CONCEPTUALIZING THE EXPERIENCES OF WOMEN'S CAREER DEVELOPMENT IN

CYBERSECURITY: A NARRATIVE STUDY

by

SWAGATA DAS

(Under the Direction of Janette R. Hill)

ABSTRACT

The rise in the use of digital devices and rampant cyberattacks has necessitated the need for cybersecurity measures for individuals and businesses. However, the field of cybersecurity suffers from a supply mismatch problem and struggles with gender diversity, with women representing less than one-quarter of the global workforce. To counter this problem, this study explored the life and work experiences of women working in the field of cybersecurity. Using gender as a lens, the inquiry focused on the lived experiences of women in cybersecurity careers.

To develop an in-depth understanding of women's career development experiences, a qualitative research study was conducted using narrative inquiry where every participant's story became the basic unit of analysis. In terms of philosophical perspectives, both interpretive and critical frameworks were used. The theoretical framework utilized social cognitive career theory, feminist standpoint theory, theory of Wholehearted living, and understanding of meaning making. Participant interviews were used as the primary data source. Driven by the theoretical perspectives and study design, the analysis of participant interviews, individually and across all participants, led to the findings of this study. Overall, 12 participants were interviewed, but 6 participant accounts were considered for the study given the robustness of their data. The

participants had experience in academia, industry, the government, or in a combination of these areas, and were located in different geographic locations. They also varied in number of years of work experience; thus, leading to a broad array of descriptions of their career trajectories. This study was conducted in the United States.

The findings from the study provide a deeper understanding of women's career experiences. First, in terms of career choice factors, participants demonstrated a desire to research and study things, and were very technically oriented. Second, their key career influential factors included intrinsic, extrinsic, interpersonal, and work environment factors. The resulting categories within each of these factors are explained in detail. Third, participants made meaning of their career in relation to meaningful work, gendered experiences, and motherhood. Finally, implications for theory, research, and practice are provided. Recommendations for future research are explained.

INDEX WORDS: Women in Cybersecurity, Career Development, Feminist Standpoint Theory, Social Cognitive Career Theory, Narrative Inquiry, Qualitative Research

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DEDICATION

To my parents, Monalisa Das & Jagadananda Das: Thank you for loving me, caring for

me, educating me, and guiding me along the way.

To my sister, Ipshita Das: Thank you for the most unique gift of sisterhood.

To my husband, Senthil Dorairaj: Thank you for empowering me and helping me rise above my

emotional confusion, always. This would not have been possible without you.

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CHAPTER 1

INTRODUCTION

Background and Context

COVID-19 is not the only risk with the ability to quickly and exponentially disrupt the way we live. The crisis shows that the world is far more prone to disturbance by pandemics, cyberattacks or environmental tipping points than history indicates. (Davis & Pipikaite, 2020)

We are living in unforeseen times where a biological virus has literally taken the world in its grip. Unfortunately, the lockdowns and remote working spurred by the pandemic have also resulted in an increase in the volume of global cyber-attacks such as phishing, ransomware, social media threats, Trojans, cyber-warfare, as well as supply chain attacks (Muncaster, 2020). News and media reports have raised an alarm on the challenges of navigating cybersecurity amidst the pandemic (Microsoft, 2020), warning against an inevitable future "COVID-like global cyber pandemic" with an ability to quickly disrupt our lives in terms of social contact and create huge economic impact (Davis & Pipikaite, 2020). Even before the pandemic hit, cybersecurity was a huge concern for businesses and individuals; the current context has made it an even greater necessity in terms of focus and attention for organizations (Quade, 2020).

The digital world in which we live today is a massive socio-technical system consisting of human and technical factors (Esteves et al., 2017). The growth in cyber-attacks that have affected social, political, economic, and cultural contexts (Gandhi et al., 2011) creates a need to

not only innovate technical countermeasures, but to have more experts to lead such measures. Almost every business today needs cybersecurity professionals, but there is a vast shortage of skills and people to take up these responsibilities. Cyberseek, an organization that provides data about the cybersecurity job market, reports an availability of 504,316 job openings in the United States (U.S.) as of June 2020. Despite the high number of job openings and the ever-increasing national security pressures, women, who comprise about 57% of the country's available workforce, continue to be underrepresented in cybersecurity (Catalyst, 2019b). In order for us to be safe in our digital spaces, we need cybersecurity to support humans in their social, organizational and economic contexts, which includes adopting a gender inclusive culture.

