interview results detailed as possible. I reviewed the survey questions with my advisor prior to distribution to eliminate bias influence or question sequencing. Additionally, my use of surveys and interviews with numerous people served as a triangulation strategy to validate conclusions.

## **Findings**

The interviews I conducted with established professional women involved in the Agile community and the survey I distributed to the greater Agile community yielded an array of results. These results include six key themes detailing why women are less involved in the Agile community and five key strategies that could help increase women's involvement in the Agile community.

It is important to note that many factors influence these reasons for less involvement and strategies to increase involvement. These influencing factors are important to consider as they relate to how to address the reasons and how to introduce and apply strategies. I will discuss these factors throughout the findings and the recommendations sections.

### **Interview Participants**

In Appendix F, Table 1 shows the characteristics of the women I interviewed. I ensured I interviewed a diverse selection of women with varying involvement levels, age, Agile experience, and career and industry goals. For their privacy, I used numbers for identification and have not included the companies where they are currently employed. I calculated the means for these categories to compare with the female survey participant means and found no statistically significant difference, which indicates the sample was representative of the larger population sample.

The women I interviewed were very receptive to the questions I asked. I sent the questions prior to the interviews and it was clear all the women had reviewed them beforehand. The most apparent observations I made were regarding the confusion about my definition of involvement, conflict about women's positions in software development and Agile, and the genuine passion regarding the topic and helping other women.

The women displayed confusion surrounding my definition of involvement, which I meant to mean external to women's daily job responsibilities. Some of the activities I listed as external involvement companies may consider as part of regular daily job responsibilities, such as attending a conference. However, most employers do not pay employees for external involvement activities done outside of work such as blogging, writing articles, and attending user

groups. In response to this confusion, I tried to remind interview participants how I defined external involvement and modified my survey questions to address this confusion.

The women also displayed authentic concern about the problems women face in male-dominated fields. They were very forthcoming and it was apparent that they were facing their own internal struggles answering the interview questions and relating them to their personal experiences. They struggled to justify why some of their experiences had unfolded in the stereotypical ways as the research described regarding hostility, confidence, and overall lack of diversity (Etzkowitz et al., 2010; Wentling & Thomas, 2009).

The genuine passion they felt toward other women and their Agile careers was encompassing and encouraging. The interviewees all were compelled to help other women through their own experiences and felt a strong call to action when I invited them to participate in my study. The passion they radiated made me wonder if men would demonstrate the same passion toward similar topics. I did not interview men because of my study's emphasis on women, so I had to rely on the survey results to draw those conclusions.

### **Survey Participants**

I observed a few key trends from the survey participants when analyzing the results. These included the gender disparity and demographic profile of survey participants, the number of supportive comments in the survey directed at my study topic, and the rapid response rate of the survey. These emerging observations coupled with the interview findings had a great impact on the quality of the overall themes and their influence on my study.

A gender disparity revealed itself in the survey participants' demographics. In total, I included 103 respondent's results from the survey; 41 men and 62 women (40% and 60%

respectively). Five participants started the survey and did not proceed past the first two questions so I removed those results from the final survey count. For participants who took the majority of the survey but skipped a few questions, I only included their results from the questions they chose to answer. I anticipated more men would take the survey because of the gender disparity in the Agile field, but as the interviews demonstrated, women responded to the call to action to help in earnest. In addition, because the survey included “Women In Agile” in the title, it likely caught the attention of more women though it stated that men were welcome, too.

Table Two in Appendix F details the profile of the men and women who participated in the survey. It shows the mean data for each gender in each category and if the difference in means were statistically significant or not. The tables with this data are located in Appendix G. This table helped me determine what tests to execute to determine if there were relationships between variables that could relate to involvement levels. I describe these test results in more detail later in the findings.

Supportive comments were prevalent in all of the free response questions and the final section where I asked participants to leave any closing thoughts. Comments ranged from confusion about the gender disparity to suggestions and actions that participants had tried. Many comments expressed an interest for me to share the survey and study results upon completion, which I plan to fulfill.

The response and promotion rates of the survey were inspiring and showed the unique passion and inclusion of the Agile community. I distributed the survey mainly on Twitter but also through LinkedIn and Google+. In only four days, the survey reached the required 100 participants because of diligent retweeting of the link and participants sharing the survey through

other means. At final count, the original tweets had been retweeted about 30 times. Subsequent tweets and replies were also prevalent.

Both the interviews and surveys resulted in rich data. It was obvious that certain themes were emerging frequently about reasons for women's lower involvement levels in the Agile community. There was no shortage of strategic actions that helped study participants increase their involvement levels.

### **Themes: Reasons for Less Female Involvement in the Agile Community**

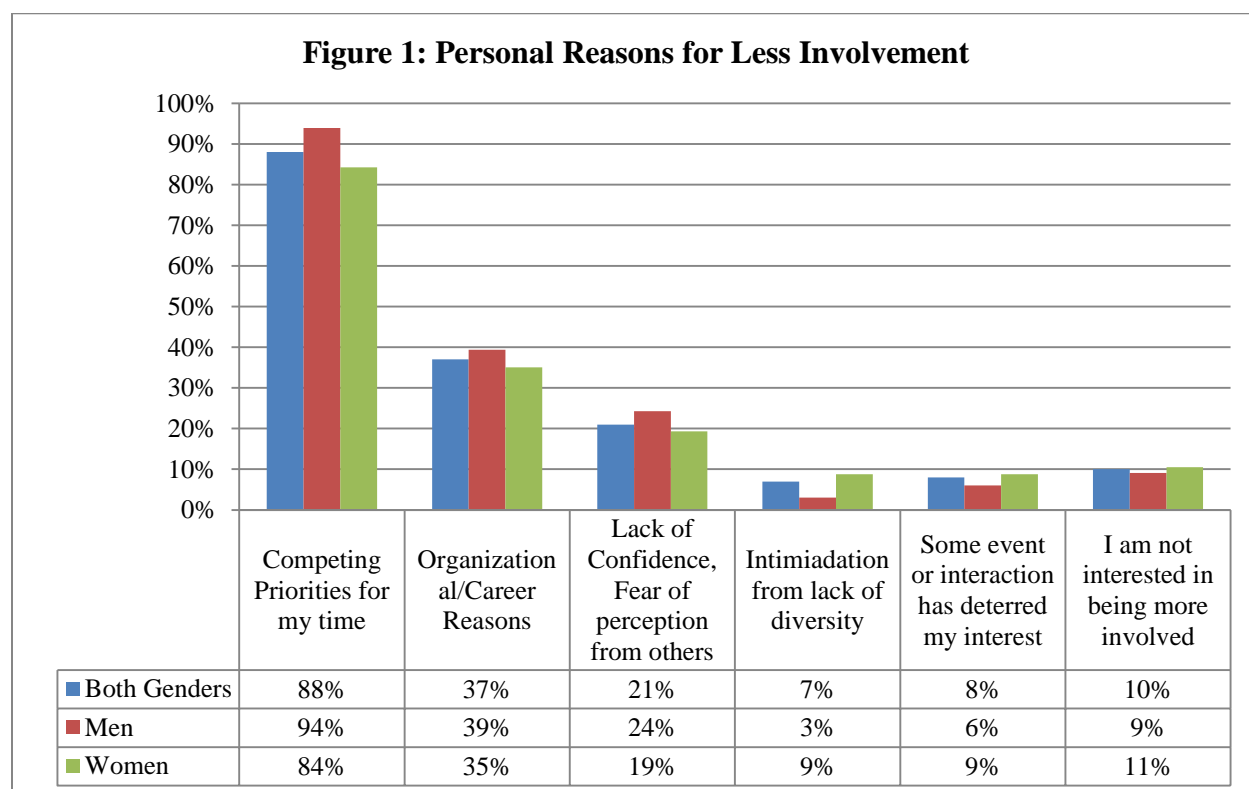
The six themes that emerged and explained the reason for women's lower involvement levels in the Agile community were influenced by internal, societal and Agile community factors, which women have varying degrees of control over. The reasons that emerged from the interviews are: competing priorities for time, a lack of confidence and the fear of others' perception, intimidation from the lack of diversity in the Agile community, an event or interaction deterred their interest in being more involved in the Agile community, organizational and career reasons, and lack of interest for greater involvement.

None of the emergent research themes explaining women's lower involvement levels can be assigned explicitly to females; meaning the reasons can be involvement limiting to men, too. However, the societal stereotypes and the primary research data I collected attribute that the reasons are more likely to lower women's Agile community involvement than men's involvement.

After the interviews identified these primary reasons, I listed them as answer choices in two of the survey questions posed to the greater Agile community (Appendix E). I directed the first question at the individual participant's involvement level asking, "What prevents you from

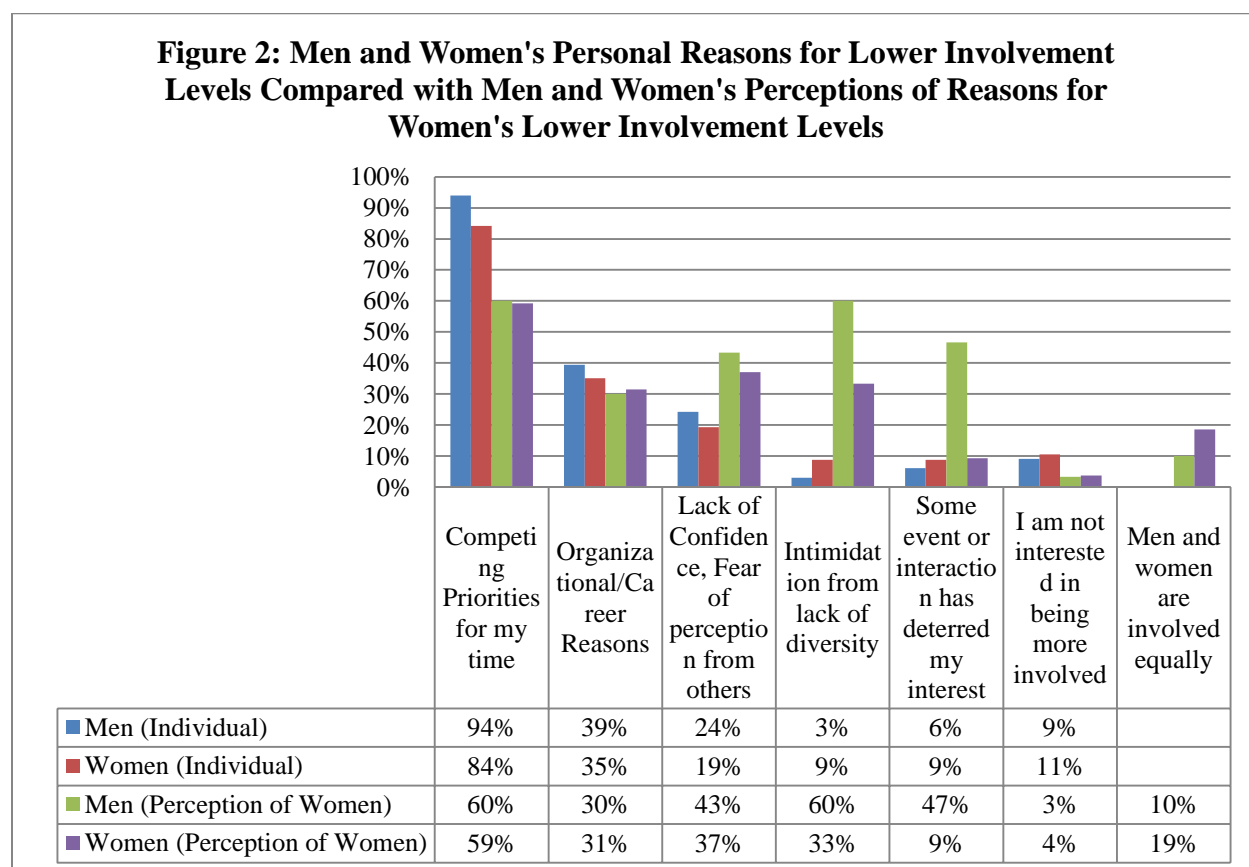
being more involved in the Agile community?” and the survey listed the above reasons and instructed them to pick the top two. The second question directed at participants was, “When you think about the Agile community, in your opinion why are men more involved than women?” and listed the same answers, with one additional option, “women and men are involved equally.”

