Women in Technology

An investigation into how the demands of a mid-level technical woman's home life, as well as how their male dominated working team environment can affect their retention rates in American IT organizations

Anna Touzel

A dissertation presented in partial fulfillment of the requirements for MA in Human Resources Management

National College of Ireland

Submitted to the National College of Ireland, September 2013

Abstract

Purpose: An investigation into how the demands of a mid-level technical woman's home life, as well as how their male dominated working team environment can affect their retention rates in American IT organizations. Author: Anna Touzel

Methalogical approach: Quantitative methods were used in this research report, in the form of an online survey. The survey was used to investigate participant's home lives and team environments and how they perceived the organisational culture, mentoring and networking opportunities and flexible work policies within their organisation.

Findings: The results concluded that the barriers to retaining mid-level technical women in the IT indusrty are affected by their family situation and also by their team environment. The most significant findings uncovered the diversity of the women's family situations and the extent to which this affects; what a woman needs from an organisation, in order to be able to balance home and work-life symentaneously. It also uncovered the affects of having a female manager in relation to females perception of organisational cutlure and how important women feel that mentoring and networking are to their success in the indusrty.

Declaration

I hereby certify that the material which is submitted in this thesis towards award of the Masters (M.Sc.) in Human Resource Management is entirely my own work and has not been submitted for any academic assessment other than part-fulfillment of the award named above.

Signature of candidate: ……

Date: ……

Acknowledgements

I would like to express my appreciation to my dissertation supervisor, Michele Kehoe, for her encouraging mind-set. Without her guidance, help and feedback this dissertation would not have been possible.

I would also like to thank my fellow student Aoife Keane, without whom I would have found the process to be much harder and lonely.

Last but not least, I would like to thank my family and my friends for all their love and support.

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List of abbreviations

BLS	Bureau of Labor Statistics
CS	Computer Science
EU	European Union
IT	Information Technology
LPFI	Level Playing Field Institute
NCWIT	National Center for Women and Information Technology
NSF	National Science Foundation
SET	Science Engineering Technology
STEM	Science Technology Engineering Mathematics
UCLA	University of California, Los Angeles
U.S.	United States

Chapter 1: Introduction

1.1 Overview

The aim of this thesis is to determine how mid-level women's home life and team configurations can affect the barriers that they face as an under-represented minority, within technical positions in the information technology (IT) industry. Once this is determined, solutions can be proposed for organisations that can make a difference in their attempts to retain women in the industry.

The second chapter of this study will explore the academic literature and recent discussions regarding women in technology and the industry itself, and will have a particular focus on the reasons women leave the technology industry. In order to understand these issues, it is necessary to examine what barriers women face in the industry and how personal experiences can affect these barriers. Chapter three will list the research questions posed, chapter four will explain the method of research and why it was deployed for this particular research and chapter five will display the results that were discovered. Chapter six will then discuss the results in more detail and chapter seven aims to draw conclusions from the study and pose recommendations for the industry.

1.2 Rationale

The commercialization of the Internet in 1995 opened up the door to a new range of companies that began to emerge (Kleinrock 2011). The IT industry is a rapidly growing industry (Dohm & Shniper 2007), however there is a lack of available IT professional human resources, which is posing a serious concern if the industry is to sustain its rapid growth (Trauth 2000). Consensus among literature is that there is a need to bridge the gap of diversity and increase the numbers within the underrepresented groups into this field. (Ahuja 2002; Panko 2008; Trauth, Quesenberry, Jeria & Huang 2009). Women currently only occupy 25% of professional computing-related positions within the industry. Increasing female participation into technical positions is one of the industry's top priorities (Wentling & Thomas 2009). It is essential that women participate in innovating

and advancing the IT field in order to ensure that the workforce is prepared to meet the employment demands of the future (Simard 2009). Women bring a different perspective to the creation of products to men and their participation is essential in order for the diverse workforce to reflect the diverse customers of the industry (National Center for Women and Information Technology (NCWIT) 2007).

In recognition of the need to increase women in IT, entities such as the European Union and the National Science Foundation are funding vast quantities of research, along with an increase in publications; an *Encyclopedia of Gender and Information Technology* (Quesenberry, Trauth & Morgan 2006), the publication of special issues of *Information Technology and People* (Adam, Howcroft & Richardson 2002) and *Information Systems Journal* (Quesenberry & Trauth 2012). In the 2009 AMCIS conference, a track on gender issues was also established (Trauth et al. 2009). Based on this research and publication trend, organisations such as the NCWIT (www.ncwit.org) have been established to develop interventions in order to address the under-representation of women in the IT industry. This research highlights the complexity of the problem and seeks to find solutions (Trauth et al. 2009).

Extensive research has been conducted on the recruitment of female IT professionals (Ahuja 2002; Panko 2008; Trauth et al. 2009). A study completed by Quesenberry et al. (2006) highlighted women's poor retention statistics once they enter the IT industry which lead to further studies by Hewlett, Luce, Servon, Sherbin, Shiller, Sosnovich & Sunberg (2008), Wentling & Thomas (2009), Trauth et al. (2009), Simard, Davies, Gilmartin, Schiebinger & Whitney (2008) and Simard (2009), who researched women's high attrition rates and the barriers that they face once they enter IT organisations.

To date, most of this research has investigated the barriers that women face, such as a lack of mentoring opportunities and role models, the masculine and achievement culture of the organization and a lack of work-life balance associated with the industry, and how these differ from the barriers that men face (Hewlett et

al. 2008; Simard et al. 2008; Simard, 2009). However little research has been conducted regarding how women's own personal situations and individual team configurations affect these barriers and how they relate to their retention. This is worthy of research as the sector is still struggling to find IT talent in the numbers necessary to satisfy its growth. This aspect of women's retention has not been investigated and deserves attention. Further research is required to increase female participation and increase the poor retention statistics of this industry (Csorny 2013).

The current study aims to capture unique data and explore the reality of people's lives and how each personal situation affects the complex set of barriers that converge at the woman's mid-level career stage (Simard et al. 2008).

Chapter 2: Literature Review

2.1 Introduction

This literature review explores the dominant themes of the research: the IT sector, diversity and women in the industry, women in the workforce, and barriers to retaining women in IT such as organizational culture, work-life balance and role models, mentoring and networking. The IT industry is a growing and successful industry; however, it is currently facing a workforce dilemma that threatens to restrict its growth (Csorny 2013). Women are not graduating in the correct proportions from computer science (CS) degrees (National Science Foundation (NSF) 2012), and the women who do enter the industry are leaving after about ten years, at a rate of 41% versus 17% of men (Hewlett et al. 2008). There are sets of complex barriers that face women, which are rooted in work and family issues, outmoded workplace practices and cultures that are not set up for a diverse workforce (Simard et al. 2008). If an understanding of the barriers that women face in the IT workforce can be gained, it will put the industry in a much better position to eliminate the barriers and increase female participation, aiding future growth of the industry.

2.2 The IT sector

The Internet (originally known as ARPANET) first began to be developed in the late 1960s. The first time that it was announced to the world was by the University of California, Los Angeles (UCLA) on the 3rd July 1969 (Kleinrock 2011). The Internet was first commercialized in 1994 (Greenstein 1998) and by 1996 and 1997, Internet growth was measured at about 1,000% year on year (Coffman & Odlyzko 1998). As of late 2012, the number of Internet users is about 2.4 billion (File 2013).

It has been over 50 years since the birth of the Internet, which sparked one of the greatest technological transformations in history. It created an enormous global market for information and communication technologies, which allows information flow and networks to spread across borders in ways that were not

possible before its creation. It inspired the next generation of companies who were able to base themselves on the Internet and connect with the world in a way that was not possible before then. Small startups such as Google, Facebook, Amazon, Twitter, Pinterest, Dropbox, Yahoo and Instagram have evolved into large companies with global users (Bilbao-Osorio, Dutta & Lanvin 2013).

From 1990 to 2001, employment in the IT industry flourished, according to Csorny's (2013) Bureau of Labor Statistics (BLS) report. Many businesses caught on and began to invest in computer systems. Since 2002 the IT industry has grown by an average of 128%. During the recent recession (2007-2009) employment in the IT sector decreased by 1%; however, employment in 2010 was higher than it had ever been before (Csorny 2013). As part of the BLS Csorny (2013) projected that between 2010 and 2020, IT jobs will grow by a further 28%. A survey carried out by TechServe Alliance reported that the number of technology jobs has reached an all-time high. It reported that in a one-month period - February to March 2012 - the number of IT jobs in America grew by 15,000. It also estimated that there are currently 4.15 million IT jobs in the U.S., with an annual increase of 120,000 jobs requiring a minimum of a bachelor degree (Microsoft 2012). This trend shows no sign of slowing (JobThread 2012).

Over the past decade, Trauth (2000) and Panko (2008) have documented the lack of CS graduates in the proportions needed to satisfy the growth of the IT sector. CS graduate numbers decreased significantly after the dot-com crash, where there was a possibility that IT jobs may be redeployed to India (Avery 2012). According to the NSF (2012) report, in the past two years (2011 and 2012) there has been an increase in the numbers enrolling in CS degrees, but not in sufficient quantities to fulfill the growth of the sector. A bachelor's degree in CS is often a basic requirement for people entering into technical positions within the IT sector. Silicon Valley IT organisations have a technical workforce that is highly educated, with 53.5% holding CS qualifications above a bachelor's degree (Simard et al. 2008). The NSF (2012) report highlighted that the higher education system currently produces 40,000 bachelor degrees in CS year upon year. Of

these 40,000 bachelor degrees, women only make up 18% (She++ 2013). If the projections of growth in the technology industry made by Csorny (2013) on behalf of the BLS are fulfilled, there will not be enough CS to sustain the growth of the industry (Microsoft 2012).

The lack of CS professionals has resulted in elite technology leaders such as Mark Zuckerberg (CEO and founder of Facebook), Eric Schmidt (Executive Chairman at Google), Marissa Mayer (CEO at Yahoo!), Reid Hoffman (Co-founder of LinkedIn) and Drew Houston (Founder and CEO of Dropbox), in conjunction with other leaders in the industry, to question the federal government regarding United States immigration laws. Technology companies are campaigning for immigration reform to make it easier for foreign workers to obtain green cards, increase the number of H-1B temporary worker visas and help more foreign-born students reside in the United States after completing their studies there (Wasserman 2011; Fitzpatrick, 2013). The increase of CS talent is instrumental to the growth of this ever-expanding industry and the support that this issue has received from the leaders in the industry shows the critical nature of the workforce crisis that the industry is currently facing.

2.3 Diversity and women within the industry

The aforementioned growth statistics of the IT industry, in conjunction with the lack of computer scientists being produced by universities, highlights the need for IT organisations to address the IT workforce dilemma. IT organisations have already taken a focus on immigration reform. Another approach they are also taking to address this issue is to increase the number of women and other minority, diverse groups within the industry (Ashcraft & Blithe 2010). The term “diversity” describes the differences among people including a person’s age, gender, race, cultural background, education, mental and physical disabilities, sexual orientation and so on (Hitt, Black & Porter 2009).

Silicon Valley is renowned for its ability to attract a global workforce in the form of top technical talent. A Saxenian (1999) report highlighted that, in 1998, one-

quarter of Silicon Valley's new technology businesses were run by either Chinese or Indian immigrants who had come to the United States after the 1970s to pursue graduate studies. Some of the leading IT organisations, such as Apple, Google, Oracle, eBay, Yahoo, LinkedIn and Amazon were founded by immigrants or children of immigrants (Meeker & Wu 2013). A study of the IT industry, carried out by Simard et al. (2008) found that only 54% of their respondents were White, while 39% were Asian. The minority groups within the industry lie in the underrepresentation of African Americans/Blacks and Hispanics/Latinos and women of all ethnic diversities (Simard et al. 2008). IT organisations have addressed a need to focus on the recruitment and retention of minority groups into this industry. 'To strengthen the U.S position as a technical leader we need to examine the reasons why the industry is not attracting and retaining more people with varied backgrounds and take action to stem the current tide' (Ashcraft & Blithe 2010). Although increasing diversity across all underrepresented groups is equally important, this study will focus on women and their lack of representation in technical positions within this industry.

According to the She++ documentary (2013), the number of women enrolling in CS degrees has dropped by 79% between 2000 and 2009. In support of these findings, the NCWIT (2012) also determined that 57% of all undergraduate degree recipients in 2010 were women; however, women only represented 18% of computer and information science degrees that same year. In recognition of this, the She++ community was established by Stanford University in conjunction with leaders in the tech industry. It was set up in order to inspire women to embrace CS and to encourage the numbers of women entering CS, in an attempt to increase the lack of CS graduates. These statistics are also reflected in the workforce, with women holding 57% of professional positions in the U.S. (NCWIT 2012) but only 18% of software developer positions and 20% of computer programmer positions (Gourdeau 2012). The NCWIT (2012) reported that, on average, women made up 25% of technical positions. In an attempt to increase female participation in the industry and create a community of support,

all-female workshops, meet-ups and social groups such as Women 2.0 and Women Who Code have been initiated (Farr 2013).

Women's participation in computer-related occupations is low overall; however, this percentage decreases in senior level positions. Wentling & Thomas (2009) reported that only 13% of board members and executive officers in the top 100 Fortune 500 IT companies were women. The NCWIT (2012) report highlighted a lack of movement with regards to women reaching top positions within Fortune 500 IT companies and reported that only 5% of Chief Technical Officers were women.

From a workforce perspective, women's lack of participation in the IT sector is leaving the computing professions with a shrinking pool of qualified professionals (NCWIT 2007). Women are an extremely valuable and untapped human resource, and their under representation has left a gap in IT positions being filled, technology being created and problems being solved. Their underrepresentation also results in the technology being designed with a male-dominant perspective. The technical design process is a creative one, and women bring a different perspective to the innovation and development of these products (NCWIT 2007). As there are currently so few women involved in the creation of the technology upon which society increasingly depends, there is no way of knowing what type of problems women would solve or products they would create if in the correct proportions (NCWIT 2007). Ensuring that there is a broad range of minds and a diversity of backgrounds designing IT products yields more innovative products and services that support the diversity of their global customer base (McMahon 2010).

Ashcraft & Blithe (2010) stated that women were responsible for 45 percent of - and influenced up to 61 percent of-all consumer electronics purchases. Goudreau (2010) reported that Facebook, the world's largest social networking tool, is made up of 57% females and that women are responsible for 62% of the content shared on Facebook. Despite women's consumption of IT they are still underrepresented in its creation (Ashcraft & Blithe 2010). The technology industry is undoubtedly a

growing and successful industry, however there could be further growth and success if the underrepresented groups began to increase in enough proportions, which would mirror our diverse society.

> "Our products and tools serve an audience that is globally and culturally diverse - so it's a strategic advantage that our teams not only encompass the world's best talent but also reflect the rich diversity of our customers, users, and publishers. It is imperative that we hire people with disparate perspectives and ideas, and from a broad range of cultures and backgrounds. This philosophy won't just ensure our access to the most gifted employees; it will also lead to better products and create more engaged and interesting teams" (Eric Schmidt, Former Chairman and CEO of Google).