It is not only the field of cybersecurity where there is a demand for jobs, yet positions stay unfilled and gender inequities exist. The technology sector overall has seen job demand trends globally (Holtzblatt & Marsden, 2018), and still women do not represent a high percentage of the workforce. In 2016, women comprised of only 26% of the computing workforce in the U.S. with 3% African American, 5% Asian, and only 2% Hispanic (NCWIT, 2017). In Canada, the number of women in the technology sector has remained the same over a decade at 25% (Jones & Trop, 2015). In 2015, Australia reported that 28% of their Information and Communications Technology (ICT) professionals were female (Australian Computer Society [ACS], 2015). More recently, Kaspura (2019) further explained that Australia has fewer than 15% of female engineers and their unemployment rates for women are much higher compared to men, and this is in spite of their educational qualifications. According to a 2018 McAfee Cybersecurity Talent Study, Australia's cybersecurity workforce is 25% female (Morgan, 2019). In the European Union, of all ICT specialists' women represented only 16% of

the workforce (Eurostat, 2017). Together, these numbers indicate that there is strong evidence of a global need to diversify the ICT workforce.

The need for recruitment of women into ICT is important but so is the need for retention. Data from a study by Iclaves (2013) provides evidence that women may go into the field, but do not necessarily stay long-term. For example, Iclaves' study indicated that by age 30 women represented only 20% of those who graduated with an ICT degree and still continued to work in the field; by age 45, only 9% remain. This is significant for both the short-term "appeal" to women as well as sustainability of a diverse workforce. The challenges of recruitment and retention of women in the ICT field may align with the hypothesis that people naturally and circumstantially gravitate to working with others of their own group (Holtzblatt & Marsden, 2018). That said, the lack of women and people of color (e.g., Black and Latinx) in ICT is problematic on multiple levels. Perhaps one of the most significant reasons relates to the fact that technology companies spur digital innovation, yet the lack of diversity in ICT excludes a significant portion of the population in this work. While problematic in and of itself, research indicates that the presence of women in the technology sector is highly correlated with innovation, creativity, revenue and profits in the organizations (Holtzblatt & Marsden, 2018; Hunt et al., 2015; Phillips, 2014; Scott et al., 2017; Thomas et al., 2016). The low percentages of women and people of color thus, strangle the potential for increased innovation.

There are some indications that things may be changing. A 2017 study reported that women comprise only 11% of the total global cybersecurity workforce and women in North America comprise 14% (Reed et al., 2017). The 2019 report by the same group shows a change

in that statistic, with women now representing 24% of the workforce; however, this increase is attributed to an expansion in the scope of the study to include women who spent 25% of their workday in cybersecurity related activities ((ISC)², 2019).

In terms of STEM education in the U.S., women obtain more than 50 percent of undergraduate degrees in biology, chemistry, and mathematics, but less than 20 percent of undergraduate degrees in computer science, engineering, and physics (Cheryan et al., 2017). The authors further discuss women in computer science as following a "unique trajectory":

> Women's participation in computer science has followed a unique trajectory: It is the only field to have experienced a marked decrease in the percentage of bachelor's degrees earned by women during the last three decades..... By the mid-2000s, the percentage of bachelor's degrees in computer science earned by women had dropped by nearly half to around 20% to meet physics and engineering. Since the mid-2000s, no STEM field has seen much change in the percentage of bachelor's degrees going to women. (p. 3)

Cheryan et al. (2017) found three overarching factors contributing to the gender gap in computer science, engineering, and physics: (a) masculine cultures in these fields that lower sense of belonging to women, (b) insufficient early experience with topics such as computer science, engineering, and physics, and (c) gender gaps in self-efficacy (Cheryan et al., 2017). Therefore, it is not surprising that a low representation in education or the work pipeline results in a low representation in the workforce.