Graph 1 displays the most common reason for less personal involvement was competing priorities for both genders. Men, however cited, this reason at a higher percentage than women did. Men also cited organizational and career reasons and lack of confidence at a higher percentage than women did. While women followed closely behind the men on each of these first three reasons, they answered a lack of diversity, and event or interaction deterring their interest, and less interest in being involved at a higher percentage than men are.



Two surprising findings included the greater number of men stating insecurity as a reason and the number of women who stated they are not interested in being more involved. Research indicated confidence of abilities as a detriment to women's careers (Jones, 2010). I did not find any research indicating that men had these same fears at the level the survey indicates. Additionally, I did not find any research indicating that women were not as interested in being involved as men as this survey indicates for the 11 percent of women who chose this option.

In contrast, when I asked participants about their perceived reasons for why women specifically have lower involvement levels the answers changed dramatically, particularly between genders, as show in Figure 2. I included the percentages from Figure 1 for comparison. I discuss these results in more detail in the individual reason sections next.



**Competing priorities for time.** All of the women I interviewed cited competing priorities for their time as a key reason for less involvement in the Agile community. These competing priorities ranged from family commitments and raising children to organizational and volunteer involvement. This reason was also exceedingly the most popular reason in the survey selected by both genders to explain why they are less involved in Agile community activities by a factor of two. Based on the research and the busy nature of society, this was not surprising.

Men, however, cited competing priorities as one of their top reasons for less involvement more frequently than women did at 94 and 84 percent respectively. While both men and women have priorities competing for their time, women still seem to withstand the worst of the family commitment in the United States society but have more practice at balancing responsibilities. The women's survey comments on this question cited needing babysitters and partners who help to make involvement possible, whereas men did not make any comments relating to this.

Each of the women I interviewed that had children referred to them at least once in the interview. Many referred to them over five times on separate occasions. As the earlier research states and the opinions of those in the interviews and surveys confirm, women still are responsible for the majority of the child rearing and this takes priority over career building and involvement (Etzkowitz et al., 2010). Two interview participants indicated a theme of valuing one spouse's career over the other, and the family priorities falling on the other spouse, usually the woman, but, outside of the comments or lack thereof, the survey did not indicate this disparity specifically. When asked why men are more involved than women are, one interview participant said:



Raising four kids and working in a very challenging career, I couldn't have it all...I believe that's the reason. It's not that we aren't intelligent, very capable, very willing to be out there, it's that there's so many things pulling on our time... It's almost like you have to sacrifice one person's career for the other one, but maybe you don't have to. Maybe it's possible. Maybe we're setting our own limitations. (personal conversation, February 2015)

Regarding other priorities besides family that are competing for women's time, the opportunity cost and preference of one activity over another was often cited as a reason for less involvement in the Agile community. A few women discussed how they were previously more involved in the Agile community, but now other organizations are more important to spend their time on because they generate more perceived return on investment. Additionally, some activities within the Agile community are simply too time consuming. Women indicated they would rather spend their time on activities where they feel they can make more of an impact or receive more value. Other women discussed how their careers were an obstacle to involvement.

**Company and career reasons.** The second most popular reason for lower involvement levels agreed upon by both genders was company and career reasons. These reasons include a lack of company funding and support for involvement, a perception that external involvement is not a part of their job or they do not see the benefit of it, and heavy involvement in Agile activities internal to the company such as user groups, unconferences, or internal blogs and training.

Participants frequently cited the necessity of company support both financially and through encouragement in the survey comments. Participants indicated that 40 percent of their

companies did not provide financial support and 32 percent said their companies did not provide encouragement for external involvement (Appendix H). Free response survey comments indicated the barrier created when companies do not provide this support, because many of the participants indicated the value of these activities. Some comments indicated a limited funding budget for involvement like training and conferences. Several other comments indicated that participants were unsure if their company provided support, or discussed how encouragement happened more frequently at the team level than at a higher management level. One interviewee talked when the economy is difficult and companies are not hitting their goals, and they often eliminate the training and conference budget first.

A lack of company support proves to discourage employees from being involved and decreases their job satisfaction in many cases. According to the survey data, the mean job satisfaction women reported on a scale of 0-10 was lower (5.59) when companies did not provide financial support than when they did (7.69). The difference in means proved to be statistically significant and therefore not due to chance (Appendix G). The mean involvement level reported from both men and women on a scale of 0-10 also was higher when companies provided financial support (5.31) than when they did not (4.12). The difference of the means was statistically significant in this case, too (Appendix G).

Other interview participants discussed the challenge of separating external from internal involvement and staying motivated to be involved in both. They talked about how difficult it is to stay engaged externally after an entire workday. An example of this conflict arose when I contacted a woman who had agreed to participate in an interview with me. At first, she was hesitant but agreed after learning more about the opportunity. Then as the time came to set up the interview, she rescinded her offer. She said she was just too busy at work to spend any time

outside of work engaging with me. This interaction personally validated company and organizational reasons as a hindrance to Agile community involvement.

Finally, a few of the women I interviewed recollected how their involvement has decreased as they advance their careers. They named the reasons for lower involvement levels related to their workload, in addition to not getting the same level of benefits from involvement as earlier in their careers. They cited a gap in the Agile community activities targeted toward established professionals at varying career and experience levels. At a more senior position in their careers, they were not experiencing enough career-advancing return on investment from involvement. If women do not recognize these involvement activities as investments that will provide a return, they will not be as involved or invested.

**Lack of confidence/fear of perception from others.** Confidence is a trait that is less often associated with women according to the research. Society describes women displaying confidence using different words, tones, or underlying meanings, which discourages individual outright confidence (Sandberg, 2013). Interviewees mentioned individual and societal confidence perceptions many times during the interviews both as a reason for less involvement and as a perceived reason for lower female involvement levels in the Agile community. The sub-themes ranged from the fear of the Agile community not wanting to hear their ideas, to worries about a lack of experience, the fear of losing face when interacting and being involved, and the high and possibly unrealistic standards these women imposed on themselves.

The survey revealed that both genders look at confidence differently when relating it to involvement. When asked the question “What prevents you from being more involved in the Agile community? Please choose the top two reasons,” 21 percent combined percentage of both

genders chose lack of confidence as one of their top two reasons, the third most popular reason. However, the division between men and women who selected this answer was surprising. A higher percentage of men than women reported lack of confidence as one of their top two reasons for lower involvement at 24 and 19 percent respectively. These percentages disagree with what the research and interviews indicated about societal and individual confidence perceptions of women and men.

Another interesting finding was the outcome of the next question, “When you think about the Agile community, in your opinion why are men more involved than women? Please choose the top two reasons.” The combined percentage of both genders who selected lack of confidence as one of the top two reasons greatly increased from 21 to 40 percent. It was still the third most popular reason overall. When looking at the answers separately, 43 percent of men and 37 percent of women thought lack of confidence was a top reason for less involvement. What is surprising is that the female survey participants did not identify a lack of confidence as frequently when referring to themselves individually, but when asked about other women, they perceived lack of confidence to be an issue with almost double the frequency. Men also perceived a lack of confidence as an issue that women face more than women did individually.

There were several times in the interviews and other interactions I noticed confidence as a reason for lower involvement among women. The research suggests that women hold themselves and the work they produce to a higher standard than men (Etzkowitz et al., 2010). Sometimes this standard is unattainable and hinders women from getting more involved (Jones, 2010). Sandberg (2013) cited one example of this standard relating to job applications. If men meet 60 percent of the stated qualifications, they will apply for the job. Women will not apply for the job unless they meet 100 percent of the required qualifications. This same statistic

emerged in two of the interviews when discussing confidence levels in women and the relation to involvement, so women perceive its basis in truth.

Another example of standards of work and confidence emerged when two interviewees discussed personal blogs that they created but never publicly posted. Their fear is that no one will want to hear their ideas and they are not high enough caliber to post publicly. One woman mentioned, "It's hard to come up with ideas you think are good enough to post. We want things to be a certain caliber before it's released or something. I don't know." (personal conversation, February 2015) This comment demonstrates the struggle women have about why they allow these societal and individual perceptions to influence them, they do not have the answer.

Experience and credibility also emerged as a theme relating to a lack of confidence when I interacted with a woman who I wanted to interview. At first, she was very interested, but as I sent her the questions and tried to organize an appointment, her responses became distant. She referred me to another woman in her organization because she was not confident she had the experience to answer my questions. The unfortunate part was her different experience level was exactly why I was curious to interview her.

Imposter syndrome was another wrinkle that emerged in the lack of confidence discussion and the research (Sandberg, 2012). Imposter syndrome refers to when women perceive themselves as "imposters," regarding their knowledge and their experiences as illegitimate or unworthy of being credible. This perception may be reflective of how girls are treated growing up, when more value is placed on looks and boys are encouraged to be risk takers, one woman told me. Another candidly said, "I received comments at multiple conferences I've gone to along the way that, 'you're not just a pretty face' and then when I start talking,

people think that ‘wow she actually knows what she is talking about’.” (personal conversation, February 2015). It is important for women to recognize these feelings and their origins, but also to understand that not only women have a fear of others’ perceptions and losing face as shown by the survey.

When discussing conference submissions for presentations, one woman indicated she would be interested but then at the same time asked herself and me, “have I earned enough credibility in the space?” (personal conversation, February 2015) She went on to say in reference to her career and her position, “one of the things I’ve struggled with my whole career is confidence...I didn’t know if people would take me seriously or if I could do it...Confidence came with the title.” (personal conversation, February 2015) The lack of gender diversity in STEM fields and the fact that there are fewer women in leadership roles to set an example of confidence may contribute to this perception.

**Intimidation from lack of diversity.** The lack of gender diversity in STEM fields across all age groups, as discussed in the earlier research, emerged from the study as a reason for women’s lower involvement levels. It was common to hear in the interviews that women sometimes feel unwelcome or uncomfortable when “no one looks like them.” (personal conversation, February 2015) Some of the interviewees felt the Agile industry catered to men and they did not know how to break into the inner circle of involvement. Other women mentioned they were not invited to participate in Agile community activities. They stated if they were invited, they would be more likely to be involved. Finally, observations about limited openness to networking emerged because of limited diversity in the Agile community.

As a reminder, the women participated in the survey at a higher rate than men at 60 percent and 40 percent, respectively. Unfortunately, this proportion did not extend any further into the survey. Nine percent of women indicated that intimidation from a lack of diversity was one of their top reasons for lower involvement levels in the Agile community. However, when the survey asked both genders why they perceived women to have lower involvement levels, intimidation from lack of diversity was the second most popular choice (43 percent) for both genders' combined results. This was an important finding because the disparity was so great between individual perceptions and perceptions of women.

More shockingly, though, was that 60 percent of men perceived a lack of diversity was one of the top two reasons women have lower involvement levels. Men's perception of women relating to this reason was almost double women's perception of 33 percent. This demonstrates the male survey participants perceive women to be more intimidated by a lack of diversity (mainly gender diversity) than women perceive themselves. This huge disparity begs more research into why men perceive women to be more intimidated than women perceive themselves. It also introduces questions regarding how this perception influences men to act around women they perceive feel intimidated.