It has been estimated that from 1980 to 2020, the white working population of America will decline from 82% to 63% and that the minority proportion of the workforce is projected to double in this same time frame (Hitt et al. 2009). The current statistics representing the lack of diversity in the IT sector shows that it is not in line with these projections and would suggest that there is a lot more work to be done within this sector (NCWIT 2012).

The Level Playing Field Institute (LPFI) is an organization set up to explore and eliminate gender and racial imbalances within STEM communities. In 2011, LPFI carried out a study across this industry that found that maintaining a diverse workplace was not high among hiring managers' priorities. Despite the low representation of women within the companies studied (representative of the rest of the tech industry) 68% of managers and engineers polled said that they were satisfied with their company's diversity efforts (LPFI 2011). If companies are to increase diversity within their teams, to create a competitive edge and help address the shortage of IT talent available, top-level executives must recognise the benefit of diversity and drive successful diversity hiring and retention programs (Ashcraft & Blithe 2010). 'Diversity of human capital is a key component of the ability to attract and retain a high technology industry. Talent powers economic growth, and diversity and openness attract talent' (Wentling & Thomas 2009).

Furthermore, research from Ashcraft & Blithe (2010) found that diverse perspectives increase innovation, productivity and competitiveness in the workforce. They studied greater than 100 teams across 21 companies and found that teams with equal numbers of women and men were more likely to experiment, be creative, share knowledge and fulfill tasks. Further studies indicated that, if managed correctly, teams comprising of diverse members consistently perform better than teams comprising of 'highest-ability' members (Ashcraft & Blithe 2010).

2.4 Women in the workforce

The feminist movement worked and continues to work against the status quo in American society (Hooks 2000). The women's movement began in the late 19th century and has since challenged the notion of predetermined gender roles as "natural." Instead of this, gender roles are socially constructed classifications created by society, communities and families (Jakobsh 2012). The fundamental structure of Western patriarchal society underpins that males are superior and more powerful and that women are understood to be inferior, lacking power and autonomy, and secondary to men. These values are so deeply ingrained into western society's consciousness, that they are largely invisible and accepted. Today's western society has been set up by men, for men, in order to support men, which restricts women's participation and progression in the workforce (Jakobsh 2012).

Women's representation in leadership positions in the corporate world is low, with 4% of women in the *Fortune 500* companies leading as CEO's (Sellers 2012). The Catalyst Census is a non-profit organization that works to expand opportunities for women and businesses. In 1993, it started its Fortune 500 Census (F500), which tracks women's share of all Executive Officer and top earner positions on an annual basis. This census has showed that women's progress into top positions in corporate America is very slow, with only a 0.2 percent increase from 2011 to 2012 (Catalyst Census 2012). In the US, women occupy 17% of board seats (Catalyst Census 2012), 15.8% in the EU and 8.7% in

Ireland (European Commission 2012). Catalyst Census (2012) quoted 'What gets valued gets paid, and women's lack of progress among Fortune 500 top earner positions indicates that not only are women struggling to enter this elitist leadership group, but are struggling to enter the positions of power and influence even among that leadership group'. Sheryl Sandberg (2013), Chief Operating Officer of Facebook and advocate for women in leadership, believes that for women's perspectives to be heard and organizational policies to change to support women in the workforce, the proportion of women needs to increase at boardroom level. If women's perspectives were taken into account, and workplace practices developed to support women, the barriers that currently face women in the workplace could be reduced and retention statistics would be improved (Hewlett et al. 2008).

2.5 Retaining women in IT

In 2006 a survey of 300 technology companies identified hiring and retaining skilled technical workers as their main concern (Overby 2006). In 2006 one of the biggest and best-known studies in this area, the 'Athena Factor', was launched by a group of 43 global companies operating in the science, engineering and technology (SET) sector called the 'Hidden Brain Dain'. This research study paid particular attention to factors that affect the retention of women within SET (Hewlett et al. 2008). Through their extensive research, they found that women's attrition rates spike at their mid-career level. Simard et al. (2008) define the mid-level stage of a technical women's career to be when she has between 10 and 20 years of experience, but has not yet reached leadership positions. The study found that 41% of technical women leave technology companies after ten years of experience, compared to 17% of men (Hewlett et al. 2008).

The mid-level point in a person's career is when the loss of talent is the most costly to the company (Simard et al. 2008). Most high-tech companies recognize the need to invest in retaining and promoting technical women after they have spent valuable resources in their recruitment and training. It is at this mid-career level point that women face their most critical juncture, as there are a set of

complex gender barriers that converge at this stage of their career. These barriers are routed in work and family issues, outmoded workplace practices and cultures that are not set up for a diverse workforce (Simard et al. 2008). Trauth (2002) highlights that participation in the IT profession is not the same for all women, that each woman is different and that there are individual perspectives that need to be taken into account. Trauth et al. (2009) built on her previous study and brought to light that many theorists attribute women's under representation in the IT sector to biological differences between men and women and that others underpin the gender imbalance as a result from structural problems with society. Trauth et al. (2009) suggests that researchers should focus on both individual and environmental factors in order to understand why women leave the industry in such high proportions at this stage.

There is consistency within the practitioner and scholarly literature regarding the retention and advancement of women in the IT sector and this continues to be a highly talked about topic due to its critical nature in addressing the IT workforce dilemma. Earlier studies such as Ahuja (2002) and Tapia & Kvasney (2004) denote the poor retention statistics of women in the IT industry, to women's negative perception of the workplace as unwelcoming, isolating, male-dominated and hostile with a lack of female role models and mentors (Bartol et al. 2006; Armstrong, Reimenschneider, Reid & Allen 2007; Tapia & Kvasny 2004). Hewlett et al. (2008) added to these findings, as part of the two year study called the 'Athena Factor', and found that as well issues such as negative workplace perception by women in the industry and a lack of role models, issues such as work-life balance and corporate cultural issues (expressed as work place cultures, that are often exclusive and predatory, reward systems and extreme work pressures) were also reasons for women's poor retention statistics.

These issues are consistent with other similar studies; Simard et al. (2008) study 'Climbing the technical ladder', Simard's (2009) study 'The recruitment, retention and advancement of technical women', Trauth et al. (2009) 'Retaining women in the U.S IT workforce: theorizing the influence of organizational

factors' and Wentling & Thomas (2009) 'Workplace culture that hinders and assists the career development of women in information technology', which have identified cultural fit, a lack of mentors and role models and work-life balance as key players in women's retention within the industry.

Later studies are still identifying similar issues in relation to this topic, which identifies that there is still a need to study and improve this area. Ashcraft and Blithe's (2010) study 'Women in IT: The facts' found unconscious bias, isolation and a lack of mentors, promotion processes and work-life balance to be the barriers in this area.

2.5.1 Organisational culture

Schein (2004) defines organizational culture as a pattern of shared basic assumptions that are considered valid and used as a mechanism to perceive, think, and feel about organizational problems. Chatman et al. (2013) adds to the conversation and highlights that organizational culture encompasses three different dimensions; the content of norms (for example; teamwork or integrity), how forceful these norms are held by the organization (its intensity), and how widely employees agree about the norms within the organization (consensus). Organisational culture is at the core of the company and can lead to and support cultural norms such as risk-taking and cooperation (Smith, Collins, & Clark, 2005), meritocracy (Castilla & Benard 2010), or stability and predictability (Beugelskijk, Koen and Noorderhaven 2006; Chatman et a. 2013).

Trauth et al. (2009) point out that over the past decade two key findings have emerged in relation to organizational culture. The first has highlighted the importance that organizational culture has in the retention decisions of its employees. The second is that organizational culture is not typically, gender neutral. Guzman, Stanton, Stam, Vijavasri, Yamodo, Zakaria, & Caldera, C. (2004) believe that the organizational culture embedded in many IT organisations is characterized by 'pride in possessing restricted IT skills; high value of technical knowledge; need for constant self-reeducation in a continually changing

environment; extreme and unusual time demands; feeling of superiority relative to the IT user community; high pervasiveness in non-work context (use of IT in leisure time); a typical lack of formal work rules in the IT occupational setting; and finally, cultural forms such as frequent use of technical jargon and social stigmatization as geeks or nerds' (Trauth et al. 2009). Simard et al (2008) back this up by stating that the IT industry has a culture which is predominantly masculine, white, and heterosexual, associated with hard programming, obsessive behavior and extensive working hours and is described as a 'hacker' culture. Simard et al. (2008) looked at how these issues affected women's perceptions towards working in the IT industry. The 'hacker' stereotype is one that has attached itself to the IT industries culture, and research has shown that it deters women and other minority groups to enter and remain in the industry (Margolis & Fisher 2003). They also found that women were more likely than men to perceive the workplace culture as competitive and that women see the workplace culture to be one that connections to power and influence are needed in order to advance. Simard et al. (2008) also found that women did not feel that they fitted-in with the culture of their IT organisations. Soe & Yakura (2008) highlight that an organisations culture can significantly affect women's participation and employment outcomes.

Simard (2009) found that technical employees within IT companies in Silicon Valley work within an 'achievement culture'. Their paper states that an achievement culture emphasizes teamwork, urgency, ambition, self-promotion, speaking up and quick decision making in order to achieve a common mission where often long working hours are expected. They state that creativity, innovation and teamwork are also rewarded, however in contrast to this, friendliness and mentoring were seen as the least rewarded attributes/behaviors within the industry. Through their interviews Simard et al. (2008) found that women referred to barriers stemming from a workplace culture that rewarded self-promotion, speaking up and ambition.

2.5.2 Work-life balance

Work-life balance refers to the negotiation of time and energy demands between an employee's work and personal lives. When an employee's work and life exist in harmony, true work-life balance has been achieved. Work-life balance is also used to refer to family-friendly policies and practices which are increasing in importance due to the rise in dual-working families over recent years (Grady, McCarthy, Darcy & Kirrane 2008). The term 'work-life balance' is not isolated to people with families, it also encompasses management of work-family conflict, work-life conflict, work-life interference and/or work-life convergence (Trauth et al. 2009).

Not only does flexible working allow a better work-life balance for employees, but studies have also found that employees who work from home report significantly higher productivity levels (Johnson 1995). Park & Jex (2011) found that employees who were allowed to work from home when they needed to were significantly less lightly to suffer from stress, felt less conflicted between work and family responsibilities and had greater work performance than those who were not allowed. As well as this, the war on talent in the IT industry has led to a need for organisations to focus on becoming an employer of choice for women. Organisations have become increasingly aware that women are a source of skilled labor and need to find ways to attract and accommodate the needs of this group (Grady et al. 2008). Unfortunately not enough is being done to conquer this problem, and academics refer to work-life balance within the IT industry as work-life conflict, due to the extreme work pace and high demands of the industry (Simard & Gilmartin 2010).

Work-life imbalance has been found to cause job dissatisfaction (Thomas & Ganster 1995), job stress (Judge & Bretz 1992; Armstrong et al. 2007) and overall poor well being (Igbaria et al. 1994). Workplace inflexibility has also been linked to depression (Googins 1991) and the inability to fall asleep/stay asleep, changes

in appetite and physical and mental illness (McNaughton 2001; Trauth et al. 2009). Among the literature surrounding the IT workforce, stresses related to work-life balance is cited to be one of the main reasons responsible for women leaving the IT industry (Trauth et al. 2009). In support of this, Armstrong, Reimenschneider, Reid & Allen (2006) found that high attrition rates in women in the IT sector were linked to perceptions about family and responsibilities and the flexibility to determine their own work-schedule.

Webster (2002) argues that typically women continue to be the primary carer for children and assume larger percentages of the domestic responsibilities within the home, even when they are working full-time. Armstrong et al. (2007) built on this but examining the linkages between managing domestic responsibilities, work stress, work schedule flexibility and job performance. Their findings showed that women were facing challenges from family life, work-life and also found it a challenge to keep their skills up to date in the fast paced and constantly changing IT work environment (Trauth et al. 2009). In a similar report one woman stated 'it can be difficult to maintain family commitments in an environment where 68% of staff can work up to 10 hours a day' (DTI 2005). When looking at work and family within the IT sector, Simard et al. (2008) found that women were more than twice as likely as men to have a partner who works full-time, that men are four times more likely to have a partner who assumes the primary responsibility for domestic responsibilities and that nearly 70% of women report that their partners work in high tech.

2.5.3 Mentoring, networking and role models

Higgins & Kram (2001) describe a mentoring relationship as one that usually involves a senior person (mentor) working in the mentee's organization, who helps him or her with their professional development by providing both career and psychological assistance. A mentoring program aims to develop the mentees technical and managerial experience, while providing the mentee with sponsorships and access to different networking opportunities and therefore increasing their visibility and knowledge of the organisation (Trauth et al. 2009).

Granovetter (1995) highlights that building connections within and between social work networks is key to career opportunities and advancement. The findings of a study completed by Podolny & Barton (1997) showed that senior managers with more network connections bridged between different groups were more likely to be promoted within the IT industry. However, women from entry to mid-level have fewer opportunities to network outside their own departments and therefore are less likely to gain the benefits.

Ashcraft & Blithe (2010) highlight that women in technology often feel 'isolated' at work and are often the only woman sitting at the table. Scholars (Trauth et al. 2009; Wentling & Thomas 2009; Ashcraft & Blithe 2010; Hewlett et al. 2008; Simard et al. 2008; Quesenberry et al. 2006; Ahuja 2002) agree that isolation, a lack of role models and lack of mentoring opportunities for technical women are key barriers to women's retention and advancement within the industry. Role models and mentors are key to a technical woman's success, however Hewlett et al. (2008) point out that women in technology are likely to suffer from a lack of mentoring and role models (Simard 2009). This is a result of women's low participation in technical careers, however participation is reported to significantly decrease the further up the career chain that you go. The NCWIT (2012) report uncovered that only 5% of Chief Technical Officers in Fortune 500 companies are women.

Mentoring can facilitate positive socialization between technical women by encouraging communication with people in higher-level positions. This support helps women to overcome perceived gender role barriers and is found to have a positive correlation with success in retaining women in the industry (Amelink 2009). This proven success is based on the ability of mentoring to increase a woman's self-confidence and enhance communication skills among women in technology. Mentoring relationships provide role models and present opportunities to discuss work-life balance issues and other issues that women may have (Chesler, Boyle Single, & Mikic 2003). Soe & Yukura (2008) argue that although mentoring is an important aspect in relation to retaining women in

technical careers, mentoring programs must be implemented in conjunction with a larger goal of changing the organizational culture to support women who work in technology.

2.6 Conclusion

The lack of females in technical positions in the IT industry and their low levels of representation at senior, decision-making positions has lead to male dominated perspectives shaping the culture and work place policies and practices of the industry. This acts as a deterrent for women entering the industry and also causes women to leave the industry at a high rate, as these policies do not support dual-working families leading to work-life conflict for many women. Women also feel isolated due to the low numbers of females in technical positions and report a lack of role models to look up to, and mentors for them to seek support from. If the industry is to succeed in attracting and retaining more women, in an attempt to fulfill the employment demands of the future, it will need to address these issues and find solutions to the barriers that face women and drive them to leave the industry in such high numbers.

Chapter 3 : Research questions

Saunders, Lewis & Thornhill (2009) emphasize the importance of defining clear research questions from which clear conclusions and new insight can be drawn. To be successful in this process, the research questions have to be posed with clarity, providing neither too complex nor to simple research questions.