There is some evidence that provides insights into why women may not stay in cybersecurity long-term. Bagchi-Sen et al. (2010) conducted a study to explore women's work

experience in cybersecurity. The results of the study found that social and institutional factors were significant contributors to a lack of job satisfaction, including (a) lack of technical knowledge transferred to business situations, (b) insufficient team collaboration, (c) exposure, (d) 24*7 work environment, (e) gender stereotypes of being mistaken for staff or secretary, and (f) lack of networking opportunities posed as early career barriers. The challenges for women in cybersecurity are found in related fields. For example, studies related to women in engineering careers describe several reasons why women leave the workforce such as poor compensation, inflexible work environment, lack of advancement opportunities and recognition (Fouad et al., 2017), as well as a lack of professional role confidence (Cech et al., 2011), susceptibility to stereotype threat (Block et al., 2011), absence of satisfaction with pay and promotions (Hunt et al., 2012), and unmet needs from the occupation (American Association of University Women, [AAUW], 2015).

On the contrary, women who persist in engineering careers in the U.S., demonstrate high levels of self-efficacy, a strong engineering identity, are motivated by the challenges of the profession, and showcase adaptability to male dominated work culture despite discrimination and other workplace related challenges (Buse et al., 2013). Fouad et al. (2011) suggest that three domains of self-efficacy and outcome expectations differentiate women who stay in engineering careers versus those who leave: (a) confidence in engineering tasks, (b) confidence to navigate organizational culture, and (c) confidence in their ability to manage multiple life roles. Additionally, Fouad et al. (2016) in a similar study, found that women who persist in engineering careers do not differ from those who leave in the three aforementioned domains. Instead, those who continue in these careers experience better workplace supports and therefore, demonstrate

higher levels of occupational commitment. All of these factors also help to create an understanding of related factors that might hold true for women in cybersecurity as well.

Statement of the Problem

The current picture of women in ICT fields is quite different from that in the beginning of the field. In its earliest decades, computer programming was a women's field (Abbate, 2012; Ensmenger, 2015). Today, women's woefully declining participation in the same field they helped to establish has prompted various research and initiatives to reverse the trend. Cybersecurity is one such profession in the technology sector where particular attention is needed (Reed et al., 2017). While cybersecurity remains an ever-increasing concern for the safety of the U.S. and the world, workforce demands continue to outpace supply. Cybersecurity is a field that has a workforce shortage (Morgan, 2017), yet it is also a field that lacks diversity, especially along gender lines ((ISC)², 2019). While there is a need to alleviate the problem around workforce shortage, there is also a need to increase women's participation in the STEM field of cybersecurity which remains the focus of this research.

Cybersecurity will benefit from the potential contribution of women who are interested in the field leading to "innovation, creativity and collective intelligence" (Cheryan et al., 2017, p. 3). It will also help women take advantage of careers that offer higher income and status and finally, increase in women's participation will also help address the supply and demand mismatch that currently exists in the field. Furthermore, there is a need to create a workforce that embraces diversity, equity, and inclusion where everyone is treated fairly, is not hampered by barriers in terms of stereotypes and prejudices and has access to needed resources to be recruited,

retained and find advancement opportunities in the field. Thus, women who choose to be in the field can fully take part in their individual career growth and in doing so, find support in their sustenance in the field.

Purpose Statement and Research Questions

The purpose of this narrative inquiry was to explore the life and work experiences of women working in the area of cybersecurity. Therefore, women working across different sectors (e.g., academia, industry, and the government) and at different stages in their career development in cybersecurity were recruited for the study. Using gender as a focal lens, this study interrogated the nature of their work experiences in detail. An underlying focus was to find better ways to encourage and support more women to both apply and remain in the field. Through the study rich and complex storied accounts of women's lives were created, including factors leading up to a career in cybersecurity, their past and present work experiences as well as future aspirations. Thus, the study sought to identify and describe the narratives of supports, barriers, coping mechanisms, motivations, relationships, as well as many other aspects that bring meaning to each of their work lives.