Though this study did not focus on recruitment, the interview discussions heavily suggested encouraging women to join STEM fields at all ages to increase gender diversity. Many of the interviewees and survey participants made it clear that women are intimidated long before they join the Agile or IT industries. Those women who do make it through the initial intimidation in their younger years still face intimidation issues later in their lives, which the research mirrored (Etzkowitz et al., 2010). Women discussed the feeling of intimidation that

results from a lack of diversity as a complex societal issue. One woman talked about girls at a fifth grade level where a lack of gender diversity was already apparent:

I did a few classes for elementary school kids where we brought in computers and I tore them apart and I let them look at them, and then ask me any questions they had about the computers. At fifth grade level, 24 kids signed up. Not a single girl...I don't understand how we're losing the girls. (personal conversation, February, 2015)

Interviewees and the initial research discussed how a lack of gender diversity extended into college, where girls dropped out of computer science (Jones, 2010). Many of the women had personal experiences as the only female in the room. One woman related this to confidence in college and in her career now:

You'd go in and you are the only female, I can see how a lot of people might drop out and be deterred from that fact. It's not like in a college setting, where there's three women and 28 guys, and the professor can call on you and boost your self-esteem and say that you're just as smart as everyone else in the room, there isn't that community across states and in the country. I think it's a little more probably intimidating for women to look at all these people writing these blogs and articles, and they seem super smart and you compare yourself to them. (personal conversation, February 2015)

If women are not invited to participate, they feel intimidated, excluded, and unwelcome. It can feel like a good-old-boys network that is impossible to break into. A woman discussed how she did not plan to study computer science until a professor encouraged her. This invitation changed how she looked at the field and instilled confidence, because someone else thought she could succeed in the male dominated classroom.



In another example, one interviewee brought up an example about the Agile Manifesto, a credo that Agile software development is centered around, and its creation (Agile Manifesto, 2006). “Those darn guys did not invite us to the manifesto party. Shame on them... It was kind of a good-old-boy network, and that’s the way it has been.” (personal conversation, February 2015) This is of great importance to Agile community involvement because the Agile Manifesto is the cornerstone of the industry and its associated principles. Almost every presentation about Agile will start with the Agile Manifesto. Women were not welcomed or invited to participate in its creation, so is it surprising that they do not feel welcome to be involved in the Agile community?

Even when invited, women still feel intimidated by the lack of diversity they experience. In a final example, a woman talked about arriving at a conference and walking into a panel discussion where it was “all old white guys.” She looked around the room, knew every woman in there, and felt like the token female in the small group discussions. These examples and interactions are very deterring to women and do not help to increase the diversity in the Agile community.

**Some event or interaction deterred my involvement interest.** An involvement deterring event or interaction is not a reason exclusive to a gender or industry. It did emerge in the interviews as a reason for less female involvement, though. The women I interviewed were very candid in sharing their stories about interactions that made them feel uncomfortable. Some deterred them from being more involved while some were disturbing and were described them as a cost of doing business. The stories ranged from a hostile interaction to situations that were uncomfortable and even maddening.

When the survey asked participants about their personal involvement, eight percent of both genders selected an event or interaction deterred my interest in involvement as one of their top two involvement deterring reasons. When the gender proportion is broken down, women selected this reason more than men did at nine and eight percent respectively.

The interesting outcome was, again, when the survey directed the question at perceived reasons for women's lower levels of involvement exclusively. While still ranked as the fourth most important reason for the combined gender score (23 percent), the separate male and female answers showed a different trend. Men perceived this as one of the top reasons at a significantly higher proportion than women did at 47 and 9 percent respectively. In fact, women selected this reason at the same proportion when they perceived other women as they perceived their own involvement, which was not the trend in any other reasons.

Though women report this reason at a low percentage, three of the women I interviewed had stories or interactions that fell into this category. Consequently, each of the interactions described below involved a man, which may correlate with why men chose this reason in such high numbers.

Men and women interact very differently, and gender issues can cause tension, discomfort, and hostility, especially from behind the safety of a computer screen as the research states (Marcella, 2002). One woman reported an interaction via email with a man in her professional network. She had contacted him to point out a lack of gender diversity in some of the community events he helped to organize. She proactively offered to help, speak, or recruit other women to make the playing field equally engaging. When recounting the interaction she said,

I got back the most rude email I have ever gotten... Basically I felt bad for him actually because you could tell he felt like he had to defend himself. He felt like I was accusing him so I just let that sit. I didn't write him back right away. I waited 24 or 48 hours. (personal conversation, February 2015).

When I pressed for details of what happened she said she acknowledged the response and agreed with the anger around the issue of lacking diversity and then he offered accept her offer to help. By that time, she was frustrated by the interaction and felt she had been offered a consolation prize and was being punished for speaking out. "It was gross." (personal conversation, February 2015). She told me she has attended events sponsored by his company since and has instead focused her efforts toward other organizations.

Other interactions women discussed included how male co-workers have acted that makes them uncomfortable when they are around different people. She discussed a co-worker interaction, "He's exactly the same way every time I meet him. Then I had this experience once where another guy came in and it was like he had turned into another person. He was adjusting himself... It was really disgusting." (personal conversation, February 2015).

Another woman discussed the dynamics of happy hour and feeling uncomfortable going to a bar with a married co-worker, but feeling excluded when she is not invited. She recognizes that those interactions are where co-workers solve problems, but it does not ease the potential discomfort in casual setting interactions with alcohol involved. The same discomfort was apparent and widespread in an interaction one woman had at a conference. She talked about how networking happens over drinks after the conference sessions are done. She discussed how networking is important to her and she values those connections. She also discussed how as the

night goes on, men's wedding rings disappear and what started out as networking turns into a potential situation for sexual harassment.

These interactions are not unique to the Agile industry or women, nor are they surprising based on what the research discussed about hostility and discomfort (Etzkowitz et al., 2010; Wentling & Thomas, 2009). It is, however, unfortunate that these interactions happen to anyone and deter involvement activities.

**Lack of interest in more involvement.** The final reason that emerged from the interviews was simply a lack of interest in more involvement. This lack of interest identified usually was from an internal lack of motivation to become more involved. The survey results distinguished between women and men who were already involved and did not want to increase their involvement, and those who were not involved and had no interest in becoming more involved in the Agile community.

According to the survey, ten percent of men and women attributed a lack of interest as one of their top two reasons for less involvement in the Agile community. When examined separately, men and women reported similar percentages of lack of involvement interest, with nine and 11 percent respectively. When asked specifically about reasons for lower women's involvement levels, only four percent men and women perceived lack of interest as one of the top reasons.

The survey indicated that lack of interest was not one of the top hindrances to Agile community involvement for either gender. When asked about their desired level of involvement in the Agile community, 29 percent of women and 38 percent of men reported they are involved

at their desired level. In fact, only five percent of women and three percent of men indicated they wanted to be less involved than they already are, which matches the other survey results.

According to the survey though, men are more satisfied (52 percent) than women (32 percent) with their involvement levels in the Agile community. Men reported a higher mean desired level of involvement and a higher mean satisfaction level than women, though the mean differences were not statistically significant (Appendix G).

The interview results were split between women's levels of satisfaction with their involvement, though most indicated they wanted to be more involved. Two women indicated they were satisfied with their lower levels of involvement based on where they were in their lives and careers and were not interested in being more involved. One remarked, "It's good enough for my company. It's more than others are doing." (personal conversation, February 2015). The rest of the women indicated they wanted to be more involved than they currently were. One woman ended the interview saying, "I have thought, because I've been watching you, maybe I should get involved again. I don't know if I will or not." (personal conversation, February 2015).

It was refreshing to see that a lack of interest was not prevalent among women or men from achieving higher levels of involvement. The difficulty for participants was finding the right balance between where they current were and where they wanted to be in the future. This balance and desire is sometimes maintaining the same level of involvement instead of increasing.

**Women and men are involved equally.** I added one additional reason to the survey question targeting reasons why women have lower levels of involvement: "Men and women are involved equally." I wanted to include this option because some participants believed this to be true. These participants thought the only reason we saw fewer women involved in the Agile

community is because there were fewer women in the Agile and IT industries as outlined in their comments. They believed the proportions of women and men's involvement levels relative to the population was the same, but my research found this to be false.

The survey showed that more women than men thought men and women's involvement levels were equal at 19 and 10 percent respectively. My survey results show that based on what the participant-reported involvement levels, men are involved in the Agile community at higher levels than women. On a scale of 0-10, women reported their mean involvement level at a 4.47. Men reported their mean involvement level at a 5.47. A t-test indicated the difference in means was statistically significant (Appendix G).

I conducted one other test to determine if men or women were under or over-reporting their involvement levels. I compared the answers they gave in the survey grid of their involvement levels in the last year based on community activities in which they participated (Appendix C, E). I assigned numbers to each of the answers to form a point value for their level of participation in each activity. I summed the activities' point values for each participant and converted the number to the 0-10 point scale. Then I compared the calculated level based on the activities participants reported to the self-reported involvement level (Appendix G).

I found the mean self-reported involvement level from both men and women was higher than the calculated involvement level based on their grid activity answers. The difference between the means of the self-reported and calculated involvement levels was not statistically significant. Since both genders over-reported their actual involvement levels by about the same factor, this statistic does not skew the result toward either gender. The result is the same: men have higher levels of involvement in the Agile community than women.

The results of greater involvement by men were consistent in individual involvement activities, too. Men were more active than women on average in every activity except for receiving certifications (Appendix E, G). The most popular activity for both genders, determined by mean involvement, was user group participation. This was followed by conference attendance, blogging, conference submission and presentation, certifications, and submitting or publishing articles as shown in Appendix H. Women and men's involvement in these activities showed the same ranked order for each activity, though men's rank tied on the least popular two activities of certifications and article submission and publication.

All of the above results and reasons only reinforced the need for my research project. By identifying the underlying reasons contributing to lower involvement levels for women, the strategies could directly address the problems instead of treating the symptoms. The next section details the strategies that participants identified to help boost women's involvement levels in the Agile community.

### **Themes: Strategies to Boost Women's Involvement in the Agile Community**

The second portion of my research question was to determine strategies and actions to help boost women's involvement in the Agile community. I based these strategies on the reasons for women's lower involvement levels the survey and interviews identified. The interviews revealed some potential strategies to address the barriers to involvement and the survey validated these strategies and added more detail.

I asked two interview questions to understand strategies that were helpful in encouraging women's involvement. These questions were, "Which of the following have you participated in and what, if any, was the most helpful support you received in doing so?" and "What other

actions can be taken to support and encourage professional women in the Agile community to be more involved in contributing their knowledge and insights through some of the activities we discussed?” (Appendix B). The women openly discussed strategies and steps to take at societal and individual levels to help increase women’s involvement. Some of the strategies are already being utilized within the Agile community, but the interviewees either were not aware of them or indicated that the community was not implementing the efforts well.

The survey addressed strategies to increase involvement in a similar way. It asked four questions relating to strategies for greater involvement. Participants were able to leave short answers to the questions (Appendix E):

- How does your company encourage and support your involvement in the Agile industry?
- What is your primary reason for being involved in the Agile community (outside of your daily job)?
- What support or actions have helped you or would help you to become more involved within the Agile community (outside of your daily job)?
- What support or actions do you think would help encourage women to become more involved in the Agile community (outside of their daily job)?

I exported all the short answer responses from the questions and grouped them into strategies based on the themes that emerged. I added to the themes that had emerged from the interviews and created some new themes from the survey data. I chose the top five most popular themes as the most effective strategies to examine.

The main themes compiled from both the interviews and the surveys in order of frequency mentioned are: early recruitment efforts in STEM fields, personal invitations to



participate, company support (both financial and through encouragement), promoting and seeking out diversity in Agile community activities, and building and maintaining a network within the Agile community. Similar to the reasons for lower female involvement levels, these strategies are not gender exclusive, nor are they mutually exclusive to the Agile community. Companies and individuals can apply these strategies to boost and encourage involvement for both genders in a variety of industries.

**Early recruitment efforts in STEM fields.** As reiterated throughout this action project, the goal of this study is not to address or increase recruitment in STEM fields or the Agile community, but rather to understand and utilize the women who are already present. However, the problem of an unequal female presence in software development and the Agile community continually emerged in my research and I needed to address it strategically.

A common perception of my study participants was that women's lower involvement was not entirely because of the previous reasons the study uncovered. The perception was that women were less involved in the Agile community because there were fewer women present to be involved. Though the proportion of women in the Agile community is smaller than that of men, my research shows that in the participant sample that took the survey, men are still more involved than women in Agile community activities regardless of population and proportion size (Appendix G).

By continuing to challenge perceptions of stereotypical gender-related skills, including math, science, visual and spatial reasoning, and focusing on recruitment to STEM from many angles, we can expect the percentage of women in these fields to increase to meet the growing demand for technical skills (Adams & Weiss, 2011; Jones, 2010). My interview and survey

results revealed that these stereotypical perceptions are still common, but there is hope. The study results suggested targeting girls at a younger age and through both home and school-based avenues.