Having reviewed the relevant literature and other sources of information on the topic, six research questions were developed.

1. What are the characteristics of mid-level technical women within the IT sector?
2. What is the configuration of the teams that these mid-level technical women work in?
3. What attributes and norms define IT organisations culture?
4. How important do women feel networking and mentoring opportunities are for their career progression?
5. How important is flexible working to women in the IT industry?

Chapter 4 : Methodology

4.1 Introduction

This chapter will present the methodology deployed in this study and explain the choice of research methods adopted. It will outline in detail the research approach undertaken, the focus of the research including the research objectives, as well as the chosen research instruments. The following chapter has also been designed to explain the sample selection, describe how the data was collected, and provide an explanation of procedures used to analyze the data that was collected throughout the study.

4.2 Philosophy

In order to gain an insight into the working and home lives of mid-level technical women and the reasons for their high attrition rates at this stage of their careers, a deductive research approach with elements of induction was chosen. The theory suggests that the male dominated culture of the high-tech sector, along with long working hours, a lack of female leaders to look up to and a lack of female mentors is why so many women leave the sector before they climb the technical ladder (Blaxter, Hughes & Tight 2006). A deductive approach allowed for the collection of quantitative data through surveys (Saunders et al. 2009), to identify how women's home lives and the configurations of their working teams affect the driving factors for women's high attrition levels at this stage of their careers.

Quantitative research refers to research where facts are collected and relationships are studied through the use of statistical analysis, by using techniques that produce quantified conclusions (Bryman & Bell 2011). Opposed to this, research can take a qualitative form where researchers seek understanding and insight into underlying reasons and motivations rather than statistical analysis. In spite of the differences between the two approaches, it is possible when employing a quantitative research approach to draw upon qualitative techniques and vice versa (Blaxter et al. 2006).

Anderson's (2009) publication outlines that there are many different ways of thinking about knowledge that effects how researchers undertake their investigations. He outlines that there are two worldviews; objectivist and constructivist. Saunders et al. (2009) describes that the objectivist view supports the positivist research approach whereas the constructivist view supports the interpretivist research approach. Bryman & Bell (2011) add to this and outline that positivist researchers tend to value scientific and factual data (quantitative) whereas interpretivist researchers value data that is anchored on meaning and that is articulated through language and words (qualitative). Alternative approaches exist such as the mixed method approach, which occurs when quantitative and qualitative research occurs in tandem. Many HR researchers can see the value of the mixed method approach; they find the use of both the positivist and interpretivist approach a good basis from which to develop their research (Anderson 2009).

4.3 The research focus

The quality of research can be strongly affected by a researchers own motivations and ideals, and therefore allows the researcher to maintain a strong interest in the chosen topic throughout the course of the research. In addition, researchers make the most of their existing knowledge and ensure the research is of value to others if they have expressed a strong interest in the topic (Bryman & Bell 2011).

The focus of this study was established through an interest in the technology industry and the industries current battle to increase the numbers of available technical employees. The majority of the researcher's professional career has been based in two of Silicon Valley's top high-tech organisations, where the focus has been to recruit a technical workforce. This is where the author's interest and passion stemmed, for this relevant and topical research area.

4.4 Sample

The research objective of the study is to explore and understand how the home lives and working team environment of mid-level technical women can affect their retention rates in the industry. As this was the focus of the study, participants needed to meet a certain criteria for their input to be relevant in answering the objectives set out by researcher. Non-probability purposive sampling was chosen for the study, as the participants needed to be; female, at the mid-level stage of their career (technical employees with considerable work experience, but who have not yet reached senior leadership positions), living and working in the Silicon Valley area and in a technical position, rather than participants from the whole or average representative population of professions.

The sample was compiled through the sources shown in Table 1. In conjunction with Table 1, personal connections from working in the industry were utilised and specific female engineers, meeting the desired profile, were identified and contacted.

LinkedIn Group Name	Number of members	% Working in an IT profession	% Working in the IT industry
.NET Developers	180,593	31%	36%
C++ Developers Group	15,726	46%	21%
C++ and System Engineers. Software Engineering Freelancers and...	1,552	46%	19%
CyberCoders Tech	35,426	58%	26%

Embedded Software Engineering	4,511	59%	9%
Google Professional Network	4,989	7%	47%
Google Staffing Alumni	1,037	<1%	27%
Java Developers	172,903	36%	36%
Model Based Software Engineering (MBSE)	3,575	43%	9%
Real-Time Embedded Engineering	27,934	46%	10%
Software Engineering Careers	9,170	38%	17%
Tech Plus	47,317	8%	20%

Table 1 (Statistics shows as of LinkedIn Group Statistics Table: http://www.linkedin.com/groups)

LinkedIn provides group statistics, which allowed the researcher to guestimate the number of eligible sample sources in each group. The total number of members from the groups joined was 504,733, however it is important to note the following:

- According to the NCWIT (2012) publication, women only make up 25% of computer related positions. Therefore it would be estimated that women would make up about the same proportions on these technical groups. Therefore out of the total number of members (504,733) only 126,183.25 would be women

- The average number of members of these groups working in an IT profession is 34.91%

- The average number of members within these groups working in the IT industry is 23.08%

- An unknown amount of members fit the age profile and career level needed for this study

- Some individuals may be members of different groups

Therefore the total number of members (504,733) within all groups combined will not be reflective of the actual sample size/individuals reached. The sample size is significantly lower than the total number of members of these groups.

Having reviewed the above sample sources (including personal connections) and the sampling technique applied (self-selection), the sample size was found to be sufficient and representative for survey used in this study.

4.5 Research instruments

Consideration was given, whether to conduct a qualitative study with in-depth interviews or conduct a quantitative study via a survey. Previous research of a similar nature had utilised both quantitative and qualitative approaches. Wentling & Thomas (2009), Quesenberry et at. (2006), Trauth, Quesenberrry & Morgan (2004) had all utilized a qualitative research approach whereas Hewlett et al. (2008) and Simard et al. (2008) had used a primarily quantitative research approach.

For the purpose of this study, the author determined the use of a structured survey to be most appropriate, as it was important to identify trends in the information. In

conjunction with this, technical organisations that were approached were unwilling to allow their technical women to participate in a study that could potentially expose them to allegations surrounding gender issues. The use of a survey allowed the researcher to contact participants independently, and allowed them greater confidentiality, as they could remain anonymous; the survey did not record the names, email addresses or organisations that the participants were associated with.

In order to address the research objectives through an exploratory approach, a structured survey with 5 groups of questions was developed and applied; 'A bit about you', 'Your Team', 'Advancement', 'Mentoring and Networking' and 'Work and Life'. This survey resulted in new qualitative and quantitative data and insights. Surveys have been described as a popular strategy when embarking on exploratory research as they enable the researcher to obtain a large amount of data in a very economical way (Saunders et al. 2009).

Analysis of the available survey creation Internet applications was conducted prior to the study. Kwiki Surveys (www.kwiksurveys.com) was chosen as it provided flexibility in terms of the types of questions that were available. The use of multiple choice, single response, checkboxes, dropdown lists, multiline textbox, star ranking, order ranking and matrix/grid tables were all available, which would allow advanced data gathering and analysis. In addition to this, this online tool allowed the researcher to review and analyse the results while the survey was still open. Kwiki Survey is competitively priced in the market place as it not the market leader, however still possesses all the functionality of SurveyMonkey, the market leader.

The survey questions were designed based on the most pressing topics informed by the literature review. Considering the broad scope of the research topic, the first survey draft was made up of about 60 questions. This amount of questions, however, was not feasible for a survey, especially when wanting to ensure a high response/ completion rate and avoiding survey fatigue. Therefore, the survey was refocused and narrowed down to 37 questions.

4.5.1 Pilot study

A pilot survey (Appendix 1), created on Kwiki Survey, was completed prior to the full-scale survey being sent out to participants. A pilot study is a crucial element of a good study design and increases the likelihood of a successful study. It was used in order to pre-test the research instrument, to establish whether the sampling frame and technique are effective, identify areas of ambiguity and to test the adequacy of the research instrument prior to the dispersal stage (Teijlingen van, Rennie, Hundley & Graham 2001).

This pilot study was sent out to 18 work colleagues and had a response rate of 66.6%. It gathered information and pointed to areas that needed adaptation in order to collect the data needed for the final study. A comments box was provided at the bottom of ever page, which asked for feedback relating to that page. From here revisions were made and the final self-completion survey (Appendix 2) was created and finalized.

4.5.2 The survey

The literature review, which encompassed information surrounding the technology industry, its technical workforce and women in the workforce addressed all of the research objectives and raised a number of questions for consideration in the research survey. Saunders et al. (2009) highlight that 'there is a limit to the number of questions that any survey can contain if the goodwill of the respondent is not to be presumed on too much'. Therefore, the survey needed to be focused and every question needed to have a specific purpose in answering one of the research objectives.

The first page of the survey presented information regarding the purpose of the survey and assured any potential participants 100% confidentiality, as their names or organisations would not be recorded. It was important to include a confidentiality statement to reassure participants that no personal details would be published in the study and that the information gathered would only be used for the purpose of this study. It aimed to increase participant's confidence that the

survey was confidential in order for them to be willing to share information. Participants were asked to state their consent in taking part in the study. It also included an estimated length of time it would take to complete the survey to encourage participation.

For ease of analysis, the questions were then grouped under five sections. The first group of questions, 'A bit about you', assessed who the participants were through a series of multiple choice questions surrounding; gender, age, field of work, title, type of education and years in the industry. This information ensured that the correct participants were answering the survey and allowed for the elimination of participant responses that did not meet the survey criteria. This section also gathered information on the participant's home lives, such as relationship status, presence of children, partner characteristics and household responsibility distribution, in order for further analysis in relation to assessing if the home lives of women impact the barriers that they face in the industry.

The second group of questions, 'Your Team', assessed the type of team and environment that the respondent worked in. This was made up of a series of questions, which identified the gender distribution and size of the teams that the respondent was working in and about the gender distribution of the participant's managers and leaders. This information was gathered in order for further analysis in relation to women feeling isolated and having a lack of role models and mentors.

The third group of questions, 'Advancement', sought to uncover the participant's attitudes towards advancement; perceptions of what characteristic are needed to succeed within their organization in the technology industry, what attributes they believe that they possess and if these are aligned. It also sought to uncover the perception of the company culture and what is valued by the organization and if participants felt that it was possible to advance in the industry if they had children. Multiple choice questions and Likert scale ranking questions were used to assess the participants views regarding what characteristics were needed to be successful in the technology industry.

The fourth group of questions, 'Mentoring and Networking', looked at the significance of mentoring and networking and the impact that they have in relation to advancement and career progression within the technology industry. The use of multiple choice, Likert scale questions were utilized at this stage to identify a trend in the importance of both mentoring and networking and whether the participants felt that they were exposed to these within their organisations.

The fifth group of questions, 'Work and Life', gathered participant's opinion in relation to the ability to be successful and be family orientated and the importance of flexible working practices. This section sought to find out if the participants work-life balance was an issue or if it could potentially be a reason for the high attrition rates at this stage of their career (Hewlett et al. 2008). The use of a Likert scale multiple choice questions were utilised along with questions with open text boxes were used to encourage forthcoming of rich qualitative data that could be later analysed.

The majority of the questions used in this survey were adapted from a study completed by the Anita Borg Institute for Women in Technology, called 'Climbing the technical ladder' (Hewlett et al. 2008). This extensive two-year study sought to uncover the barriers of success and the retention of women in this sector and was an excellent basis to base my study on.

A total of 52 completed surveys were received in this one-month period. The response rate of the survey is unknown as the sample size was unable to be defined. However the data that was retrieved could be analysed and results could be presented.

4.6 Data collection

Participants who were unknown to the researcher were contacted via LinkedIn groups, technical discussion forums and facebook technical groups. To post within these groups membership is required. Once membership was established in each group, the availability to post information within them becomes open.

The link to the survey was posted with a short explanation (Appendix 3) to each of the groups shown in Table 2. This was added to the technical groups' discussion/ news section on a daily basis for a one-month period. All individuals interested in or made curious about the topic were then directed to an online survey through which data was collected from those who responded.

LinkedIn Group Name
.NET Developers
C++ Developers Group
C++ and System Engineers. Software Engineering Freelancers and...
CyberCoders Tech
Embedded Software Engineering
Google Professional Network
Google Staffing Alumni
Java Developers

Model Based Software Engineering (MBSE)
Real-Time Embedded Engineering
Software Engineering Careers
Tech Plus

Table 2 (LinkedIn Group: http://www.linkedin.com/groups)

As the researcher had previously worked in engineering recruitment teams within two American technology organisations, some participants were contacted via personal connections. A personal email (Appendix 4) was sent to each female engineering contact with an explanation of the study and an emphasis on confidentiality.

4.7 Ethical considerations

According to Saunders et al. (2009) the research design should in no circumstances subject the population to embarrassment or place the population in a disadvantageous situation whatsoever. As personal information regarding home and family life was gathered it is important that the survey be as unobtrusive as possible by allowing the participant to self-report. The author will conduct the research in an ethical manner, primarily making certain that no personal details would be published in the study and that the information gathered would only be used for the purpose of this study and would not be shared with any third parties.

Chapter 5 : Results

5.1 Introduction

This chapter will present both the quantitative and qualitative findings to the questions contained in the survey that was received from the participants. Charts and tables will be used to help explore, present and describe the quantitative data. The questions that were of a qualitative nature will also be brought to light where necessary.

While completing the data analysis on the 52 completed surveys, the research questions and objectives were kept in mind. In a first step the data was recoded and developed into a set of categories and common themes, which were aligned with the research questions and sub-headings of the literature review. The survey results were added to SPSS in order for further analysis. Descriptive analysis methods were utilized to describe and summarise the data and also to investigate the frequencies of the participant's demographics. Basic inferential statistic methods, such as cross tabulation, contingency tables, Person's correlations, Chai-square tests and the Friedman's test, were used to investigate any relationships, interdependencies or trends within the data.

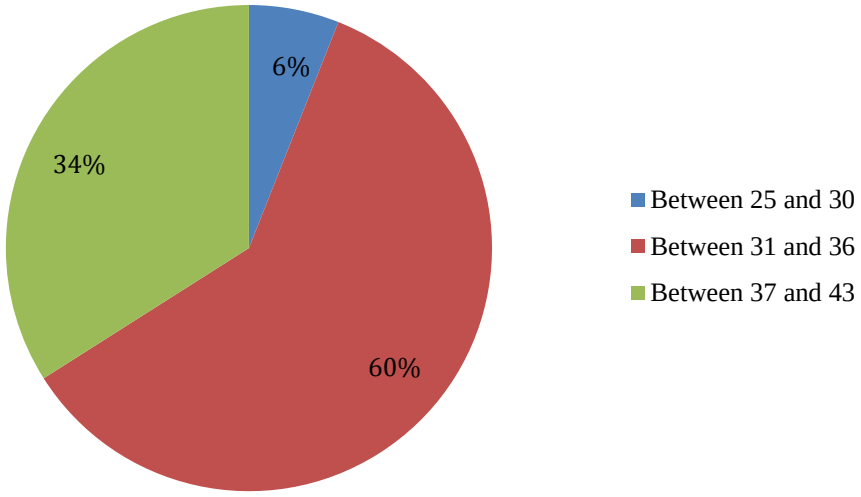
The subsequent chapter 'Discussion' will then analyse the results and provide the findings linked to the aim and objectives of this research.