Overall, this study aimed to create an understanding of cybersecurity as a career or profession for women and to use stories as format for capturing their experiences. This study attempted to find answers to the following research questions:

1. How do women describe their career choice of cybersecurity?
2. What are the key factors or events that influenced their career paths in cybersecurity?
3. How do women make meaning of their work experiences as cybersecurity professionals?

Overview of Chapters

This dissertation is organized in six chapters. In Chapter 1, I introduce the background and context of the research problem, statement of the problem, purpose statement and research questions, and a brief introduction to what each chapter holds. In Chapter 2, I discuss the literature review and theoretical framework of the study. The literature review is organized in the following sections: gender gap in the technology sector, "herstory" in computing, gender discrimination in the technology sector, value of workforce diversity, gender gap in STEM and cybersecurity, and initiatives taken to improve participation of women in cybersecurity. The theoretical framework includes theories and their related studies such as social cognitive career theory, feminist standpoint theory, theory of Wholehearted living, and meaning making of lived experiences. The influence of gender in relation to the theories and to the research context is highlighted too. In Chapter 3, I introduce the rationale for qualitative inquiry and explain the two modes of narrative inquiry – paradigmatic and narrative modes of analysis. The chapter also includes other considerations for qualitative research such as validity and reliability, methodological limitations, ethical considerations, as well as researcher subjectivities. In Chapter 4, I report the findings and interpretation of each research question for every participant; thus, engaging in a narrative mode of analysis. In Chapter 5, I report the findings and interpretation of each research question across all participants; thus, engaging in a paradigmatic mode of analysis. In Chapter 6, I provide a brief summary of the study, its findings and interpretations, implications for theory and practice, limitations and future recommendations for research, and end the study with a brief conclusion.

CHAPTER 2

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Cybersecurity, I would consider is just learning to walk right now. It has not taken ahold yet. The need has taken hold, but I do not believe that we have enough educational institutions that are focusing on it. So that is where I was, when I graduated in computer science. I was one of four computer science females. Okay 35 years ago, so granted it is very gradual, but today, I believe that there are up to about 25% females coming out of computer science programs. ~Sherry, Study Participant

Introduction

Cybersecurity is an ever-increasing concern for the safety of the United States (U.S.) and the world, yet workforce demands continue to outpace supply. Even in the face of national security pressures, women, who comprise about 50% of the U.S. available workforce, continue to be woefully underrepresented in cybersecurity. The number of women in the tech sector is startlingly low (26% globally) and the number is even lower in cybersecurity (Holtzblatt & Marsden, 2018; Reed et al., 2017). An estimate has women currently representing 24% of the global cybersecurity workforce, which is an increase from the mere 11% reported in 2017 ((ISC)², 2019).

Conjectures abound regarding the reasons for the lack of gender diversity not only in cybersecurity but in STEM-related fields in general; however, the factors and experiences of

women entering, staying, and leaving the field of cybersecurity are poorly understood. In order to address cybersecurity's talent and gender gap, a more informed perspective is required to illuminate the enabling and hindering factors in shaping the career trajectory of women in cybersecurity. To help create a more informed perspective, this chapter examines individual, socio-cultural and environmental factors that contribute to women's career choice and development in cybersecurity. Thus, the literature review explores factors related to career choice and career sustenance posing as support as well as barrier to women's career trajectory in the field of cybersecurity.

I start by looking at the current statistics of gender and skills gap in the cybersecurity and information technology (IT) workforce, history of women in computing, the value of workforce diversity and why we must pursue those efforts tirelessly. In addition, I also provide some background on past research and understanding of the gender gap in cybersecurity and STEM, gender discrimination in the overall technology sector and current initiatives taken towards improving gender diversity in cybersecurity. The second section of this chapter presents a theoretical framework comprising three theories: social cognitive career theory, feminist standpoint theory and theory of Wholehearted living to understand women and their career trajectories.