Today's society immerses children in technology and the Internet from a very young age; therefore, they are more comfortable with it than any previous generation. The research agrees there is no longer a discrepancy between men and women's involvement online (Haight et al., 2014; Ruleman, 2012). As a result, children are often more tech-savvy than their parents and may have a greater understanding about how technology operates and can be manipulated to fulfill their desires. An interviewee stated that this familiarity alone might help to attract more girls into STEM careers. She compared it to boys' interest in video games contributing to their interest in technology historically. Another interviewee discussed the importance of parents' knowledge and encouragement in this equation:

I think we have to train more adults, because I think a lot of adults don't get the value. You know, if you've got, as an example, a stay at home mom like my sisters [who have husbands in technology careers]...my sisters don't comprehend. They know what their husbands do at a high level probably but how do you speak to your children about it if you don't get it. How do we train adults just to understand it enough to understand the value and then have that conversation with their kids...we forget people living outside the four walls [of technology] don't understand a thing. (personal conversation, February 2015)

The quote makes a good point. If parents lack an understanding of technology and associated careers, how can they intelligently market these careers and skills to their children?

However, parental involvement and encouragement alone is not enough, especially if girls are not interested in math and science initially.

As society exposes children to math and science, the community and companies can nurture the interested ones presenting in classrooms, making women in technology and leadership visible, and sponsoring external technology activities. By putting more emphasis on the girls that are interested in technology early in their lives, and continuing to challenge the societal status quo stereotypes that hold women back from these interests, STEM fields and the Agile community will see more success (Sandberg, 2013). An interviewee agreed:

I think we have to get out there and talk to women at a very early age... It's for those girls who would like to be in technology but somehow they're telling themselves, "Oh, I can't do that. I'm not smart enough. I'm not good enough." We have to get down there into, really, even the elementary levels and make math fun, make science fun, and let them see that there are women in these professions. (personal conversation, February 2015)

By addressing the gender disparity in STEM fields from many angles, including school and home, we can put the emphasis on society to help solve the inequality. Anyone who interacts with girls can help nurture their interests, educate, and encourage them to pursue these careers. The first step is to extend a welcoming invitation.

**Extend a personal invitation to participate.** The second most popular strategy the interviews and surveys revealed to encourage higher levels of women's involvement in the Agile community was extending a personal invitation to participate. Many interviewees stated that

when Agile community members, especially other women, reached out to them to participate they were much more likely to accept.

A personal invitation to attend a user group, write a blog, or submit a presentation helps to address the lack of confidence that limits involvement. When an Agile community member invites another member to be involved in an activity, they are validating their confidence in that member and their ideas. Additionally, reaching out on a personal level helps to build relationships, which the research indicates is typically a female skill and value (Adams & Weiss, 2011, Jones, 2010).

This may seem like a very simple strategy but it proved effective in two personal situations. I decided to do an experiment using a personal invitation to solicit women's involvement at a user group. In a group of about 30 people at a user group meeting, four were expected to be on the small stage in front discussing various Agile topics and giving their opinions to the group. When someone from the audience wanted to contribute to the conversation, they simply joined the group on stage and one person left.

I noticed at one point that all four people on stage were men, but about one third of the audience members were women. I only knew a few people in the audience personally and had already been on stage myself, so I decided to invite some other women to participate. I walked up to a group of three women and whispered, "There are not enough women up there. You ladies should go up there and change that." I did this a few more times throughout the room. Within about three minutes, there were three women on stage, each of whom I had invited and encouraged to contribute.

A similar situation happened when I was invited to participate and speak at a user group via email. First, I received the group's generic monthly email, with details for the coming events, and I ignored it. A few days later, I received an email from a woman I knew personally in the group describing the next meeting and how she would like me to contribute by presenting. The topic was how to submit a proposal to present at a conference. If I would have noticed the topic on the generic email initially, it would have interested me, but I likely would not have been motivated to attend. By receiving the personal invitation, it motivated me to commit to going because I felt an obligation and duty, in addition to the desire to nurture my networking relationship with the woman who invited me.

The simple gesture of personally inviting someone to participate makes her feel welcome, valued, and confident. In this context, women inviting women was especially effective, but I believe the results would be similar with men extending invitations to either gender, too. Companies can even extend personal invitations to employees to increase their participation in Agile community or company activities.

**Increase company support to participate.** Both the interview and survey results indicated that company support, such as involvement encouragement and financial support, was vital to involvement patterns. Participants indicated that a lack of this support hindered their involvement by ranking it as the second most prevalent reason.

When companies encouraged and funded involvement, study participants indicated they were more likely to be involved. According to the survey, 60 percent of respondents indicated their companies provided financial support for external involvement for activities like conferences (91 percent), training (89 percent), and certifications (69 percent) (Appendix H).

A T-test comparing mean job satisfaction levels of women whose companies funded external involvement (7.69) proved to be greater than women's job satisfaction levels when companies did not financially support their involvement (5.59) at a statistically significant margin (Appendix G). Mean self-reported involvement levels were also higher for both men and women when companies financially supported their involvement, but this result was not statistically significant (Appendix G). Though clearly important, financial support is not the only type of support companies can provide aid their employees' involvement.

A few interviewees mentioned company encouragement as a type of support. Most often, this support came from co-workers or managers and not as an overall company strategy that supported external involvement. One woman discussed her company's support for internal involvement, which allowed employees to hold Agile topic meetings during the workday. That company also encouraged user group creation on internal online communities, internal blogging, and idea sharing. Another woman mentioned her co-workers encouraged her to attend conferences and user group meetings with the team. She said they socialized afterward, discussed the ideas they heard, and talked about how to implement those ideas at their company.

Survey participants also agreed on company support helping them to be more involved. Two of the survey questions targeted company encouragement specifically, "Does your company encourage and support your involvement in the Agile industry?" and "How does your company encourage and support your involvement in the Agile industry?" (Appendix E). Respondents indicated that 68 percent of their companies provided encouragement to participate in Agile activities external to their daily job. The survey comments indicated this was vital to their involvement and companies allowed them to leave work early to attend such events. They

discussed company sponsored user group events and how some companies allowed them to attend activities during the workday while still being paid.

A T-test determined if the mean involvement levels of women whose companies provided encouragement was higher than those whose companies did not. Though the mean involvement level was higher for women whose companies encouraged their involvement, the result was not statistically significant (Appendix G). It was apparent that while company encouragement was important, financial support was more impactful to involvement levels.

**Promote and seek out diversity in Agile community activities.** In both the interviews and the survey comments, participants mentioned the need for actively seeking out and promoting diversity in Agile community events and activities. They indicated the community should specifically seek out this diversity, by looking for women to present (and inviting them personally) and promoting a variety of topics, presenters with a broad range of experience and skill levels, and hosting events at diverse and interesting venues and locations.

This strategy relates to one of the reasons for less involvement: intimidation from a lack of diversity. One of the interviewees detailed how it is difficult to break into the inner circles both at local and national events. “After you have been in the community for a few years, the content and those presenting the content through various channels; like conferences, articles, user groups, and social media; do not offer much variety. It’s the same people saying the same things.” (personal conversation, February 2015)

The research agrees with this strategy as it touts diversity as an asset in the software development field. The Agile community can realize the benefits of diversity, too. Diverse activities, participants, and ideas will help the Agile community maintain a competitive

advantage and better business outcomes (Pless and Maak as cited in Ridley & Young, 2012, Wentling & Thomas, 2009)

Another interviewee reflected that earlier in her career she would glean greater benefits from Agile community activities. With greater career experience, she finds advanced topics lacking at Agile community activities and therefore is not as active as she previously was. Her role in the community has changed from an audience member to a speaker and coach. Though she recognizes she can help junior members she also notices the diversity of audience members who are not as involved. She recognizes that not everyone has the confidence she had earlier in her career and some need more active recruitment efforts to become involved. As the research states, many women are concerned about hostility and not being received seriously (Wentling & Thomas, 2009). By actively increasing diversity at these activities, these concerns may be allayed organically.

Many opportunities in the Agile community to participate in activities are by word of mouth and through networking. If women are not actively staying involved, networking, and connecting with the right people, they will miss these opportunities.

**Encourage and facilitate networking among women.** Research cites women as being more talented at forming relationships with others (Jones, 2010; Adams & Weiss, 2011), though some women see networking in a male-heavy environment as daunting, dangerous, and intimidating. The final strategy for increasing women's involvement in the Agile community is to encourage and facilitate networking among women through women's groups, mentorship and sponsorship, active networking and introductions, and collaborative sessions to help build knowledge and skills.



The interviews and surveys indicated that some women experienced a hostile and unwelcome environment and it was a reason they were less involved in the Agile community (Wentling & Thomas, 2009). Women also detailed they lacked confidence and were afraid they would not be taken seriously, which parallels with what the research describes (Etzkowitz et al, 2010). The women in the interviews and surveys who overcame these obstacles had strong networks behind them.

The study participants discussed the importance of surrounding yourself with supporters. One woman discussed how she was mentored regarding corporate politics from another woman. In return, she mentored her on technical topics. She discussed how men could be good mentors, but how fit and intention needed careful consideration. The lack of diversity in the Agile industry results in men having many more leaders of the same gender to look to as role models. With women, “you have to recognize that they’re the ones that helped pave the way so that we have a place at the table.” (personal conversation, February 2015)

In the interviews and survey comments, women discussed the idea of sponsorship, too. A woman described sponsorship as unsaid support, where leaders at the top pull up others to help with projects. They coach and put their brand on the employee by supporting their work and giving them opportunities. Men often do this naturally but because there are fewer women at the top of leadership, it is more difficult to be sponsored by one. She stated that between men and women it is different,

All these men are typically reaching down to pull up other men like, ‘Hey let’s talk about this project. Do you want to go get a beer?’ It’s going to be really weird for me to go get a beer with another married person. I’m a married person. He’s a man. I’m a woman.

That just doesn't have good optics and so there are really no women to reach out and look for sponsors. (personal conversation, February 2015)

Another idea was establishing women's groups within the Agile community. There are already many female groups within the technology industry, but Agile specialization is lacking representation. Those Agile women's groups that do exist are lacking promotion and transparency to the broader Agile community. These are online groups using social media to foster open communication, mentoring, sponsorship, and introductions to other women through networking. The challenge is continuing to promote and make these groups visible and transparent to a broader population of women in the Agile community. This networking strategy needs to be implemented and promoted at individual, societal, and Agile community levels to be successful.

### **Recommendations**

The survey and interview participants identified several strategies that relate to one or many of the reasons limiting women's involvement in the Agile community. Under the canopy of each strategy, several different actions can address and mitigate the reasons to which they relate. These strategies, however, must be implemented by individuals, society, and the Agile community over various time periods. The real issue is changing the perceptions of women and their involvement in Agile, technology, business, and society. I recommend implementing these strategic actions in three tiers: immediate, mid-range, and long-term.

#### **Immediate Implementation**

The most immediate and scalable strategy that can be implemented is extending a personal invitation to participate. Anyone can extend an invitation at any time, regardless of

gender. As shown in the stories I cited, this strategy is quickly successful in a variety of different situations. The personal interactions, interviews, and survey showed women respond to a call to action quickly, especially if it is a personal request from another woman. It helps increase confidence and makes involvement less intimidating when there is personal encouragement of a woman's participation.

I have been experimenting with the implementation of extending personal invitations and responding to those invitations I receive. I will continue to engage with other women at user groups, conferences, other networking events, and through social media to encourage their involvement through personal engagement and hope they will do the same. One way I will promote personal invitations is by writing a blog post about this strategy on my personal website and on the #WomenInAgile website. I will then extend a personal invitation to a few other women in my network to try the strategy, share their experiences through blogging and social media, and pass on the message and invitation to other women. I will continue to spread the message and think of other unique ways to encourage women to extend personal invitations to participate.

This strategy can start to change the perceptions of the reasons women are less involved, too. By personally inviting women, they will feel more welcome, less intimidated, and more confident because someone is confident enough in them to invite them. It is also more difficult to say no to a personal invitation than it is to ignore an email invitation. When a person receives a personal invitation, it is more likely to become a priority than a mass-distributed message. If a woman shows interest in another woman's involvement, she is more likely to be interested because of a personal connection and investment.