5.2 Survey findings

In total there was 52 completed surveys received which the data analysis was conducted upon. The results were analysed and an overview of the findings are as follows:

Q1) What are the characteristics of mid-level technical women within the IT sector?

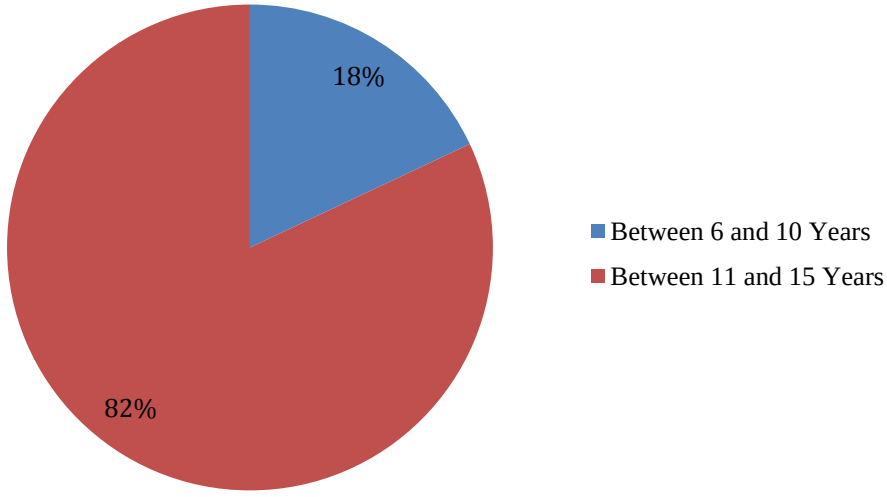
a) What is the age range of these mid-level technical women?



Graph 1

6% reported that they were between 25 and 30, 60% of the population was between the ages of 31 and 36 years of age and 34% were between the age of 37 and 42.

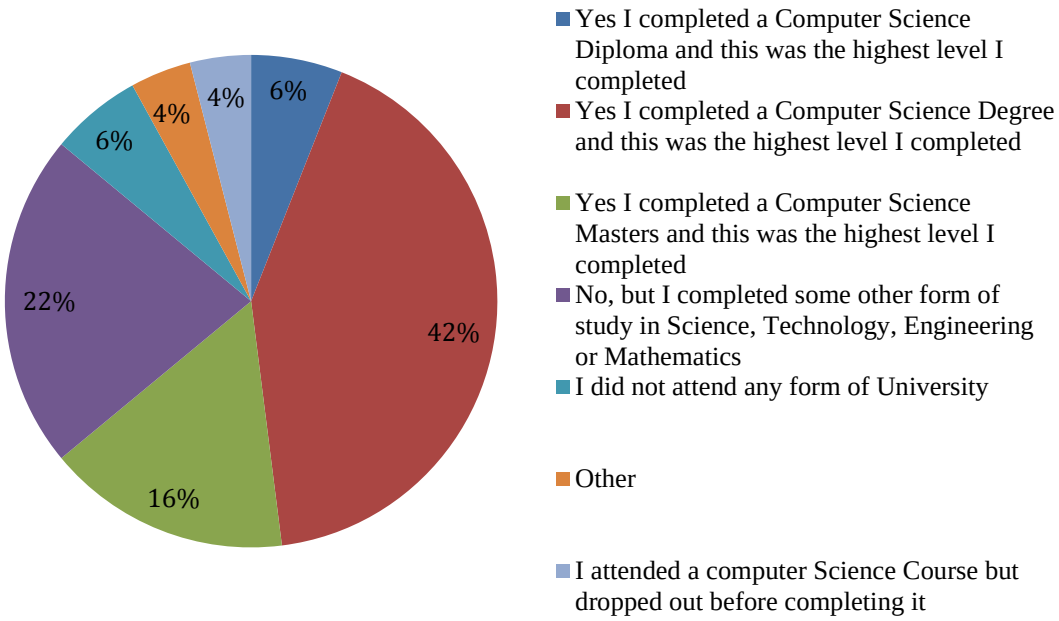
b) How many years of experience do the participants have in the IT industry?



Graph 2

18% of respondents reported that they had between 6 and 10 years of experience and 82% reported that they has between 11 and 15 years of experience.

c) Did they complete a CS course in university, and to what level?

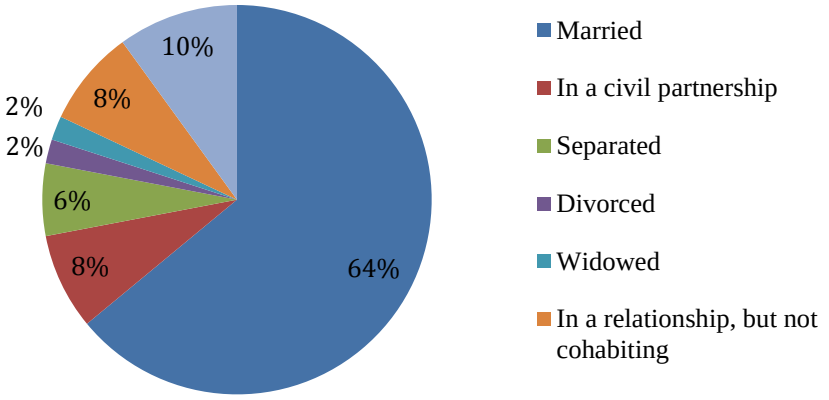


Graph 3

6% recorded that the highest level of education that they had was a CS diploma, 42% had a CS degree, 16% had a CS masters and 4% recorded that they had undertaken a CS course of some kind, but that they had dropped out without completing the course.

22% recorded that they completed some other form of study in STEM subjects, 4% recorded that they had completed some other form of study and 6% recorded that they had never attended university.

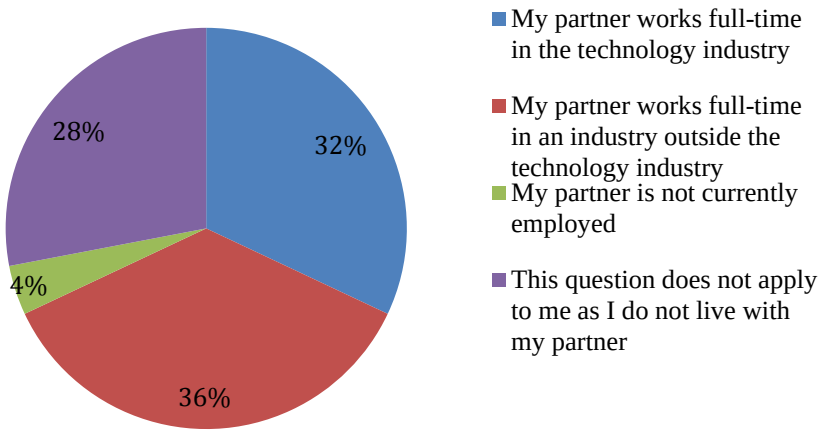
d) Which statement best represents their relationship status?



Graph 4

64% of the respondents recorded that they were married, 8% stated that they were in a civil partnership, 6% said that they were separated, 2% divorced and 2% widowed. 8% of respondents recorded that they were in a relationship but were not cohabiting with their partner and 10% recorded that they were not in a relationship. In total 72% of women live with partners versus 28% who do not.

e) Which statement best represents the work pattern of the person they are married to or cohabiting with?

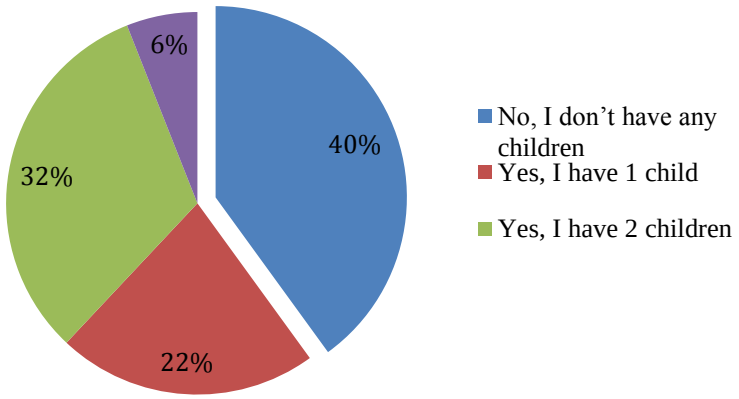


Graph 5

23% of the respondents recorded that their partners worked full-time in the technology industry, 36% recorded that their partner worked full-time in an industry outside the technology industry, 4% stated that their partner was not currently employed and 28% did not comment as they did not live with their partner. It was also asked if their partner worked part-time, however 0% of respondents recorded this as their partners work pattern.

Of the 72% of respondents who lived with a partner, 44% reported that their partner worked full-time within the technology industry versus 50% who worked full-time in an industry outside of the technology industry.

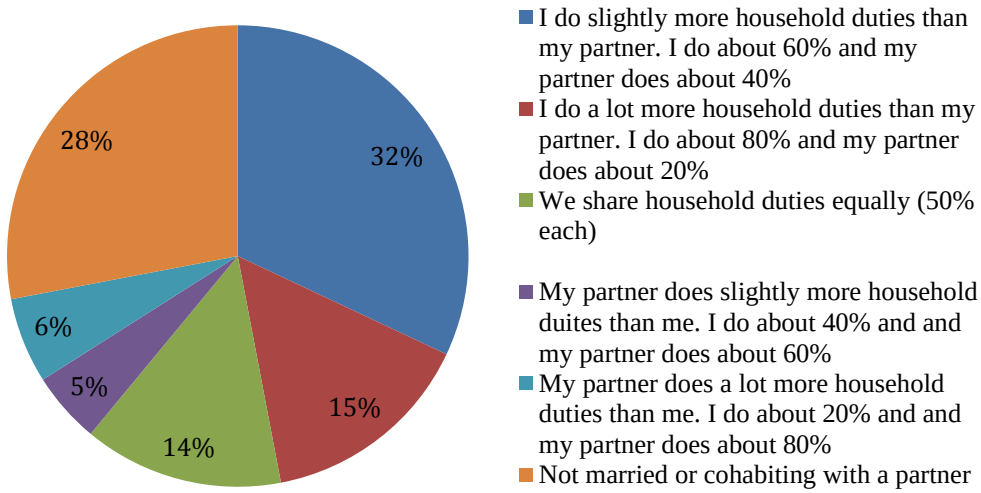
f) What percentage of these women has children?



Graph 6

60% of respondents recorded that they had children versus 40% who stated that they did not have children. 22% of respondents recorded that they have 1 child, 32% recorded that they have 2 children and 6% of respondents recorded that they have 3 children. The option to record if they have 4 or more children was also there, however this did not respond to any of the participants.

g) Do women see themselves as the primary provider for domestic and childcare responsibilities?



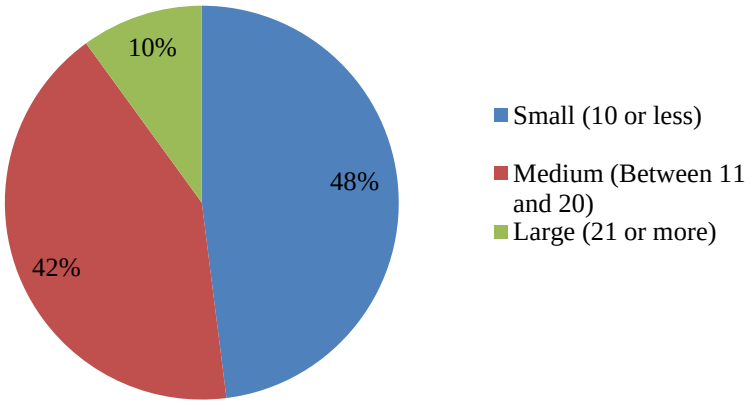
Graph 7

32% of respondents felt that they do slightly more duties than their partner, 15% felt that they do a lot more household duties than their partner and 14% recorded that they share duties equally with their partner. 5% of respondents felt that their partner does slightly more household duties than them, 6% recorded that that their partner does a lot more household duties than them. 28% of respondents did not answer this question as they do not live with a partner.

As previously highlighted, 72% of the women in this study live with partners, versus 28% who do not. When asked about the distribution of household duties and child care, 65% of the women who lived with partners, felt that they assumed more household duties than their partners versus 15% who felt that their partners did more than them.

Q2) What is the configuration of the teams that these mid-level technical women work in?

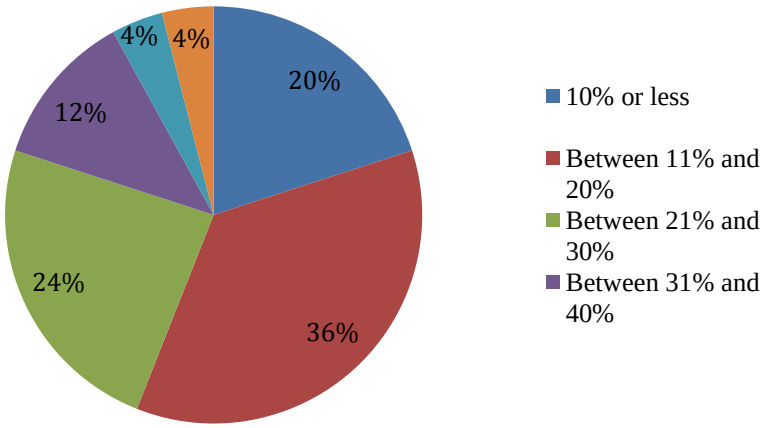
a) What is the size of the team that these women work in?



Graph 8

48% of participants recorded that they worked in a team that was 10 members or less in size, 42% recorded that they worked in a team size between 11 and 20 members, and 10% recorded that they worked in a team of 21 or more members.

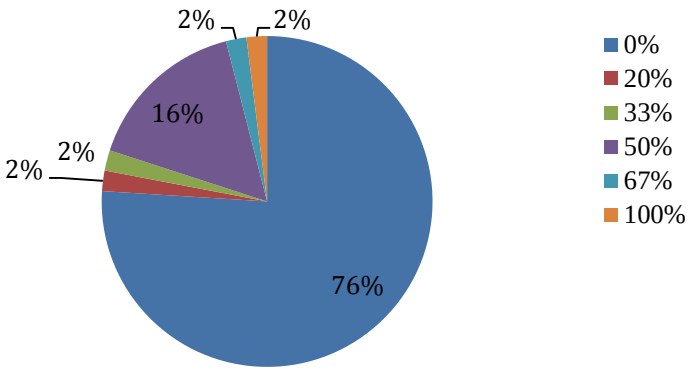
b) What is the percentage of females in their teams?