## **Mid-range Implementation**

Unlike the low barrier to entry and scalability of immediate impact strategies, mid-range strategy implementation will take additional planning and organization to be successful. Though individuals can certainly be the drivers of mid-range strategies, local companies are needed, too. The three strategies that can be implemented over a mid-range time frame, ranging from a few months to a few years, are increasing support from companies for women to participate in Agile community activities, promoting and seeking out diversity in Agile community activities, and encouraging and facilitating networking among women.

**Company support of Agile community involvement.** The findings identified company support, both financial and through encouragement, as a huge influence for both men and women's involvement in Agile community activities and their overall job satisfaction. Companies should heed this call to action and understand the benefits in employee engagement, knowledge building, and satisfaction that come with involvement.

Companies already providing support should continue. Companies that are not currently supporting their employee's involvement have a longer process to implement. I propose all companies communicating a positive stance toward supporting external employee involvement. Individuals should start the conversation and disseminate the benefits to management. Companies and employees need to agree what is a reasonable budget and schedule for Agile community involvement activities. Though most companies cannot fully implement this strategy immediately, in the mid-range period of six months to one year, it demonstrates a strong, pointed step to address the lack of company support hindering involvement among both men and women.

The benefits of engagement to employees, especially women, are immeasurable. Involvement can help to build women's confidence by making them feel appreciated, valued, and trusted in the workplace to manage their career and seek new ideas for improvement. If companies deem involvement a priority, it will peak employee's interests and they will likely become more involved, invested, and more valuable knowledge workers.

**Promote and seek out diversity in Agile community activities.** The second mid-range strategy is the promotion of diversity through specifically seeking it out in Agile community activities. Through both increased company support and extending personal invitations to participate, the involved Agile community should become more diverse organically. However, this does not address the issue of the same topics and the same people presenting them, which led to some women being intimidated and disinterested. This strategy is a mid-range implementation because it will take time to change how the Agile community organizes its activities.

For many Agile user groups, one person oversees the organization. They organize the meetings, schedule the speakers, order the food, choose the topics, etc. At large Agile conferences the conference chairs rotate so there are new ideas and shared responsibility. However, the submission processes and the conferences are conducted in a very similar way each year. The people reading the submissions are usually veterans of the process, too. While this contributes to a smooth event, it does not lend itself to variety. Many conferences and events are planned a year or more ahead of time; therefore, changes need to be implemented in a mid-range period of three months to three years.

Individuals, local groups, and companies need to promote diversity in the topics they are discussing, the people presenting the topics, and the venues and schedules that usually are

unchanged. While this presents a challenge in logistics and planning, diversity is likely to attract and engage more participants. This can start at the user group level and can be suggested at the larger conference level.

An engaged audience with diverse ideas leading to knowledge generation, collaboration, and idea sharing is the desired outcome of this push for diversity. If women observe other women presenting and engaged, or are invited to do so, they will likely to continue to attend and promote the activities. As demonstrated in one of the interviews, when the same speakers are presenting stale topics that do not engage the broader audience, women feel less inclined to participate in the future.

**Encourage and facilitate networking among women.** The final mid-range strategy is encouraging and facilitating networking among women. Intimidation from a lack of diversity was a reason that led to women's lower involvement levels. If events become more diverse, or there are specific events for women to meet each other, this reason's significance will start to decrease. If women develop relationships with other women, personal invitations will increase, women will feel involved, welcomed, confident, and comfortable, and likely will be interested in increasing their involvement.

Individuals need to introduce themselves to women at gatherings. They need to introduce women to other women and nurture the networking relationships after the gathering. Though there are all-women groups, these are infrequent or not well attended. Companies can encourage and support these gatherings by funding or hosting them.

At large conferences, women can informally have dinner or form a group to chat about ideas. Though this seems immediate, it will take more of a mid-range implementation to form

lasting relationships and plan women's events. In addition, larger conferences are held once a year and larger events with international representation have a longer lead-time. This strategy can be implemented over the next three months to three years and will rely on targeted efforts and organic growth.

### **Long-term Implementation**

Long-term actions and implementation of strategies can have noticeable impact during the immediate and mid-range periods, too. These efforts usually take more time to have an expansive, sustainable impact over the populations influence. I propose expanding and improving early recruitment efforts in STEM fields toward girls and women to be implemented over a long-term period.

The research shows many reasons for gender disparity in STEM fields (Adams & Weiss, 2011; Jones, 2010; Etzkowitz et al., 2010). The main reasons are societal perceptions and stereotypes around men and women's skills differences. By continuing to focus on promoting STEM skills to all children, especially girls, in a different it will challenge and break down these societal barriers. I propose to promote STEM fields in new ways including educating adults, engaging children, and making technology fun.

Educating adults about technology and the broad range of possible careers will increase the likelihood of them passing this knowledge on to their children and promoting involvement in STEM-related programs. Education can use simple workshops, either through local organizations, or through larger avenues. These avenues can include special interest pieces in newspapers or documentaries funded by technology companies or local organizations.

Individuals who work in technology-related careers have a responsibility to explain their daily

job, instead of glossing over it at a high level to avoid confusion. By explaining technology to other people, it demystifies the field and generates more interest through shared understanding.

Another facet of educating adults is educating college students that a STEM career is a possibility. The research cites that many women did not think about a STEM career or even know it was possible and of those that did, many dropped out because of stereotypical and societal issues (Jones, 2010). The same was true of women who completed college but later dropped out of STEM fields because their companies were not supporting them (Judy, 2007). Education and promotion needs to be present at all levels of recruitment.

Engaging children and making technology fun is an undertaking that has been continually tried and tried again. However, it is not working because the girls are not retained through these efforts. I recommend local organizations, schools, companies, and individuals involved in these efforts look closely at the population they are targeting to determine what is missing from their efforts. Perhaps the message is only appealing to boys because of masculine language or colors. Perhaps the promotion is not distributed equally in schools. Perhaps the activities themselves are discouraging. I recommend all involved in organizing and promoting STEM recruitment activities analyze their target demographic and conduct background research including focus groups or interviews. These groups should run a Strengths Weaknesses Opportunities and Threats (SWOT) analysis to determine the correct action to improve the activities.

Until more girls are interested in STEM fields, pursue them in high school, undergraduate degrees, and career opportunities, these impacts will not be immediately noticeable. However, these actions and activities need to start immediately to begin to reap their benefits. If these actions are successful in sustaining the current women in STEM fields and they advance in



leadership and management positions, the STEM environment will be more welcoming and hospitable to girls. I hope that the trend of increased women in STEM fields continue to diminish the gender disparity society sees today. If there are more women who are included and welcomed, with mentors and role models to emulate, they will be more involved in the Agile community in higher proportions.

### **Recommendations for Future Research**

This action research project yielded a wide array of data that was vital to understanding reasons for women's involvement levels in the Agile community and strategies to implement and increase this involvement. However, as I analyzed the data and wrote up the findings and recommendations, a few items needed further research and clarification. I recommend that future researchers interview men to understand their perceptions about themselves and their involvement, understand the benefits of involvement, and determine if the strategies and implementation were successful or need to be adjusted.

I recommend giving men an integral part in a related study. I noticed many trends when interviewing women including the desire to help other women, their response to a call to action, the passion surrounding their jobs, and perceptions about themselves and other women. I recommend men be involved in interviews to compare their traits and perceptions with women's. Additionally, in the survey, I asked questions, which yielded results about individual perceptions and perceptions of women. I recommend asking men the same questions about perceptions of other men's involvement to see if the themes are similar.

I initially harbored assumptions about benefits of involvement among women. One example was that the level of involvement affected retention within the Agile industry and at

companies. While the survey and interviews had a few questions that skirted the idea, I did not focus specifically on this correlation. The result was a lack of significant data to draw this conclusion. In future research, I recommend placing larger emphasis on benefits of involvement including retention. If there is a relationship with involvement benefits, companies will be likely to promote and support involvement as I recommend, which will help women and men's involvement in the Agile community overall.

Finally, another study should assess if the strategies were successful to increase women's involvement levels. The study should determine if the strategies need adjustment to realize their benefits. This check-in could be done in different stages and to address different strategies based on the implementation progress of the strategies within the Agile community.

### **Conclusion**

Diversity is an asset in all fields of work and study (Ridley & Young, 2012). When groups of individuals are not present or involved within a field, it is detrimental to all invested. Women's involvement in Agile community activities is an asset to all its members. I hope a boost in this involvement will reap many unseen, diverse benefits as discussed in my findings and recommendations.

My research uncovered explanations why established female Agile practitioners' levels of involvement are lower than men's, and the widely different perceptions men, women, and society have relating to these reasons for women's lower involvement. The research identified five strategies to be implemented and tested to increase women's involvement in the Agile community over immediate, mid-range, and long-term periods.

Increasing involvement levels is more complex than simply getting women more involved in Agile community activities. My recommended strategic implementation addresses the most prevalent reasons women are less involved in the Agile community. By understanding why these reasons are hindering women's involvement and tailoring the recommended strategies to them, the Agile community can address the underlying issues (societal perceptions) as opposed to addressing only the symptoms. There is no immunity to generally accepted societal perceptions and stereotypes. By implementing strategic actions immediately, mid-range, and long-term the Agile community will slowly challenge and change perceptions through measurable improvement in women's involvement levels. Additionally, by testing the strategic actions and adjusting where necessary, Agile community members will ensure the strategies stay viable in addressing the societal climate and employing sustainable solutions to increase gender diversity in Agile involvement and STEM fields.

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## Appendix A

### Interview Consent Form

#### *Women's Involvement in the Agile Community* **INFORMATION AND CONSENT FORM**

##### **Introduction:**

You are invited to participate in a research study investigating the barriers to women's involvement in the Agile industry. Natalie Warnert, a graduate student at St. Catherine University, will conduct this study under the supervision of Scott Peterson, a faculty member in the Department of Organizational Leadership. You were selected as a possible participant in this research through someone in the Agile community who thinks highly of your work and experience. Please read this form and ask questions before you agree to be in the study.

##### **Background Information:**

The purpose of this study is to identify reasons women are less involved in the Agile community, and strategies to overcome these reasons in order to support greater involvement levels. For the purposes of this study, I define "involvement" as activities external to daily work including but not limited to blogging, article publication, conference proposal submission, conference presentations, and user group membership and involvement. I expect approximately seven people to participate in this phase of my research.

##### **Procedures:**

If you decide to participate, we will set up a meeting time for approximately one hour using Google+ Hangouts or Skype video call services or in person if we are in close proximity. If either of these options does not work, we can set up a conference call line for the interview. I will record the interview so I can transcribe the interview through a secure, confidential electronic transcription service and review the data and for analysis. I will not use the recording and transcript for other purposes and I will keep your name and any identifying information confidential. You can request to stop the interview at any time.

##### **Risks and Benefits of being in the study:**

The study has minimal risks. There is a risk that you might reveal confidential information to me through our interview interaction. I will ensure personal identifying information remains confidential. You are free to strike statements from the record at any time or request I stop recording and I will comply. You are free to terminate your involvement in the study at any time.

There are no direct benefits to you for participating in this research. It is hoped that there will be an overall benefit to the Agile community, in that women will gain support and encouragement to become more involved.

**Confidentiality:**

I will not disclose personally identifiable information I obtain in connection with this research; I will keep your answers confidential. In any written reports or publications, no one will be personally identified or identifiable.

I will keep the research results in a secure hard drive on my computer and only my advisor and I will have access to the records while I work on this project. I will finish analyzing the data by June 2015. I will then destroy all original recordings and personal identifying information that is linkable back to you.

**Voluntary nature of the study:**

Participation in this research study is voluntary. Your decision whether or not to participate will not affect your future relations with St. Catherine University or me in any way. If you decide to participate, you are free to stop at any time without affecting these relationships.

**Contacts and questions:**

If you have any questions, please feel free to contact me, Natalie Warnert at (320) 250-9301 or nawarnert@stkate.edu. If you would prefer not to ask me directly, you may contact Scott Peterson, my faculty advisor at (763) 331-0663 or petersmus@gmail.com. If you have other questions or concerns regarding the study and would like to talk to someone other than the researcher(s), you may also contact Dr. John Schmitt, Chair of the St. Catherine University Institutional Review Board, at (651) 690-7739 or jsschmitt@stkate.edu.

You may keep a copy of this form for your records.

**Statement of Consent:**

You are making a decision whether or not to participate. Your signature indicates that you have read this information and your questions have been answered. Even after signing this form, please know that you may withdraw from the study at any time by notifying me.

I consent to participate and to be recorded in the study.

---

Signature of Participant

Date



## Appendix B

### Semi-structured Interview Questions

1. Tell me about how you became involved in the Agile community and what led you to take your career in this direction. What motivated your involvement in the Agile community? (This background information helps me to get an idea of what drove them to this direction and will help to get them comfortable and establish some camaraderie)
2. Where would you like to see your career in Agile go?
3. When you think about the Agile industry, in your opinion why are there more men than women?
4. When you think about blogs, conference speakers, journal articles, what is your opinion about why there are so many more men than women doing these activities?
5. Where would you rate yourself on the scale? Where would you like to be? What would need to change/shift/happen in order for you to be as involved as you would like?
6. In what ways are you satisfied with your involvement in the Agile community?
7. In what ways are you dissatisfied with your involvement in the Agile community?
8. Which of the following have you participated in and what, if any, was the most helpful support you received in doing so?
  - i. Conference attendance
  - ii. Proposal submission to speak at a conference
  - iii. Blogging on Agile topics
  - iv. Article publication
  - v. Advanced Agile certification
  - vi. User group membership and participation
  - vii. Other

- b. What effect did that support have on your interest and ability to be more involved?
9. What other actions can be taken to support and encourage professional women in the Agile community to be more involved in contributing their knowledge and insights through some of the activities we discussed?

## Appendix C

### Tiered Involvement Levels for Agile Professionals

	<b>None</b>	<b>Less than one per year</b>	<b>1-2 per year</b>	<b>Three or more per year</b>
<b>Conference Attendance</b>				
<b>Conference Presentation or submission to present</b>				
<b>Article Publication or submission</b>				
<b>Blogging</b>				
<b>User Group Participation</b>				
<b>Agile Certification</b>				

Directions: To determine level of involvement, mark each column at the appropriate level. Add scores from all columns together. Divide sum by 16 and multiply by 10 to get the appropriate score on a ten point scale 10.

## Appendix D

### Survey Consent Form

**Introduction:**

You are invited to participate in a research study, in the form of an online survey, investigating women's involvement in the Agile industry. Natalie Warnert, a graduate student at St. Catherine University, will conduct this study under the supervision of Scott Peterson, a faculty member in the Department of Organizational Leadership. Please read this consent before you agree to participate in the survey.

**Background:**

The purpose of this study is to identify reasons women are less involved in the Agile community, and strategies to overcome these reasons in order to support greater involvement levels. For the purposes of this study, I define "involvement" as activities external to daily work including but not limited to blogging, article publication, conference proposal submission, conference presentations, and user group membership and involvement.

**Procedures:**

This survey will take approximately 10 minutes to complete and is composed of multiple choice and short answer questions. You can only participate in the survey once. Your response will only be counted if the survey is completed in its entirety. Please feel free to distribute the survey link to other professionals working within the Agile industry via social media. There is no compensation offered for participating in this survey.

**Risks and Benefits of being in the study:**

The study has minimal risks. There is a risk that you might reveal confidential information through the short answer portion of the survey. I will ensure personal identifying information remains confidential. You are free to terminate your involvement in the survey, but incomplete surveys will not be counted.

There are no direct benefits for participating in this research. It is hoped that there will be an overall benefit to the Agile community, in that women will gain support and encouragement to become more involved.

**Confidentiality:**

Your participation in this survey will be anonymous unless you choose to reveal personally identifying information in the short answer portion of the survey. I will not have access to names or email addresses associated with the SurveyMonkey participation protocols. I will not disclose personally identifiable information obtained in connection with this research. In any written

reports or publications, no one will be personally identified or identifiable.

I will store the research results on SurveyMonkey in my password secured account. Only my advisor and I will have access to the records while I work on this project. I will finish analyzing the data by June 2015. I will then destroy all personal identifying information that is linkable back to you that may have been obtained through the survey.

**Voluntary nature of the study:**

Participation in this research study is voluntary. Your decision whether or not to participate will not affect your future relations with St. Catherine University or me in any way. If you decide to participate, you will not affect these relationships.

**Contacts and questions:**

If you have any questions, please feel free to contact me, Natalie Warnert at info@nataliewarnert.com. If you would prefer not to ask me directly, you may contact Scott Peterson, my faculty advisor at petersmus@gmail.com. If you have other questions or concerns regarding the study and would like to talk to someone other than the researcher, you may also contact Dr. John Schmitt, Chair of the St. Catherine University Institutional Review Board, at (651) 690-7739 or jsschmitt@stkate.edu.

**Statement of Consent:**

You are making a decision whether or not to participate. By continuing to the survey, it indicates that you have read this information and consent.

## Appendix E

### Survey Questions

#### Survey Questions for Agile Community Involvement

##### Demographic Information

1. What is your gender?
  - a. Male
  - b. Female
2. What is your age range?
  - a. <20
  - b. 20-25
  - c. 25-29
  - d. 30-39
  - e. 40-49
  - f. 50-59
  - g. 60+
3. How long have you been practicing Agile methods?
  - a. Less than one year
  - b. 1-2 years
  - c. 2-5 years
  - d. 5-10 years
  - e. 10+ years
  - f. I do not use Agile methods
  - g. Other <please fill in>

##### Employment Information

4. What best describes your employment status?
  - a. Full time employee
  - b. Part time employee
  - c. Contractor
  - d. Consultant
  - e. Not employed
  - f. Other
5. What is your job title?
  - g. Developer
  - h. Business Analyst
  - i. Tester/QA
  - j. ScrumMaster
  - k. Product Owner/Product Manager
  - l. Project Manager
  - m. Manager

- n. Executive Management
  - o. Other – please fill in
6. Please rank your job satisfaction on a scale of 0-10 in your current position at your current company (10 – Extremely satisfied, 0 – Not satisfied)
  7. About how long have you been in your current position?
  8. Does your company provide any financial support or funding for involvement in the Agile industry for activities outside your day to day job?
    - p. Yes
      - i. Conferences
      - ii. Certifications
      - iii. Training
      - iv. Other
    - q. No
  9. Does your company encourage and support your involvement in the Agile industry?
    - a. Yes
      - i. How does your company encourage and support your involvement in the Agile industry?
    - b. No

### Your Agile Involvement

In this context, Agile involvement is defined as your participation in activities within the external Agile community - this may not be a part of your internal daily job and you may engage in these activities on your own time. Examples include participation in user groups, blogging, submitting proposals to speak at conferences or have articles published, etc.

10. Please fill out the matrix below by selecting one option in each column indicating your level of involvement in each activity.

	None	Less than one per year	1-2 per year	Three or more per year
<b>Conference Attendance</b>				
<b>Conference Presentation or submission to present</b>				
<b>Article Publication or submission</b>				
<b>Blogging</b>				
<b>User Group Participation</b>				
<b>Agile</b>				

<b>Certification</b>				
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Other involvement <please specify>

11. On a scale of 0-10 how would you rate your involvement in the Agile community based on the above matrix activities? (10 – extremely involved, 0 – not involved)
12. What level would you like your involvement in the external Agile community to be at? ? (10 – extremely involved, 0 – not involved)
13. On a scale of 0 – 10, how satisfied are you with your current level of involvement in external Agile community activities? (10 – extremely involved, 0 – not involved)
14. What is your primary reason for being involved in the Agile community (outside of your daily job)?
  - a. Short answer
15. What prevents you from being more involved in the Agile community (outside your daily job)? Please choose the top two reasons
  - a. Competing priorities for my time
    - i. Family
    - ii. Other organizational commitments
    - iii. Work
    - iv. School
    - v. Recreational activities or hobbies
  - b. Organizational and career reasons
    - vi. I would have to pay for it out of my own pocket
    - vii. I can't take time off work
    - viii. It's not part of my job
    - ix. I'm involved enough at work
    - x. I don't see the benefit of it in my career
  - c. Lack of confidence, fear of perception from others
    - xi. People won't want to hear my ideas
    - xii. I do not have enough experience to be more involved
    - xiii. I am afraid of being wrong or losing face
    - xiv. I cannot produce something of high enough caliber to contribute
  - d. Intimidation from lack of diversity
    - xv. There are few people like me and it makes me feel uncomfortable or unwelcome
    - xvi. The industry does not cater to me
    - xvii. I have not been invited to participate
    - xviii. I do not have a large enough network to feel comfortable or build more connections
    - xix. The same people are always involved and I do not know how to break through
- b. Some event or interaction has deterred my involvement interest



- i. I have been met with hostility in the community
- ii. I am burned out from trying to be involved
- iii. I was in a situation that made me uncomfortable when I was trying to be more involved
- c. I am not interested in being more involved
- d. Other <please specify>

### **Women's Involvement in the Agile Community**

16. When you think about the Agile community, in your opinion why are men more involved than women (outside their daily job)? The reasons are written from a women's point of view and this is your opinion of why they are less involved (choose the top two you think apply).

- a. Competing priorities for their time
  - i. Family
  - ii. Other organizational commitments
  - iii. Work
  - iv. School
  - v. Recreational activities or hobbies
- b. Organizational and occupational reasons
  - i. They would have to pay for it out of my own pocket
  - ii. They can't take time off work to be more involved
  - iii. It's not part of their job to be more involved
  - iv. They are involved enough at work
  - v. They don't see the benefit of it in their career
- c. Lack of confidence, fear of perception from others such as:
  - i. People won't want to hear their ideas
  - ii. They think they do not have enough experience to be more involved and contribute
  - iii. They are afraid of being wrong or losing face
  - iv. They think they cannot produce something of high enough caliber to contribute
- d. Intimidation by lack of diversity
  - i. There are fewer women than men and it makes them feel uncomfortable or unwelcome
  - ii. The industry caters to men
  - iii. They have not been invited to participate
  - iv. They do not have a large enough network to feel comfortable or build connections

- i. The same people are always involved and they do not know how to break through
- e. Some event or interaction has deterred my involvement interest
  - ii. They have been met with hostility in the community
  - iii. They are burned out from trying
  - iv. They were in a situation that made them uncomfortable when they were trying to be more involved
- f. Women are not interested in being more involved
- g. Men and women are involved equally
- h. Other <please specify>

### **Strategies for Greater Involvement**

17. What support or actions have helped you or would help you to become more involved within the Agile community (outside of your daily job)?
18. What support or actions do you think would help encourage women to become more involved in the Agile community (outside of their daily job)?
19. Any further comments regarding involvement in Agile community activities you would like to share?

## Appendix F

### Survey and Interview Participant Comparison

	Age	Agile Experience (years)	Current Involvement (0-10)	Desired Involvement (0-10)	Satisfied with Current Involvement? (Y/N)	Involvement based on matrix (Appendix C)
1	55	10+	4	4	Yes	3
2	45	6-10	3	3	Yes	3
3	35	1-2	4	7	No	4
4	32	2-5	8	9	Yes	5
5	28	2-5	5	8	No	9
6	29	2-5	6	9	No	5
7	34	6-10	4	7	No	5
Mean	36.9	2-5 years	4.86	6.71	N/A	4.86

	Men (40%)	Women (60%)	Statistically Significant Difference? (Appendix F)
Mean Age Range (years)	30-39	30-39	No
Mean Agile Experience (years)	6-10 years	2-5 years	Yes
Job Type (Mode)	Developer/Engineer	ScrumMaster	N/A
Mean Job Satisfaction (0-10)	6.9	7	No
Mean Tenure at Current Job (years)	2.25	3.51	No
Mean Self-Reported Involvement Level (0-10)	5.67	4.47	Yes
Mean Desired Involvement Level (0-10)	7.03	6.78	No
Mean Satisfaction with Involvement Level (0-10)	6.26	5.53	No
Mean Matrix Calculated Involvement Level (0-10)	4.81	3.77	Yes

## Appendix G

### Variance and T-Test Results

Table 3: Hypotheses of Women's job satisfaction with or without company financial support	
Null Hypothesis	There is no statistically significant difference in women's mean job satisfaction when companies provide financial support for Agile involvement activities.
Research Hypothesis	There is a statistically significant difference in women's mean job satisfaction when companies provide financial support for Agile involvement activities.