Graph 9

20% of participants recorded that the female members on the team made up 10% or less of the team, 36% recorded between 11% and 20%, 24% recorded between 21% and 30%, 12% recorded between 31% and 40%, and 4% recorded either 41%-50% or 61%-70% female team members made up the entire team. No respondent recorded a team that had between 51% and 60% or >70% female members on it. Therefore, 80% of teams had less than 30% female participation.

c) What percentage of IT managers/leaders are females?



Graph 10

76% of the respondent's teams had no female manager/leader. 2% of the respondents teams had female manager/leaders that made up 20% of the management on their team, a further 2% of respondents had female manager/leaders that made up 33% of the management on their team, 16% of respondents had female manager/leaders that made up 50% of the management on their team, another 2% of respondents had female manager/leaders that made up 67% of the management on their team and a further 2% had 100% female management.

d) Is there a technical woman for these women to look up to?

54% of women stated that there was a technical woman that they looked up to in their organization, versus 46% who did not.

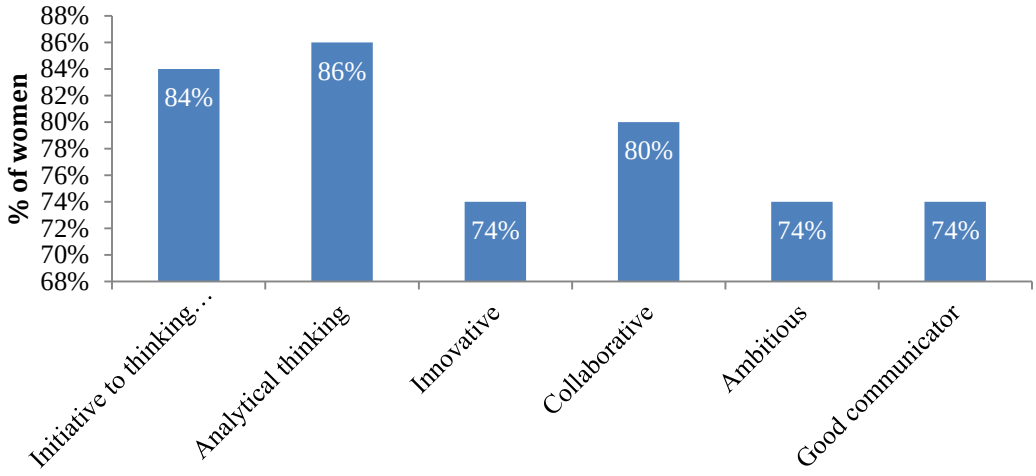
Other findings

A Pearson's correlation found that a positive relationship between having a female manager and the importance of collaboration, friendliness and mentoring others. In contrast, the Person's correlation found a significant, negative relationship between having a female manager and the importance of working late, independent working and masculine behavior.

When using a Person's correlation, it found that there was no significant correlation between having a female manager and the participants saying they did/did not want to leave the industry.

Q3) What attributes and norms define IT organisations culture?

a) What attributes do women feel are most important to be successful in the IT industry?

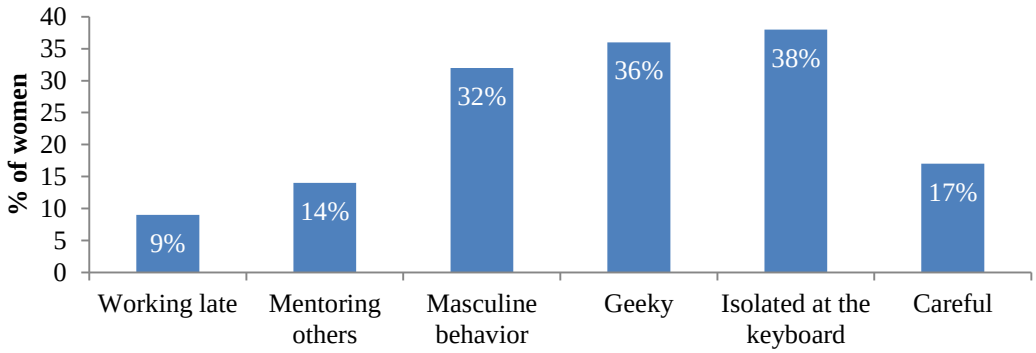


Graph 11

The above graph represents the top six attributes that women felt were necessary to be successful in the IT industry. The participants agreed that the importance of above attributes, in terms of being successful in the IT industry, were either 'Extremely true' or 'very true' in the following percentages:

- 84% said this to be true for ‘Initiative to thinking outside the box’
- 86% said this to be true for ‘Analytical thinking’
- 74% said this to be true for ‘Innovation’, ‘Ambition’ and ‘Good communicator’
- 80% said this to be true for ‘Collaborative’

b) What attributes do women see as least important to be successful in the IT industry?



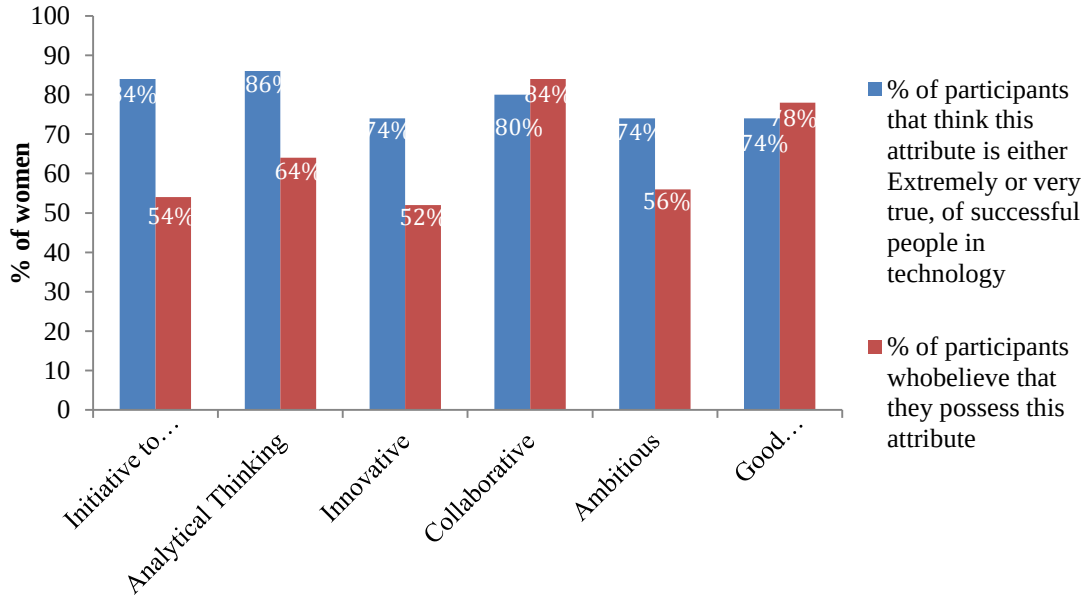
Graph 12

The above graph represents the bottom six attributes that women felt were necessary to be successful in the IT industry.

The participants agreed that the importance of above attributes, in terms of being successful in the IT industry, were either ‘Almost never true’ or ‘Not true’ in the following percentages:

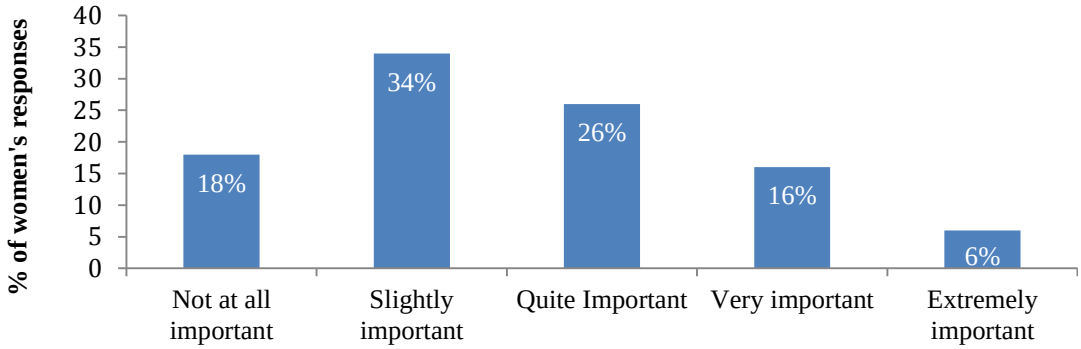
- 9% said this to be true for ‘Working late’
- 14% said this to be true for ‘Mentoring others’
- 32% said this to be true for ‘Masculine behavior’
- 36% said this to be true for ‘Geeky’
- 38% said this to be true for ‘Isolated at the keyboard’
- 17% said this to be true for ‘Careful’

c) Are women's perceptions of the characteristics required for success in the technology industry, in line with their self-perception?



Graph 13

d) How important do women feel working over a 40 hour week is for their career progression?

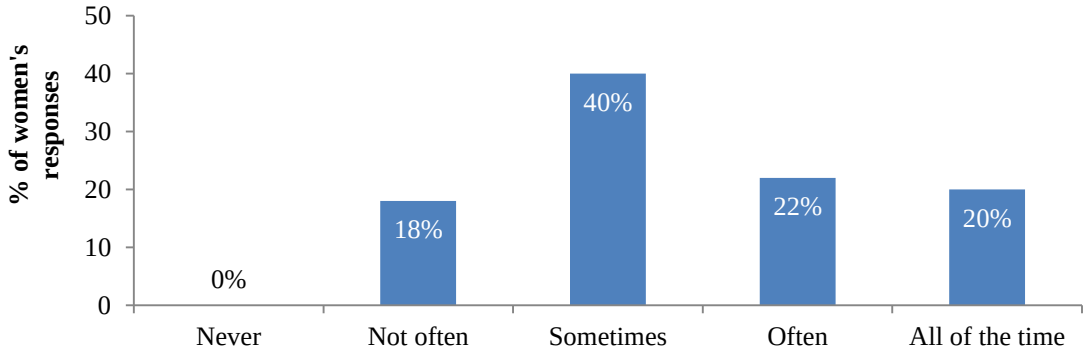


Graph 14

18% of participants recorded that working over the 40-hour week was 'Not at all important', 34% of participants recorded that it was 'Slightly important', 26%

recorded that it was ‘Quite important’, 16% that it was ‘Very important’ and 6% recorded that it was ‘Extremely important’.

e) What percentages of women often work over the required 40 hours a week?



Graph 15

20% of women recorded that they work over 40 hours ‘All of the time’, 22% recorded ‘often’, 40% recorded that they ‘sometimes’ work over 40 hours, 18% said ‘Not often’ and 0% of participants recorded that they ‘Never’ work over 40 hours a week.

Other findings

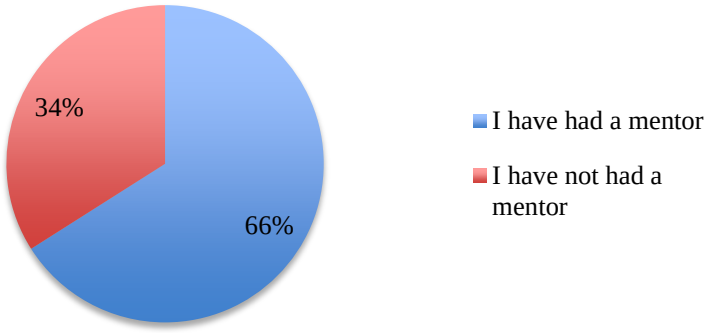
A Pearson’s correlation found a significant relationship between how important women think working long hours is for success in the industry, and how often they work over 40 hours a week.

A further Pearson’s correlation found there to be a significant relationship between working over 40 hours a week and women feeling that they cannot have a successful career and be family orientated. In conjunction with this, women who perceived themselves as extremely family orientated were less likely to work over 40 hours a week.

20% of participants have taken voluntary extended leave from their technology career. Of that 20%, 63% of them believed that it had hindered their career development.

4) How important do women feel networking and mentoring opportunities are for their career progression?

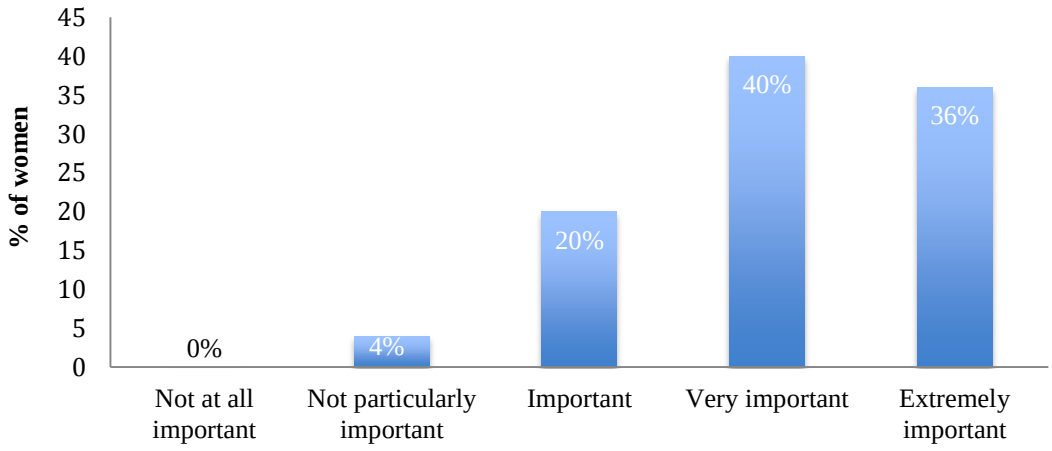
a) What percentage of women has had a mentor?



Graph 16

66% of respondents have had a mentor versus 34% of participants who have not had a mentor during their IT career.

b) How important do women feel having a mentor is for their career progression?

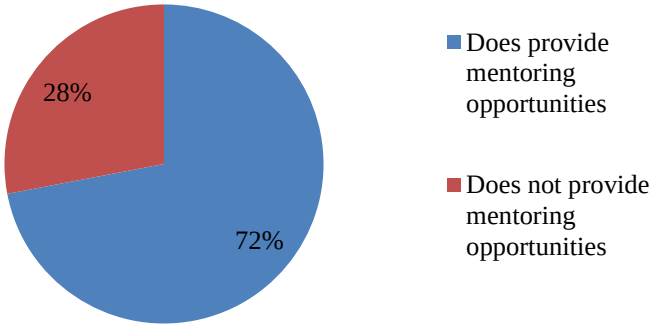


Graph 17

A total of 76% of respondents felt that having a mentor was either 'Very important' or 'Extremely important' for their career progression. In contrast, only

4% of respondents said that having a mentor was either ‘Not important’ or ‘Not particularly important’ for their career progression.