Table 4: F-Test Two-Sample for Variances: Women's Mean Job Satisfaction (0-10) with Company Provided Financial Support and No Company Provided Financial Support for Involvement Activities		
	<i>Job Satisfaction With Company Provided Financial Support</i>	<i>Job Satisfaction Without Company Provided Financial Support</i>
Mean	7.694	5.591
Variance	4.561	4.348
Observations	36	22
F	1.04889663	
F Critical one-tail	1.98437582	

Table 5: t-Test: Two-Sample Assuming Equal Variances. Women's mean job satisfaction with and without company financial support		
	<i>Job Satisfaction With Company Provided Financial Support</i>	<i>Job Satisfaction Without Company Provided Financial Support</i>
Mean	7.694	5.591
Variance	4.561	4.348
Observations	36	22
Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.000269	

In Table 4, F is less than the F Critical one-tail, so the variances are equal and a T-test assuming equal variances was run. In Table 5, the difference in means is statistically significant because the p-value is less than .05 (alpha). Therefore we reject the null hypothesis and accept the research hypothesis. There is a statistically significant difference in women's mean job satisfaction when company financial support is given.

Table 6: Hypotheses of Men and Women's Satisfaction with their Involvement in the Agile Community	
Null Hypothesis	There is no statistically significant difference in men and women's satisfaction of their involvement in the Agile community.
Research Hypothesis	There is a statistically significant difference in men and women's satisfaction of their involvement in the Agile community.

Table 7: F-Test Two-Sample for Variances: Men and Women's Mean Satisfaction with Their Involvement in the Agile Community (0-10)		
	<i>Women's Involvement Satisfaction</i>	<i>Men's Involvement Satisfaction</i>
Mean	5.526	6.265
Variance	7.503	6.685
Observations	57	34
F	1.12241275	
F Critical one-tail	1.71021495	

Table 8: t-Test: Two-Sample Assuming Equal Variances. Men and Women's Mean Satisfaction with their Agile Community Involvement (0-10)		
	<i>Women's Involvement Satisfaction</i>	<i>Men's Involvement Satisfaction</i>
Mean	5.526	6.265
Variance	7.503	6.685
Observations	57	34
Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.10371693	

In Table 7, F is less than the F Critical one-tail, so the variances are equal and a T-test assuming equal variances was run. In Table 8, the difference in means is not statistically

significant because the p-value is not less than .05 (alpha). Therefore, we accept the null hypothesis; there is no statistically significant difference in men and women's satisfaction with their Agile community involvement.

Table 9: Hypotheses of Men and Women's Desired Level of Involvement in the Agile Community	
Null Hypothesis	There is no statistically significant difference in men and women's desired levels of involvement in the Agile community.
Research Hypothesis	There is a statistically significant difference in men and women's desired levels of involvement in the Agile community.

Table 10: F-Test Two-Sample for Variances. Men and Women's Desired Levels of Involvement in the Agile Community		
	<i>Variable 1</i>	<i>Variable 2</i>
Mean	6.789	7.029
Variance	4.618	4.879
Observations	55	34
F	0.947	
F Critical one-tail	0.606	

Table 11: t-Test: Two-Sample Assuming Unequal Variances. Men and Women's Desired Levels of Involvement in the Agile Community		
	<i>Variable 1</i>	<i>Variable 2</i>
Mean	6.789	7.029
Variance	4.618	4.879
Observations	55	34
Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.303	

In Table 10, F is greater than the F Critical one-tail, so the variances are unequal and a T-test assuming unequal variances was run. In Table 11, the difference in means is not statistically significant because the p-value is not less than .05 (alpha). Therefore, we accept the null hypothesis; there is no statistically significant difference in men and women's desired levels of involvement in the Agile community.

Null Hypothesis	There is no statistically significant difference in men and women's levels of involvement in the Agile community.
Research Hypothesis	There is a statistically significant difference in men and women's levels of involvement in the Agile community.

	<i>Women's Involvement</i>	<i>Men's Involvement</i>
Mean	4.474	5.667
Variance	9.004	8.743
Observations	57	36
F	1.051876098	
F Critical one-tail	1.710214954	

	<i>Women's Involvement</i>	<i>Men's Involvement</i>
Mean	4.474	5.667
Variance	9.004	8.743
Observations	57	36
Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.0319	

In Table 13, F is less than the F Critical one-tail, so the variances are equal and a T-test assuming equal variances was run. In Table 13, the difference in means is statistically significant because the p-value is less than .05 (alpha). Therefore, we reject the null hypothesis and accept the research hypothesis; there is a statistically significant difference in men and women's levels of involvement in the Agile community.

Null Hypothesis	There is no statistically significant difference in men and women's frequency of conference attendance in the last year.
Research Hypothesis	There is a statistically significant difference in men and women's frequency of conference attendance in the last year.

Table 16: t-Test: Two-Sample Assuming Equal Variances Frequency of Conference (0-3) Attendance in the Past Year.		
	<i>Women</i>	<i>Men</i>
Mean	1.544	1.889
Variance	1.110	0.902
Observations	57	36
Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.0568	

In Table 16, equal variance assumed because of multiple choice numerical answers (0-3) leading to controlled variability in answers. In Table 16, the difference in means is not statistically significant because the p-value is greater than .05 (alpha). Therefore, we accept the null hypothesis; there is no statistically significant difference in men and women's frequency of conference attendance in the past year.

Table 17: Hypotheses of Men and Women's Frequency of Submitting to Present at Conferences in the Last Year	
Null Hypothesis	There is no statistically significant difference in men and women's frequency of submitting to present at conferences in the last year.
Research Hypothesis	There is a statistically significant difference in men and women's frequency of submitting to present at conferences in the last year.

Table 18: t-Test: Two-Sample Assuming Equal Variances. Men and Women's Frequency of Submitting to Present at Conferences in the Last Year. (0-3)		
	<i>Women</i>	<i>Men</i>
Mean	0.947	1.057
Variance	1.515	1.291
Observations	57	35



Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.335	

In Table 18, equal variance assumed because of multiple choice numerical answers (0-3) leading to controlled variability in answers. In Table 18, the difference in means is not statistically significant because the p-value is greater than .05 (alpha). Therefore, we accept the null hypothesis; there is no statistically significant difference in men and women's frequency of submitting to present at conferences in the last year.

Table 19: Hypotheses of Men and Women's Frequency of Submitting to Articles for Publication in the Last Year	
Null Hypothesis	There is no statistically significant difference in men and women's frequency of submitting articles for publication in the last year.
Research Hypothesis	There is a statistically significant difference in men and women's frequency of submitting articles for publication in the last year.

Table 20: t-Test: Two-Sample Assuming Equal Variances. Men and Women's Frequency of Submitting to Articles for Publication in the Last Year (0-3)		
	<i>Women</i>	<i>Men</i>
Mean	0.439	0.528
Variance	0.643	0.999
Observations	57	36
Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.318	

In Table 20, equal variance assumed because of multiple choice numerical answers (0-3) leading to controlled variability in answers. In Table 20, the difference in means is not statistically significant because the p-value is greater than .05 (alpha). Therefore, we accept the null hypothesis; there is no statistically significant difference in men and women's frequency of submitting articles for publication in the last year.

Table 21: Hypotheses of Men and Women's Frequency of Writing Blogs in the Past Year	
Null Hypothesis	There is no statistically significant difference in men and women's frequency of writing blogs in the last year.
Research Hypothesis	There is a statistically significant difference in men and women's frequency of writing blogs in the last year.

Table 22: t-Test: Two-Sample Assuming Equal Variances. Men and Women's Frequency of Writing Blogs in the Past Year (0-3)		
	<i>Women</i>	<i>Men</i>
Mean	0.982	1.444
Variance	1.625	1.968
Observations	57	36
Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.052517	

In Table 22, equal variance assumed because of multiple choice numerical answers (0-3) leading to controlled variability in answers. In Table 22, the difference in means is not statistically significant because the p-value is greater than .05 (alpha). Therefore, we accept the null hypothesis; there is no statistically significant difference in men and women's frequency of writing blogs in the last year.

Table 23: Hypotheses of Men and Women's Frequency of Attending User Groups in the Past Year	
Null Hypothesis	There is no statistically significant difference in men and women's frequency of attending user groups in the last year.
Research Hypothesis	There is a statistically significant difference in men and women's frequency of attending user groups in the last year.

Table 24: t-Test: Two-Sample Assuming Equal Variances. Men and Women's Frequency of Attending User Groups in the Past Year (0-3)		
	<i>Women</i>	<i>Men</i>
Mean	1.930	2.278
Variance	1.316	1.121

Observations	57	36
Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.0730	

In Table 24, equal variance assumed because of multiple choice numerical answers (0-3) leading to controlled variability in answers. In Table 24, the difference in means is not statistically significant because the p-value is greater than .05 (alpha). Therefore, we accept the null hypothesis; there is no statistically significant difference in men and women's frequency of attending user groups in the last year.

Table 25: Hypotheses of Men and Women's Frequency of Earning Certifications in the Past Year	
Null Hypothesis	There is no statistically significant difference in men and women's frequency of earning certifications in the last year.
Research Hypothesis	There is a statistically significant difference in men and women's frequency of earning certifications in the last year.

Table 26: t-Test: Two-Sample Assuming Equal Variances. Men and Women's Frequency of Earning Certifications in the Past Year (0-3)		
	<i>Women</i>	<i>Men</i>
Mean	0.732	0.528
Variance	0.200	0.256
Observations	56	36
Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.022566	

In Table 26, equal variance assumed because of multiple choice numerical answers (0-3) leading to controlled variability in answers. In Table 26, the difference in means is statistically significant because the p-value is less than .05 (alpha). Therefore, we reject the null hypothesis and accept the research hypothesis; there is a statistically significant difference in men and women's frequency of earning certifications in the last year.

Table 27: Hypotheses of Men and Women's Involvement Level Calculated Through Activities they Participate in (0-10)	
Null Hypothesis	There is no statistically significant difference in men and women's involvement level calculated through activities they participate in.
Research Hypothesis	There is a statistically significant difference in men and women's involvement level calculated through activities they participate in.

Table 28: t-Test: Two-Sample Assuming Equal Variances. Men and Women's Involvement Level Calculated Through Activities they Participate in (versus self-reported involvement level) (0-10)		
	<i>Women</i>	<i>Men</i>
Mean	3.770	4.809
Variance	8.004	7.094
Observations	62	36
Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.038312	

In Table 28, equal variance assumed because of multiple choice numerical answers (0-3) leading to controlled variability in answers. In Table 28, the difference in means is statistically significant because the p-value is less than .05 (alpha). Therefore, we reject the null hypothesis and accept the research hypothesis; there is a statistically significant difference in men and women's involvement levels calculated through activities they participate in.

Table 29: Hypotheses of Men and Women's Involvement Level Calculated Through Activities they Participate in Compared to their Self-Reported Level of Involvement	
Null Hypothesis	There is no statistically significant difference in men and women's involvement level calculated through activities they participate in compared to their self-reported level of involvement.
Research Hypothesis	There is a statistically significant difference in men and women's involvement level calculated through activities they participate in compared to their self-reported level of involvement.