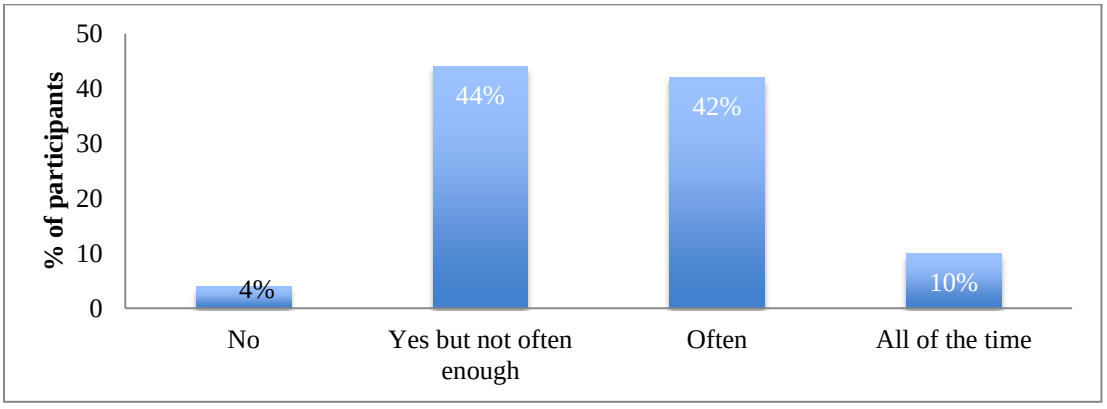
c) What percentage of organisations provides mentoring opportunities for their female employees?



Graph 18

72% of companies that the participants worked in, provided mentoring opportunities for their employees.

d) What percent of organisations provide networking opportunities for their female employees?



Graph 19

Other findings

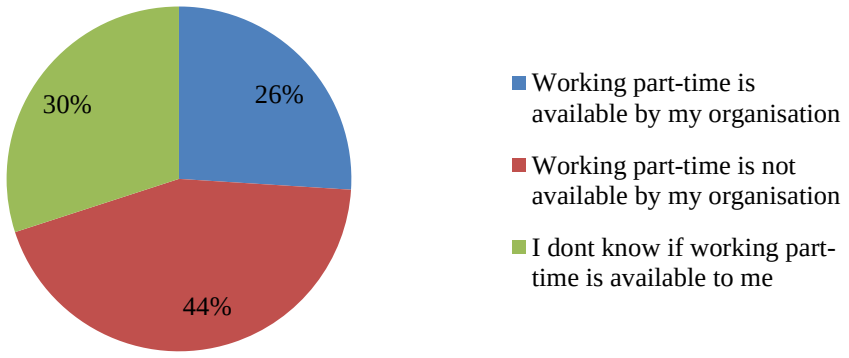
There was no significant correlation found between teams with female managers and the chance of their organization providing mentoring or networking opportunities.

There was also no significant correlation was found between the percentages of female members on a team and the chance of the organization providing networking or mentoring opportunities for its female employees.

However there was a significant correlation between organisations that provide networking opportunities for their female IT employees and the female employee's likelihood of wanting to stay in the industry. No significant correlation was found between mentoring opportunities and retaining women in the industry.

5) How important is flexible working to women in the IT industry?

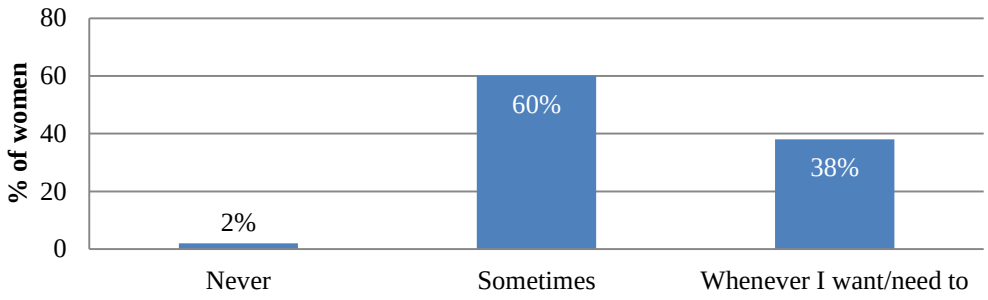
a) Do IT organisations provide part-time working to their employees?



Graph 20

26% of participants recorded that their organisations allowed employees to work part-time, however 44% recorded that part-time working was not available form their organization. 30% of the participants recorded that they did not know if part-time working was available to them.

b) Do IT organisations allow employees to work from home (WFH)?



Graph 21

38% of participants recorded that they were allowed to work from home 'whenever I want/need to', 60% recorded that they were 'sometimes' allowed to work from home and 2% said that it was 'never' allowed.

c) What issues do women face with having children and working in the technology industry?

Respondents were given the opportunity at this stage to write qualitative responses to this question. The following negative themes occurred; fast paced environment which is difficult to keep up with when on maternity leave, lack of part-time work available, travelling for work, expectation to stay late, on-call rota. In contrast there were positive responses to this question; flexible work schedule allowing people to pick their own hours and a supportive culture and supportive managers.

The survey results uncovered that 75% of single mothers said that they would want to work part-time to take care of their children if it was available to them, versus 48% of mothers who lived with partners. Of the women who lived with their partners, 31% whose partners worked full-time in the IT industry said they would want to work part-time, versus 41% who worked full-time in an industry outside of the IT industry.

Small percentages of the total number of participants said that they would work part-time to take care of elder family members (2%), undertake some form of

extra study (2%) and to pursue hobbies (16%).

In contrast the following results show the reasons that women would not like to work part-time. 52% of women with children said that they would not avail of part-time work, if it was available to them, due to the financial impact, versus 38% of women with no children. Financial impact was less of an issue when women's partners worked in the technology industry (31%) versus partners who worked in an industry outside of the IT industry (41%).

48% of women who did not have children recorded that they would not like to work part-time as it would affect their career progression versus 38% of women with children.

18% of all participants recorded that the reason for not wanting to work part-time was because they felt that it would lead to negative stereotyping as a woman, 20% recorded that it was because it was not normal practice in the organization and 14% of women said that it would affect their team moral.

24% of women recorded that they would not work part-time for 'other' reasons. Other reasons for not wanting to work part-time included women not wanting to work part-time as they loved to work and wanting their children to grow up in an equal household where both parents had the ability to have a career. The only participant that said they would work part-time for 'other' reasons stated that she already worked a three-day week.

Other findings

A Chai-square found that there was no significant relationship between the distribution of household duties and a woman's want to work part-time.

When using a Persons correlation a positive correlation was found between women wanting to stay in the industry and flexible work practices, such as the ability to work part-time and the ability to work from home when necessary.

When looking at the percentage of women who said that they wanted to leave the

industry, it was low overall. Only 20% said that they would want to leave the industry.

Chapter 6 : Discussion

6.1 Introduction

This chapter will analyse the results displayed in the preceding chapter, and provide the findings and insight linked to the aim and objectives of this research.

As part of the BLS report Csorny (2013) highlighted the numbers of computer scientists graduating each year from universities are not enough to sustain the growth if the growing IT industry. Women's lack of participation in CS courses and participation within the industry, along with their high attrition rates are adding to the IT workforce crisis (Farr 2013). With regards to the high attrition rates of females in the industry, it has been found that a women's mid-career level is the most critical juncture. It is at this point that a set of complex gender barriers converge. These barriers are routed in work and family issues, outmoded workplace practices and organisational cultures that are not set up for a diverse workforce (Simard et al. 2008). Trauth (2002) highlights that participation in the IT profession is not the same for all women and that each woman is different. Therefore, individual perspectives and situations need to be taken into account when developing workplace practices, if the industry is to reduce its high attrition rates and attract greater female participation in the industry. Hewlett et al. (2008) define mid-level technical women, to be women who are at the 'second stage' of their career, who have considerable experience but have not reached leadership positions. The current study asked participants their age and tenure in the industry to ensure that they met the criteria of the study. The participant's ages ranged from twenty-five to forty-three and their tenure in the industry ranged from six to fifteen years.

Research question one aims to uncover the personal and family situation of each participant while question two aims to bring to light the team landscape in which the participant is operating. The further research questions will then use this information, in relation to the effect that it has on their perception of the

organizational culture, how it affects their work-life balance and the opportunities for mentoring and networking within the IT industry.

6.2 Family status

Webster (2002) and Jakobsh (2012) both point out that in western society a man's career is often considered more important than a woman's and that women still act as the primary carer of domestic responsibilities, even when they are working full-time. The present study found that the majority of mid-level technical women were living with partners (72%), of which 82% had partners in full-time work. 60% of all participants had at least one child. Of the 72% of respondents who lived with a partner, 44% reported that their partner worked full-time within the technology industry versus 50% who worked full-time in an industry outside of the technology industry. Ashcraft & Blithe (2010) found that almost 70% of mid-level partnered women had partners in the IT industry. Although the statistics found in the current study are not as high as those found in the NCWIT (2007) report, the findings show that a high percentage of women in the present study are in a dual-career family with both partners working in the IT industry, which is likely to mean that constraints are exacerbated and could act as a barrier to women's retention (Simard et al. 2008).

When asked about the distribution of household duties and child care, 65% of women who lived with their partners felt that they assumed more household duties than their partners versus 15% who felt that their partners did more than them. The results of the present study are supported by Ashcraft & Blithe's (2010) report, which found that women in the IT industry were more than twice as likely as men to have a partner who works full-time, whereas men are more than four times as likely to have a partner who assumes the primary responsibility for domestic responsibility. Armstrong et al. (2007) examined the linkages between managing domestic responsibilities, work stress, work schedule flexibility and job performance. Their findings showed that women were facing challenges from family life, work-life and also found it a challenge to keep their skills up to date in the fast paced and constantly changing IT work environment. When asked, as part

of the present study ‘what issues do you foresee/have you encountered with having children while working in the IT industry’, one woman stated:

> ‘As a women I think this is a fast moving industry, you need to be up-to-date all the time. The time a family consumes might affect high-end career expectations. You need energy to stay up to date and well aware of the new solutions. Also, when something you are responsible for gets broken, you must be there to fix it. You have to be focused, rested and up to date. In my opinion, a family would hurt taking more responsibility as an IT engineer’.

If women in the technology industry continue to be in dual-career families, the primary career of children and assume the majority of domestic responsibilities, this will have a serious consequence on women meeting the expectations of both work and family and one will inevitably suffer.

6.3 Flexible working

The results of the present study showed that a low proportion (26%) of IT organisations provide part-time working options for their employees, however this number may be slightly higher as 30% of participants recorded that they did not know if part-time working was available within their organization. On the other hand, working from home does seem to be a commonly supported practice. 38% of participants recorded that they were allowed to work from home whenever they needed to, 60% said that they were sometimes allowed and only 2% said that it was never allowed. Many women in the study commented that they feel that the IT industry is very flexible and allows them the flexibility that is required to have children. One woman stated:

> ‘My company is very flexible and it means that I can work out a good schedule with my husband. My husband’s job is very rigid and he has to work set hours. My flexibility allows me to start later and bring my child to preschool and my husband collects her when he is finished. If I worked in a rigid environment we would spend less time with her and it would cost a lot more in childcare. I also work about 1 day a week from

> home, which reduces our childcare costs. I value the flexibility in my organization a lot.'

Although there was a lot of positivity from the results of the survey with relation to the flexibility that the IT industry provides, the results also show that the industry still has many improvements to make towards its overall workplace policies and practices if it wishes to decrease the numbers of women who are leaving the industry. One reason for the increasing need for family-friendly policies and practices is due to the rise in dual-working families (Grady et al. 2008), which is supported by the current study that reported dual-working families at 82%. The current study shows that an employee's family situation affects a woman's desire to work part-time. Armstrong et al. (2007) examined the linkages between managing domestic responsibilities, work stress, work schedule flexibility and job performance. Their findings showed that women were facing challenges from family life, and work-life.

The results of the present study uncovered that the main reason for participants to want to work part-time was to look after children. 75% of single mothers would want to work part-time to take care of their children versus 48% of women who were living with their partners. One participant wrote:

> 'I find being a single mother very difficult. I have to work and also look after my children. This is stressful and I sometimes feel I am not coping. My company has been very supportive of me, but I need to go to a company where I can work part-time so I can look after my children better and also work. That's not an option where I work and I think it should be.'

Of the women who lived with their partners, 31% whose partners worked full-time in the IT industry said they would want to work part-time, versus 41% who worked full-time in an industry, outside the IT industry. When investigating if the distribution of household duties had an affect on women desire to work part-time, no significant correlation was found. However, it is important to note that single

mothers would not have been taken into account in this correlation, as it is assumed that they do all of the household duties.

When looking at the reasons that women did not want to work part-time, the main reason was for financial reasons. Again, this was vastly impacted by family situation. 52% of women with children said that they would not avail of part-time work due to the financial impact, versus 38% of women who did not have children. Financial impact was less of an issue when women's partners worked in the technology industry (31%) versus partners who worked in an industry outside of the IT industry (41%).

There was a positive correlation was found between women's desire to stay in the industry and flexible work practices, such as the ability to work part-time and the ability to work from home when necessary. This is supported by the literature which states that flexible working allows employees to gain a better work-life balance, reduce stress related illnesses and reduce the chances of employees feeling work-life conflict (Park & Jex 2011). As the literature points out that stresses related to work-life imbalance (Trauth et al. 2009), perceptions about family and responsibilities and the flexibility to determine their own work-schedule (Armstrong et al. 2006) are some of the main reasons that women are leaving the IT industry.

6.4 Women entering the industry

Simard et al. (2008) carried out a study, which found that 53.3% of Silicon Valley IT organisations have a technical workforce educated in CS above a bachelor's degree. However, the present study found that 42% of participants, operating in technical positions within the IT industry, were qualified in CS to a diploma level or less, with 26% of participants never attending a CS course. Although this study found that the majority of women advance to a technical career through some form of study in CS (64%), IT organisations should take note that a significant amount of women (36%) in this study advanced to a technical career from other fields of study. A report carried out by Microsoft (2012) estimated that there are

currently 4.15 million IT jobs in the US, with an annual increase of 120,000 jobs, requiring a minimum of a bachelor degree in CS. If such a high proportion of technical women are entering the industry from other forms of study, this could be acting as a barrier to women entering the industry.

6.5 Team configuration

56% of the participants that were surveyed operated in teams that had a female participation of 20% or less and 80% of participants operated in teams of 30% or less. As this was an all-female study, it is important to note that the percentage of females on IT teams may be higher than reality. If the study surveyed both males and females, it may have shown teams with 0% female participation, which would have driven down the percentage of female participation. However, these statistics are in line with the literature, which states that on average females make up 25% of computing-related positions (Ashcraft & Blithe 2010). The low levels of female participation among teams may lead to females feeling isolated. This is concerning as Hewlett et al. (2008) found isolation to be one of the key barriers to women's retention. One participant wrote the following statement when asked the problems that she faces with having children in the IT industry and it highlights a sense of isolation:

> 'There is sometimes an expectation that I stay late when we are working on a big project. As I am in a team of all men, where their wives look after the children at home (most of their wives don't work) I feel that they don't quite understand my situation. It then means that I feel guilty leaving when everyone else stays to get the job done. I would like if there were more women on the team with children so that I did not feel like the odd one out.'

The LPFI (2011) study found that maintaining a diverse workforce was not high on most hiring managers' priorities, which is reflected in this study by the low levels of females within these teams. The literature points out three key aspects regarding women's participation in technology. Firstly, the technology products

that are being created, often by predominately male teams, need to be reflective of their customer base and therefore female participation is critical to their further success. Secondly as Ashcraft & Blithe (2010) point out that there is an agreement among literature that diverse teams are more creative, innovative, competitive and also successful. Finally, 'diversity and openness attract talent' which should mean that higher proportions of women on IT team would increase the chances of being able to hire more women in the future, reduce the chance of women feeling isolated and reduce attrition rates of females in IT (Wentling & Thomas 2009).