Table 30: t-Test: Two-Sample Assuming Equal Variances. Women's Level of Calculated Involvement Compared to Self-Reported Levels		

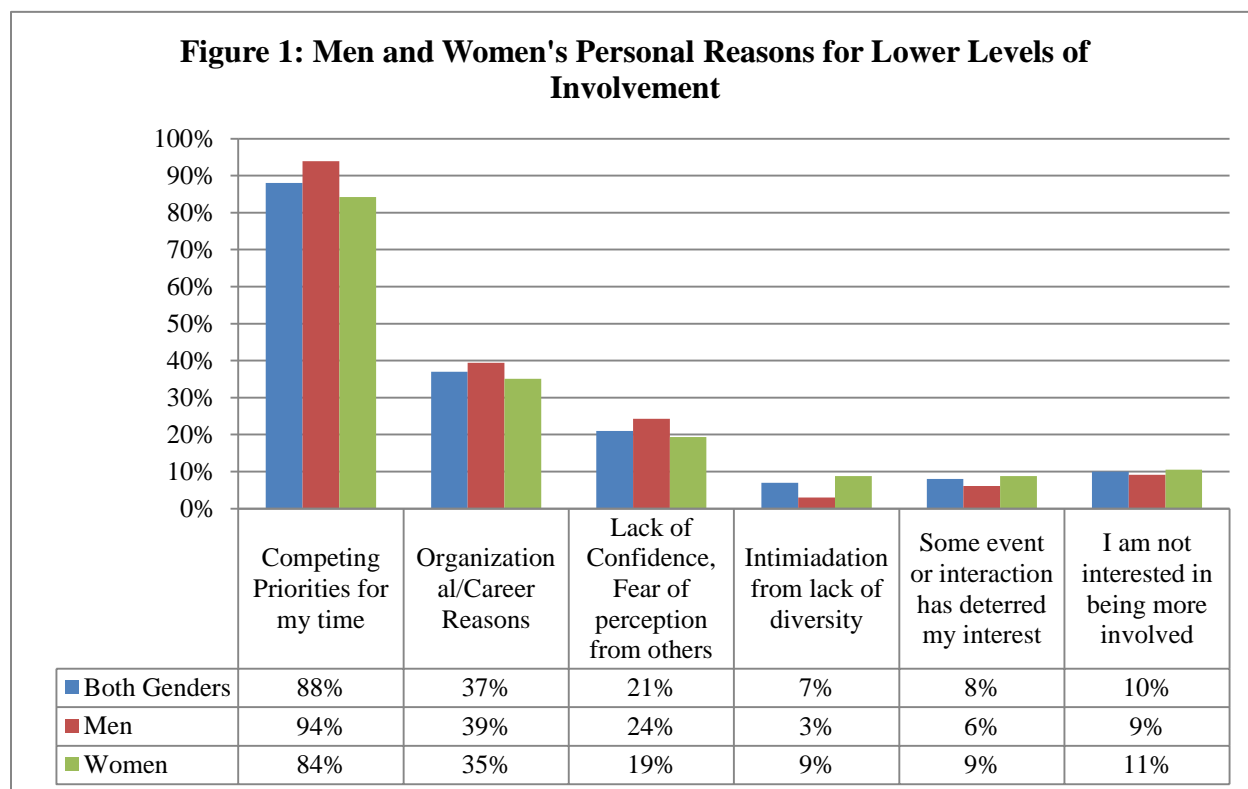
	<i>Women's Calculated Level of Involvement</i>	<i>Women's Level of Self-Reported Involvement</i>
Mean	3.770	4.474
Variance	8.004	9.004
Observations	62	57
Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.095314	

Table 31: t-Test: Two-Sample Assuming Equal Variances. Men's Level of Calculated Involvement Compared to Self-Reported Levels		
	<i>Men's Calculated Level of Involvement</i>	<i>Men's Self-Reported Level of Involvement</i>
Mean	4.809	5.667
Variance	7.094	8.743
Observations	36	36
Hypothesized Mean Difference	0	
P(T<=t) one-tail	0.100	

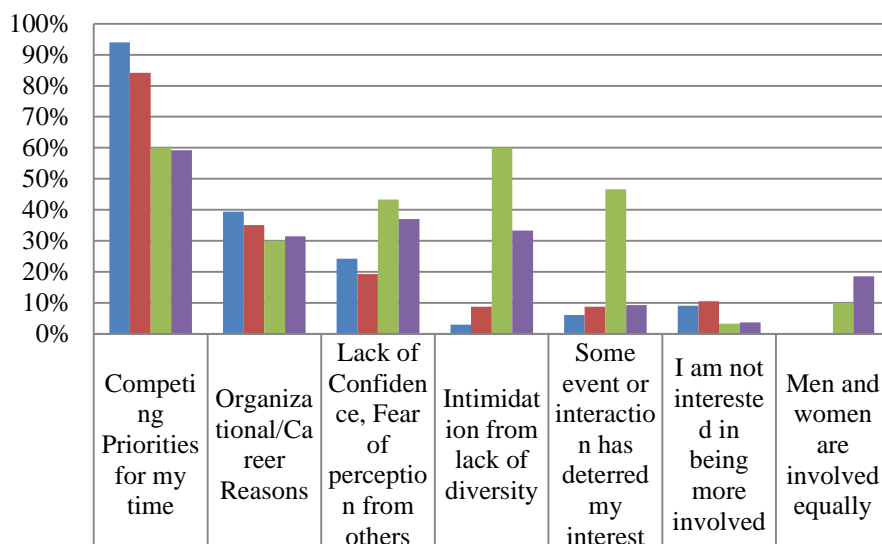
In Table 30 and 31, equal variance assumed because of multiple choice numerical answers (0-3) leading to controlled variability in answers. In Table 30 and 31, the difference in means is not statistically significant because the p-value is greater than .05 (alpha). Therefore, we accept the null hypothesis; there is no statistically significant difference in men and women's involvement levels calculated through activities they participate in compared to their self-reported level of involvement. Men and women both over-reported their involvement when self-reporting. Both the self-reported and calculated levels are statistically significant and men and women's involvement levels are not, this does not change the initial conclusion that men have higher mean involvement levels than women, both self-reported and calculated.

## Appendix H

### Graphical Representation of Survey Data

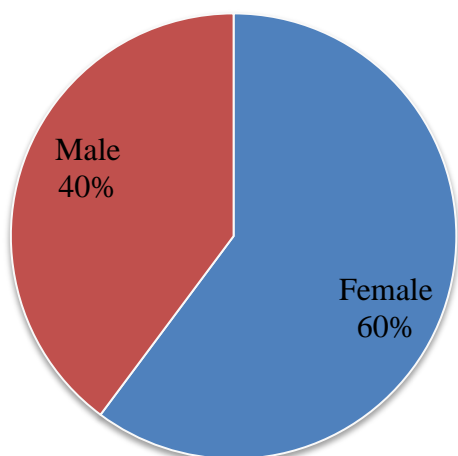


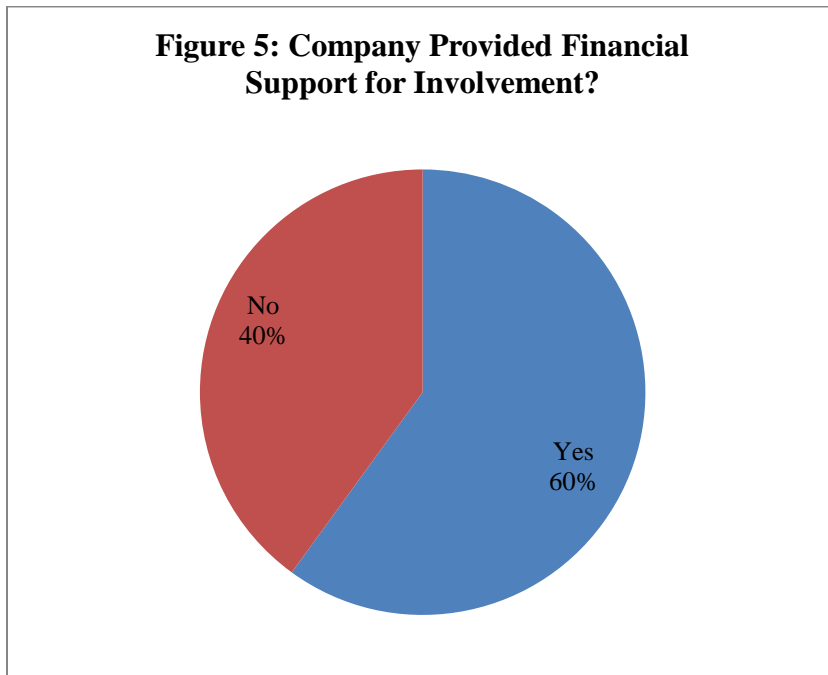
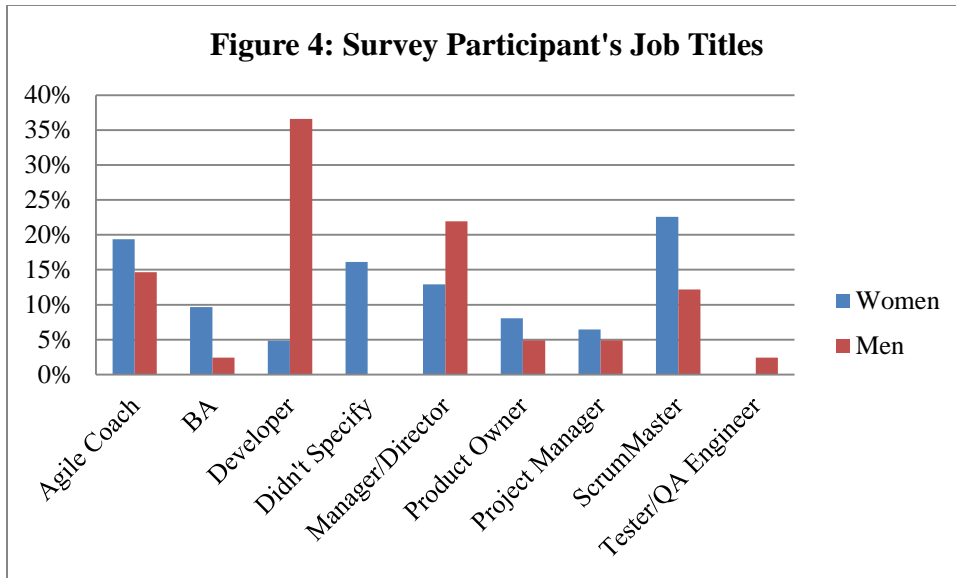
**Figure 2: Men and Women's Personal Reasons for Lower Involvement Levels Compared with Men and Women's Perceptions of Reasons for Women's Lower Involvement Levels**



■ Men (Individual)	94%	39%	24%	3%	6%	9%	
■ Women (Individual)	84%	35%	19%	9%	9%	11%	
■ Men (Perception of Women)	60%	30%	43%	60%	47%	3%	10%
■ Women (Perception of Women)	59%	31%	37%	33%	9%	4%	19%

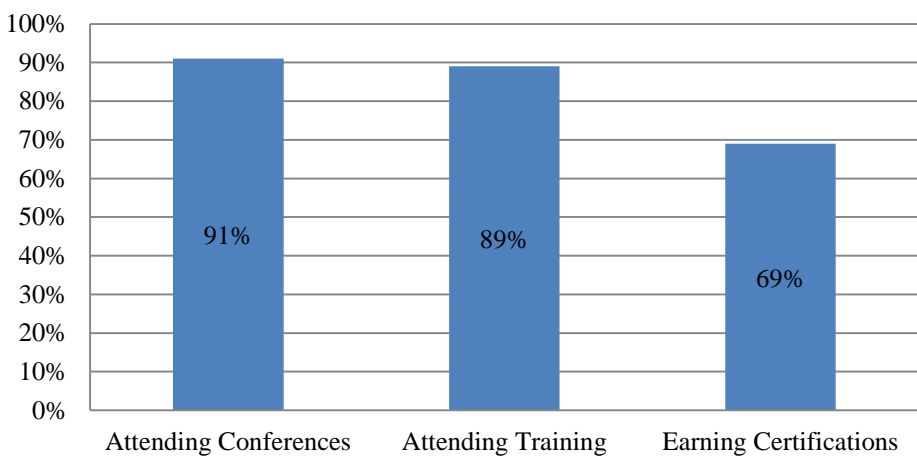
**Figure 3: Survey Participant Gender Distribution**







**Figure 6: What Involvement Activities are Company Funded?**



**Figure 7: Company Provided Encouragement for Involvement?**