6.6 Female leadership

The results of the survey revealed female leadership to be low overall, with 76% of teams having no female manager/leader versus 24% of teams with a female manager/leader. These findings are similar to Simard et al. (2008) study that found 18.1% of their respondent's had a female manager. The lack of female technical managers overall has huge implications for the industry. There is a high level or agreement within the literature that one of the key factors involved in technical women's attrition from the indusrty, is due to the lack of role models for them to aspire to and the lack of mentors to help them build the connections that are key to career opportunities and advancement (Granovetter 1995).

As role models and mentors are found to be instrumental in technical women's retention, success and advancement (Trauth et al. 2009; Wentling & Thomas 2009; Ashcraft & Blithe 2010; Hewlett et al. 2008; Simard et al. 2008; Quesenberry et al. 2006; Ahuja 2002) it is important for organisations to increase female participation in leadership positions. As the present study showed that 76% of IT teams had no female manager, an immediate manager acting as a role model or a mentor was not an option for the women working within these teams.

Ashcraft & Blithe (2010) reported that only 5% of Chief Technical Officers in Fortune 500 companies were women, again highlighting the lack of female role models and available mentors within the industry for women in technical positions to aspire to. If only 24% of teams, reflected in the present study, have a

female manager, versus 76% of teams with male only managers, the chances of women rising to senior leadership positions within IT organization is low, as they are not represented in the correct proportions at mid-management. Sheryl Sandberg (2013), Chief Operating Officer of Facebook and advocate for women in leadership, believes that for women's influence and power to be valued, perspectives to be heard and organizational policies to change to represent these perspectives, the proportion of women needs to increase at boardroom level.

6.7 Role models, mentoring and networking

The present study found 76% of participants felt that having a mentor was either 'Extremely important' or 'Very important' for their career progression. 72% of respondents reported that mentoring opportunities were available to them, however only 66% of respondents reported ever having a mentor. There are a number of possible explanations for this disconnect between the percentage of organisations providing networking opportunities for its technical employees and the percentage that avail of mentoring opportunities. One reason could be attributed to the work-life conflict pressures that women are under, and these women don't feel that they have spare time to give towards growing their career and investing time with a mentor. Another reason could be that although the organization provides these opportunities they do not reward and encourage this type of relationship, and therefore becomes a tick the box exercise. A question in the current survey showed that 52% of participants did not feel that 'mentoring others' was an attribute that was necessary for success. Therefore if technical managers in the organisations also feel that 'mentoring others' is not going to be beneficial for their career they may not actively pursue a mentee. A mentoring relationship is proven to facilitate positive socialization with people in higher-level positions, reduce the chances of women feeling 'isolated' and support women to overcome perceived gender role barriers that they may face (Chesler et al. 2003). The results of the survey that showed 52% of participants did not feel that mentoring was an attribute necessary for success, should be of great concern

to IT organisations as mentoring is proven to be essential to the retention and advancement of women (Simard et al. 2008).

Podolny and Barton (1997) advise that networking provides women with finding mentors outside of an official mentoring program. Their study found that senior managers with more network connections bridged between different groups were more likely to be promoted within the IT industry. Opportunities for women to network outside their immediate department would help them to gain the benefits of networking. The present study found that 52% of IT organisations provided women with the opportunity to attend networking events often or all of the time.

A significant correlation was found in the present study, between organisations that provide networking opportunities for their female IT employees and the female employee's likelihood of wanting to stay in the industry. Organisations should pay attention to this and encourage networking among its employees if it wishes to reduce its high attrition rates among technical women. However there was no significant correlation found between mentoring opportunities and retaining women in the industry which conflicts with the literature (Chesler et al. 2003; Trauth et al. 2009; Amelink 2009).

6.8 Defining the culture/attributes for success

The 'hacker' stereotype is one that is associated with the IT industry, and research has shown that it deters women and other minority groups from entering and remaining in the industry (Margolis & Fisher 2003). The present study took into consideration some stereotypical traits pinned to the industry such as 'geeky', 'masculine' and 'isolated at the keyboard' in contrast with other traits such as 'analytical thinking', 'collaborative' and 'careful' and formulated a question, asking participants to rate their importance level. This question was based on a previous study by Simard et al. (2008), who uncovered that the stereotype associated with the industry was not portrayed in the results of their study.

The present study found that women felt the most important attributes to be successful in the IT industry, were: 'analytical thinking', 'initiative to thinking

outside the box', 'collaborative', 'innovative', 'good communicator' and 'ambition'. The least important attributes were: 'working late', 'mentoring others', 'careful', 'masculine behavior', 'geeky' and 'isolated at the keyboard'.

Simard et al. (2008) found different characteristics to be important and unimportant in their study, however the same conclusion can be drawn from the results; 'that today's IT workforce need to be engaged thinkers who can work well in teams'. One aspect of an organisations culture rests on the agreement of norms by the employees (Chatman et al. 2013), and the present study shows that there is a consensus among female technical women that teamwork and collaboration are valued within the industry, which shows a collaborative culture and therefore the 'hacker' image is an inaccurate view of the technology industry. Trauth et al. (2009) points out the importance that organisational culture has in the retention decisions of its employees.

The present study found its results to be somewhat in line with the current literature with regards to the 'achievement culture' that Simard et al. (2008) discuss. They state that an achievement culture emphasizes teamwork, ambition, self-promotion, speaking up and quick decision-making in conjunction with long working hours. They also revealed that friendliness and mentoring were the two least rewarded attributes within this culture. Although self-promoting, friendliness, speaking-up and quick decision-making were not in the top five attributes deemed to be important in the present study, they were rated highly with noteworthy scores. 64% of participants rated quick decision-making, 60% risk taking, 56% self-promoting, and 50% speaking-up as attributes that were important for success in the industry. Simard et al. (2008) found that friendliness and mentoring were not important attributes associated with an achievement culture, however the present study found participants to deem them to be either extremely or very important at 46% and 48% respectively.

When asked about long working hours, 52% of participants in the present study recorded working long hours was not important versus 22% who recorded that it was very important. 42% of participants stated that they work long hours 'all of

the time' or 'often'. A Pearson's correlation found a significant positive relationship between how important women think working long hours is for success in the industry, and how often they work over 40 hours a week. This shows how the culture of the organization can add to a women's pressure to work long hours. A further correlation found a positive relationship between women working over forty hours a week and feeling that they cannot have a successful career and be family orientated. These findings have huge implications for the industry, as women need to be able to balance their work and family lives.

The attributes that the participants deemed to be most important for technical women are positive for the industry and show the changes that have been made over the past decade. Trauth (2002), along with other scholars at this time, repeatedly reported a culture that was described as 'excessive working hours', 'obsessive', and 'masculine' and which this survey has disproved to be the case in modern day IT organisations.

6.9 Self-perception

Women's self-perception was somewhat in line with the attributes that they felt were important for success in the industry. The highest rated self-possessed attributes were; 'collaborative' (84%), 'good communicator' (78%), 'analytical' (64%), 'ambitious' (56%), 'innovative' (52%) and 'initiative to thinking outside the box' (54%). Although the highest-ranking self-perception responses were in line with the responses of the attributes necessary for success, they were not in the same proportions.

Simard et al. (2008) found that women referred to barriers stemming from a workplace culture that rewarded self-promotion, speaking up and ambition. The present study found that 56% of participants thought self-promoting was either extremely or very important, whereas only 8% of participants agreed that they displayed this trait. Speaking-up was thought to be important by 50% of participants whereas only 20% felt that they possessed this attribute. 74% of participants rated ambition as important versus only 56% who felt that they were

ambitious. Simard et al. (2008) point out that women do not feel that they fit in with the culture, which is proven to be significantly true for many participants in this study and could act as a further barrier for their retention.

When looking at the presence of a female manager and the effects that is has on women's perception of what is needed to be successful, it was found that teams with a female manager were significantly more likely to value collaboration, friendliness and mentoring others. These teams were also significantly less likely to think that working late, independent working and masculine behavior were needed to be successful in the industry.

6.10 Limitations

This section identifies a number of limitations of this research study, while concentrating on the limitations that had the greatest potential impact on the quality of the findings as well as the ability to effectively answer the research questions.

There is a lack of women in engineering Csorny (2013) and therefore the pool of participants to contact and engage with was more difficult than if this study had targeted male engineers. Due to this it would be advised that this study be carried out over a longer length of time to increase the number of respondents, however due to the nature of the course that this study is being submitted for that was not an option. Caution must be applied to the results of this study due to the limited number of respondents (52) who completed the survey. Therefore the findings may not be reflective of the total female population, at the mid-stage of their technical careers in IT organisations.

One significant limitation of the study was that the female technical workforce is a highly protected group in IT organisations. IT organisations were hesitant to allow data to be gathered surrounding the numbers of women in technical positions and how they perceived the culture of the organisation. I therefore had to seek independent participants and was not allowed to survey the organisation that I work in.

Another main limitation of this study was the geographical distance between the researcher and the participants. This had an impact for a few reasons. Firstly, due to the lack of personal connections with female engineers in the US, contacting and finding willing participants was more difficult than originally predicted. Secondly was due to the time difference and the ability to post the survey on LinkedIn at different times of the day in the US. Another difficulty that the geographical difference posed was the lack of qualitative data that was able to be collected. Qualitative data, in conjunction with the quantitative data collected would have provided a more detailed and holistic picture of how women felt towards many of the issues raised in the study.

In addition, the questions and answer possibilities for rating scale questions were not randomized and therefore each survey respondent received them in the same order. This may have led to answers being more frequently chosen due to their location on the survey.

Chapter 7 : Conclusion

7.1 Introduction

This study was designed to explore the affect that family situation and team environment have on the barriers that mid-level technical women face within American IT organisations and how this affects their retention. With this in mind the main barriers associated with technical women in the IT industry were identified within the scholarly literature; organizational culture, a lack of roles models, mentoring and networking opportunities and a lack of work-life balance. Returning to the research question posed at the beginning of this study, it is now possible to state that a woman's family situation and team environment does affect the barriers that she faces within the organization and the main findings of the investigation are listed below.

The first significant finding of this study highlighted how the diversity between technical women's family situations impacts their needs within the organization in relation to flexible working. It also highlighted that many women, although working full-time, absorb more household responsibilities than their partners. Unfortunately this way of thinking is still embedded in Western society and may not change any time soon (Jakobsh 2012). However, if organisations wish to reduce attrition rates among its female technical employees, this is something that they need to understand, in order for them to be able to create a work environment that supports women and allows them to manage both home and work responsibilities simultaneously. The survey showed that work-from-home options were available for most women (98%), however part-time working options were low within the industry (28%). Flexible working practices were found to be very important to the women in the survey, and there was a significant correlation found between organisations that allowed flexible working and retention of their technical female employees.

A further significant finding of this study was that the IT industry seems to have developed a 'collaborative' culture of collaboration, teamwork, and

communication rather than the ‘hacker’ culture known for long working hours, isolation and geekiness. This is an incredibly positive change as the ‘hacker’ culture deterred women from entering the industry and was partly responsible for the high attrition rates of women in the industry (Simard et al. 2008).

It was found that the presence of a female manager had a big affect towards the attributes/norms that women felt were important to their career success. The attributes that are associated with the ‘hacker’ culture of the IT industry were less likely to be found important with the presence of a female manager. In contrast women found attributes associated with a ‘collaborative’ culture to be more important in the presence of a female manager. Another of the findings highlighted the lack of IT teams that had any form of female leadership. As female leaders seem to enhance the ‘collaborative’ culture and reduce the ‘hacker’ culture, which is known to deter women form entering the industry or leaving the industry (Simard et al. 2008), it would be advised that IT organisations look to find ways to increase their female management participation, as it could impact women’s retention levels.

This study found that mentoring and networking are very important to females in technical positions. A much higher percentage of organisations provide mentoring opportunities (76%) than networking opportunities (52%) to its female technical employees. It was also found that there was disconnect between the percentage of organisations and the number of women who availed of mentoring, however one explanation for this could be that 52% of participants did not rate mentoring as an important attribute for success in the industry. There was no correlation found between the presence of a female manager and the likelihood that either mentoring opportunities or networking opportunities were available in the associated organisation. There was also no correlation found between mentoring and women staying in the industry. However there was a positive correlation was found between mentoring and networking. Although these results did not find mentoring to help to retain women, in reality with a larger sample size it may have.

The technology industry has made significant improvements within its organizational culture that have been displayed in the results of this survey. Long working hours do seem to be the norm in the IT industry, however in many ways the IT industry is a much more flexible place than many corporate organisations who do not allow working from home as an option and have strict start and end times. The IT industry has been forced to look at its problems due to the severe workforce dilemma that it is facing, and make improvements in order to attract and retain minority groups (Csorny 2013). In order for the IT industry to successfully address the shrinking pool of available talent and bridge the diversity gap, the IT industry needs to understand how women's retention is affected by their home lives. They also need to recognize how team composition and access to other female colleagues can affect women in the minority. Unfortunately the industry is in a catch twenty-two situation where they have very few women participating in IT professions, and therefore it's more difficult to rise women to the top of these professions. In order for work policies and practices to change to support women, more women need to rise to the top of their careers to enforce a female voice at the leadership decision-making table (Jakobsh 2012). This may help to concur female's high attrition rates.

7.2 Recommendations for the industry

7.2.1 Incorporate flexible working practices

This study highlighted that a high proportion of women are in dual-career families and are often the primary career of children/assume the majority of domestic responsibilities. It also found a significant relationship between how important women think working long hours is for success in the industry, and how often they work over 40 hours a week. In conjunction with this a significant relationship was found between women working over forty hours a week and feeling that they cannot have a successful career and be family orientated. These findings have huge implications for the industry, as women need to be able to balance their work and family lives.

If the industry is to increase the retention of women in technical fields organisations need to create an organizational culture/environment that supports and encourages flexible work practices and allows women the freedom to create their own working schedule. If organisations do not adapt to support women, in a way that allows them to meet work and home expectations, women will struggle to meet the demands which may well lead to their attrition. Emphasis should be on to the results that are produced, rather than face-time in the office. It would also be advised that organisations look at a way of providing part-time working options for employees. This would allow women to stay in the industry who are struggling to manage both home and work demands.

7.2.2 Increase diverse backgrounds

This study found that 36% of women are entering the industry from other forms of study outside CS. If IT organisations are stating that a CS degree is a minimum requirement in job descriptions, this could be acting as a barrier to women entering the industry and needs to be addressed. This is particularly important considering the projected growth of the industry (Csorny 2013) and the lack of CS degrees being awarded each year (NSF 2012). IT organisations who integrate women from diverse backgrounds of education would put themselves in a more competitive position to meet the employment demands of the future, and gain a competitive edge. Diverse backgrounds are proven to increase a team's performance (McMahon 2010). The IT industry should create a culture that rewards hiring managers and recruitment seeking out diverse talent, to help supply the industry with enough talent to support its growth (Csorny's 2013) and increase team performance (McMahon 2010).

7.2.3 Increase women in leadership

If more women were developed into technical leadership positions the industry would reap the benefits. As a lack of role models and mentors are two of the main reasons cited for women's poor representation in the industry, an increase in female technical leaders would be instrumental. This would provide more role

models and mentors for junior technical women and would reduce the poor retention statistics in the IT industry. Mentoring must become a highly rewarded activity within IT organisations and be built into the organizational culture (Soe & Yukura 2008). Mentoring needs to be tied into female technical leaders goals and performance reviews in order to foster a mentoring culture in the organization. In conjunction with this, organisations need to actively encourage mid and low-level technical women to enter into mentor relationships within the organization, and provide them with the time out of their day job to spend developing the mentor/mentee relationship.

This study also highlighted the affect of the presence of a female manager on women's perception of the culture and attributes deemed to be important for progression. Female technical women are significantly more likely to think that collaboration; teamwork and friendliness are important attributes for success versus working late, masculine behavior and independent working. The industry should take note of these findings and concentrate on increasing the numbers of female managers into technical positions. IT organisations need to work hard to create more leadership opportunities for the women already operating in the industry. Current managers need to be assigned accountability for the progression of their team members, which needs to be driven from senior management in the form of embedded processes. IT organisations need to incorporate aspects into the company performance cycle that ensures managers are accountable for progressing minority groups into leadership positions. Targets need to be assigned to each manager encouraging them to suggest females who show future leadership qualities, in order for these women to be given the opportunity to develop leadership skills and reach management positions in the future.

7.3 Further research

This study was done with limited time and financial resources. It would be advised that further research be carried out on a much larger sample of participants to gauge if these findings are representative of the total technical female population in this industry.

Further research could also be conducted according to the age and size of the organization. In this way established organisations could be deciphered from small start-ups, who are renowned for their lack of policies and long working hours in the 'start-up' environment.

It would also be advised that further research be carried out on the difference between technical females and females in non-technical positions within the organization, to see if there is any correlation.

"We cannot change what we are not aware of, and once we are aware, we cannot help but change." - Sheryl Sandberg

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9.0 Appendices

Appendix 1 : Pilot survey

Women and Engineering (Pilot Study)

Survey Overview

Thank you for taking the time to help me. This survey should only take a few minutes of your time!

My name is Anna and I am currently in the process of doing a Masters in Human Resources within National College of Ireland. As part of this course, I am carrying out research on issues relating women in engineering - specifically in IT organizations in the Silicon Valley area.

In order for me to conduct this research, I would really appreciate if you could fill in this short questionnaire. It will ask questions about your demographics, the technology industry, your working environment and your team.

Confidentiality

This survey is voluntary and you have the right to withdraw at any time. No person's name or organization's name will be collected and all data gathered will remain anonymous and confidential. The data will only be used for the purpose of this study.

I would greatly appreciate it if you could complete this survey by ***Friday 28th June 2013***. If you have any questions, please feel free to email me on annatouzel@gmail.com.

Thank you!

Anna

1) Please state your consent in taking part in this short survey.
I agree to taking part in this survey

A bit about you

Some Questions about you...

2) **Are you female?**
Yes
No

3) **Are you working as a Computer Engineer?**
Yes
No

4) **How old are you?**
Under 18
Between 18 and 24
Between 25 and 30
Between 31 and 36
Between 37 and 43
Between 44 and 50
50+

5) **How long have you been working in the Technology Industry?**
Less than 1 year

Between 1 and 5 years
Between 6 and 10 years
Between 11 and 15 years
Between 16 and 20 years
More than 20 years

6) **Did you complete a Computer Science course and to what level?**
Yes I completed a Computer Science Diploma and this was the highest level completed
Yes I completed a Computer Science Degree and this was the highest level completed
Yes I completed a Computer Science Masters and this was the highest level completed
Yes I completed a Computer Science Ph.D. and this was the highest level completed
No, but I completed some other form of study in Science, Technology, Engineering or Mathematics
I did not attend any form of University
Other (Please Specify):

7) **Which of the following statements best describes your relationship status?**
Married or Cohabiting
Separated

Divorced
Widowed
In a relationship but not cohabiting
Not in a relationship

8) **Which of the following statements best represents the work pattern of the you are married to or cohabiting with?** *If you do not live with your partner please choose the last option 'This question does not apply to me as I do not live with my partner'*
My partner works full-time in the technology industry
My partner works full-time in an industry outside the technology industry
My partner works part-time
My partner is not currently employed
This question does not apply to me as I do not live with my partner

9) **Do you have any children?**
Yes, I have 1 child
Yes, I have 2 children
Yes, I have 3 children
Yes, I have 4 or more children
No, I don’t have any children

10) **If you have children, please write their ages in the box below.**

If you do not have children you can skip this question

11) **If you are married to or cohabiting with your partner, please mark the statement which best represents the distribution of household duties within your home (including child care if you have children)**

If you are not married or cohabiting you can skip this question

- I do all the household duties (100%)
- I do slightly more household duties than my partner. I do about 60% and my partner does about 40%
- I do a lot more household duties than my partner. I do about 80% and my partner does about 20%
- We share household duties equally (50% each)
- My partner does slightly more household duties than me. I do about 40% and my partner does about 60%
- My partner does a lot more household duties than me. I do about 20% and my partner does about 80%
- My partner does all the household duties (100%)

Your Team

You and your team

12) **How many people are in your team?**

13) **How many women are there on your team?**

14) **How many leads or managers are in your team?**

15) **What is the ratio of male to female leaders (leads or managers) in your team**

For example if there are 2 male leads or managers AND 3 female leads or managers you would answer would be: 2:3

16) Enter your question

This is the first answer choice

This is the second answer choice

17) Enter your question

This is the first answer choice

This is the second answer choice

18) Enter your question

	Strongly	Agree	Neutral	Disagree	Strongly Disagree
Row 1					
Row 2					
Row 3					

Advancement

This is a new page. You can change the options with the button above, or start dragging widgets to the space below.

19) **Have you ever taken voluntary extended leave from your technology career?**
Yes
No

20) **If you answered yes to the above question, do you think that the extended leave that you took from your career hindered your career development?**
Yes
No

21) **Rate the following statements in order of the attributes that successful people in technology possess:** *1 being the attribute that helps people to be successful the most, 22 being the attribute that is least helpful helping people be successful in technology.*	
Careful	
Critical	
Initiative to thinking outside the box	
Analytical thinking	

Self promoting	
Innovative	
Risk taking	
Questioning behavior	
Collaborative	
Speaking up	
Working late	
Mentoring others	
Friendliness	
Ambitious	
Quick decision making	
Independent working	
Entrepreneurial	
Masculine behavior	
Geeky	
Isolated at keyboard	
Assertive	
Good communicator	

22) **Mark the attributes that you possess:**

Careful	
Critical	
Initiative to thinking outside the box	
Analytical Thinking	
Self promoting	
Innovative	
Risk taking	
Questioning behavior	
Collaborative	
Speaking up	
Working late	
Mentoring others	
Friendliness	
Ambitious	
Quick decision maker	
Independent worker	
Entrepreneurial	
Masculine behavior	
Geeky	
Isolated at the keyboard	

Assertive	
Good communicator	

23) **How important is working long hours for career progression (over the required 40 hours a week)?**
Not at all important
A little bit important
Quite important
Very important
Extremely important

24) **Do you ever work over the required 40 hours a week?**
Never
Not often
Sometimes
Often
All the time

Mentoring and Networking

You can enter some introduction text here.

25) **Is there a technical woman in your organization that you aspire to/look**

up to?
Yes
No

26) **How important do you think having a mentor is?**
Not important
A little bit important
Important
Very important
Extremely important

27) **Have you ever had a mentor?**
Yes
No

28) **If you answered yes to the above question (Q3) was it within your current organization?**
Yes
No

29) **Does your organization provide you with opportunities to be mentored?**

Yes
No

30) **How important do you think networking opportunities are for your career progression?**
Not important
A little bit important
Important
Very important
Extremely important

31) **Does your organization provide networking events within the organization?**
No
Yes but not enough of them
Often
All of the time

Work and Life

You can enter some introduction text here.

32) **Did you ever forego having children due to your career in technology?**

No
Yes
Does not apply to me as I don't want to have children/ or have not thought of it yet

33) **What issues have you experienced or foresee that you may experience, with having children while working in the technology industry?** *Please explain*

34) **Rate the following statement: *'You can have a successful career in the technology industry and also be family orientated'***
Not true at all
A little bit true
True
Very true
Extremely true

35) **Rate the following statement about yourself : *'I am family orientated'***
Not true at all
A little bit true
True
Very true

Extremely true

36) **Is working part-time available in your organization?**
Yes
No
I don’t know

37) **Would you consider working part-time if available to you? Please mark the statements that best represent you...** *You can pick more than one if they represent you*
Yes - to take care of my children
Yes - to take care of elder family members
Yes - for more time to pursue hobbies, learning, exercise etc.
Yes - to undertake some form of study
No - It would impact my financial situation
No - It would affect my career progression
No - It may lead to negative stereotyping as a woman
No - It would impact the team moral or performance of the team
No - It is not normal practice and is not done by many people in my organization
Yes/No - Other (Please Specify Yes or No as well as the reason):

38) **Is it accepted for you to work from home (WFH) by your organization?**
Never
Sometimes
Whenever I want/need to

39) **Have you ever considered leaving the technology industry environment due to high levels of pressure?**
Yes
No

Appendix 2 : The final survey

Overview of the Survey - Women and Engineering

Survey Overview

Thank you for taking the time to help me. This survey should only take a few minutes of your time!

My name is Anna and I am currently in the process of doing a Masters in Human Resources within National College of Ireland. As part of this course, I am carrying out research on issues relating to women in engineering - specifically in

IT organizations in the Silicon Valley area.

In order for me to conduct this research, I would really appreciate if you could fill in this short questionnaire. It will ask questions about your demographics, your team, the technology industry and your working environment.

Confidentiality

This survey is voluntary and you have the right to withdraw at any time. No person's name or organization's name will be collected and all data gathered will remain anonymous and confidential. The data will only be used for the purpose of this study.

I would greatly appreciate it if you could complete this survey by ***Friday 20th July 2013***. If you have any questions, please feel free to email me on annatouzel@gmail.com.

Thank you for your help!

Anna

1) Please state your consent in taking part in this short survey:
I agree to take part in this survey

A bit about you

Some Questions about you...

2) **Are you female?**
Yes
No

3) **Are you working as a Computer Engineer?**
Yes
No

4) **If you are not a computer engineer please state your current position:**

5) **How old are you?**
Under 18
Between 18 and 24
Between 25 and 30
Between 31 and 36
Between 37 and 43
Between 44 and 50
50+

6) **How long have you been working in the Technology Industry?**
Less than 1 year
Between 1 and 5 years
Between 6 and 10 years
Between 11 and 15 years

Between 16 and 20 years
More than 20 years

7) **Did you complete a Computer Science course and to what level?**
Yes I completed a Computer Science Diploma and this was the highest level I completed
Yes I completed a Computer Science Degree and this was the highest level I completed
Yes I completed a Computer Science Masters and this was the highest level I completed
Yes I completed a Computer Science Ph.D. and this was the highest level I completed
No, but I completed some other form of study in Science, Technology, Engineering or Mathematics
I did not attend any form of University
Other (Please Specify):

8) **Which of the following statements best describes your relationship status?**
Married
In a civil partnership
Separated
Divorced

Widowed
In a relationship but not cohabiting
Not in a relationship

9) **Which of the following statements best represents the work pattern of the person you are married to or cohabiting with?** *If you do not live with your partner please choose the last option 'This question does not apply to me as I do not live with my partner'*
My partner works full-time in the technology industry
My partner works full-time in an industry outside the technology industry
My partner works part-time
My partner is not currently employed
This question does not apply to me as I do not live with my partner

10) **Do you have any children?**
Yes, I have 1 child
Yes, I have 2 children
Yes, I have 3 children
Yes, I have 4 or more children
No, I dont have any children

11) **If you have children, please write their ages in the box below.**

If you do not have children you can skip this question

12) **If you are married to or cohabiting with your partner, please mark the statement which best represents the distribution of household duties within your home (including child care if you have children)** *If you are not married or cohabiting you can skip this question*
I do all the household duties (100%)
I do slightly more household duties than my partner. I do about 60% and my partner does about 40%
I do a lot more household duties than my partner. I do about 80% and my partner does about 20%
We share household duties equally (50% each)
My partner does slightly more household duties than me. I do about 40% and my partner does about 60%
My partner does a lot more household duties than me. I do about 20% and my partner does about 80%
My partner does all the household duties (100%)

Your Team

You and your team

13) **How many people are in your team?**

14) **How many women are there on your team?**

15) **How many leads or managers are in your team?**

16) **Please state how many male and female leaders (leads or managers) are in your team** *For example if there are 2 male leads or managers AND 3 female leads or managers please write: 2 x Male and 3 x Female*

Advancement

This is a new page. You can change the options with the button above, or start dragging widgets to the space below.

17) **Have you ever taken voluntary extended leave from your technology career?**
Yes
No

18) **If you answered yes to the above question, do you think that the extended leave that you took from your career hindered your career development?**
Yes

No

19) **Please rate the importance of the following characteristics to be successful in technology:**

	Extremely True	Very True	Moderately True	Neutral	Slightly True	Almost never true	Not True
Careful							
Critical							
Initiative to thinking outside the box							
Analytical Thinking							
Self promoting							
Innovative							
Risk taking							
Questioning behavior							
Collaborative							
Speaking up							
Working late							

Mentoring others							
Friendliness							
Ambitious							
Quick decision maker							
Independent worker							
Entrepreneurial							
Masculine behavior							
Geeky							
Isolated at the keyboard							
Assertive							
Good communicator							

20) **Mark the attributes that you possess:**
Careful
Critical

Initiative to thinking outside the box
Analytical Thinking
Self promoting
Innovative
Risk taking
Questioning behavior
Collaborative
Speaking up
Working late
Mentoring others
Friendliness
Ambitious
Quick decision maker
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You can enter some introduction text here.

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No

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Yes/No - Other (Please Specify Yes or No as well as the reason):

36) **Is it accepted for you to work from home (WFH) by your organization?**

Never
Sometimes
Whenever I want/need to

37) **Have you ever considered leaving the technology industry environment due to high levels of pressure?**
Yes
No

38) If you answered Yes to the above questions. Tell me why you would consider leaving the industry.

Appendix 3 : The LinkedIn post that was used to gather participants

CALLING TECHNICAL WOMEN IN THE SILICON VALLEY AREA: I am currently completing a master in HR. If you are a technical woman (not in a management position) in a Silicon Valley organisation, can you please fill out my survey?

This survey is 100% confidential. No names, email addresses or companies are recorded:

https://kwiksurveys.com/s.asp?sid=1mhyj7io72skgkp164539

Appendix 4 : Email sent to personal contacts in the industry

Hi X,

I hope that you are keeping well. I am currently completing a Master in Human Resources and as part of that I am required to complete a thesis. I have decided to do my thesis on the barriers that women in engineering face, being in the minority, and how a persons home life and team can affect your needs within the industry.

From working with you in the past, I know that you meet the criteria for my study. Would you mind filling out a short, five minute survey for me to help me with my thesis? To put you at ease, this survey will not record your email address, your name or what company you work in.

Thanks!

Anna