Gender and Talent Gap in Technology Sector: Cybersecurity & ICT

Cybersecurity as a profession has a workforce shortage. The field also lacks diversity, especially along gender lines. Until recently, women were highly underrepresented in information security. Women comprised only 11% of the global information security workforce according to the 2017 Global Information Security Workforce Study (GISWS). The GISWS had

a large international data set when it was conducted between June-September 2016 polling 19,641 respondents from 170 countries (Reed et al., 2017). However, a 2019 report by GISWS has reported an increase in that representation to 24%. While conducting the latest study, GISWS expanded the scope of the study to include women who not only have cybersecurity certifications and work in related work functions, but also those who spend at least 25% of their workday in cybersecurity related tasks ((ISC)², 2019). This number is close to the 26% women comprising all IT professionals globally (Dallaway, 2014). Reed et al. (2017) also highlighted the regional concentration of women in cybersecurity, with North America representing the highest at 14%, Asia-Pacific at 10%, Africa at 9%, Latin America at 8%, Europe at 7%, and the Middle East at 5%. As per Reed et al. (2017) projections, the gap between available qualified professionals and unfilled positions in cybersecurity is expected to widen to 1.8 million worldwide by 2022. Other sources have also expressed concern regarding a shortage of skills in this industry that needs to be addressed (CISCO, 2015).

Currently, CyberSeek (n.d.) indicates a total of 504,316 job openings in the U.S. and total number of employees working in the cybersecurity sector nationally as 997,058. While there is an existing issue with demand and supply mismatch in cybersecurity, a gap in representation of women can be seen in the entire technology sector across major geographic regions (Holtzblatt & Marsden, 2018). In 2016, women represented only 26% of the entire computing workforce in the US with only 3% of this workforce being African American women, 5% Asian women, and only 2% Hispanic women (NCWIT, 2017). Similarly, in Canada, the number of women in the technology sector has remained stagnant over a decade at 25% (Jones and Trop, 2015). In 2015, Australia reported that 28% of their ICT professionals are female (ACS, 2015). They have fewer

than 15% of female engineers and their unemployment rates for women are much higher compared to men and this is in spite of their educational qualifications (Kaspura, 2019). In the European Union, women represented only 16% of all Information and Communications Technology (ICT) specialists (Eurostat, 2017). Surprisingly, by age 30 only 20% of those women who graduated with an ICT degree still continued to work in the field and by age 45, only 9% remained (Iclaves, 2013).

The number of women in positions of influence in cybersecurity is also limited. For example, the representation of women presenters at hacking and security conferences in the U.S. is very low, which may be attributed to the overall low numbers of women in the field. To get a more comprehensive picture of women's representation at hacking and security conferences, I looked at presentation data from three leading security conferences in the U.S. from 2012 to 2017—Black Hat, DEFCON, and USENIX (see Appendix A). From the data, based on the number of female speakers relative to the total number of speakers, we can say that in total only 8% women have ever presented their research at these events between 2012-2017. Such a low number raises several questions as to why women are not speaking at prestigious security conferences. The reasons for this low representation are not entirely clear. In the next section, I focus on the history of women in computing and how women's roles have altered through changing times in computing.

<center>**"Herstory" in Computing**</center>

Abbate (2012) quotes female programmers interviewed as part of her oral history and archival research of women in computing. Women shared their life stories with the author and

below are a few illustrative quotes that reflect the early period of computing and women's role in it (Abbate, 2012):

> It really amazed me that these men were programmers because I thought it was women's work!

<div align="right">Elsie Shutt, hired by Raytheon in 1953, p. 1</div>

> I was hired as a programmer.... It was something that women were believed to be good at.

<div align="right">Fran Allen, hired by IBM in 1957, p. 1</div>

> It never occurred to any of us that computer programming would eventually become something that was thought of as a men's field. At the time—just as now, actually—in the intro, beginning, lower levels of employment, it was at least half women. There were a lot of women who made straight As in math!

<div align="right">Paula Hawthorn, hired by Texaco in 1966, p. 1</div>

During the early days of computing, women were well represented in computer programming (Ensmenger, 2015). During World War 2, women formed a significant majority of programmers in the U.S. This is also the time when the first electronic digital computer ENIAC was invented. The purpose of this machine was to speed up ballistic calculations to determine the path of projectiles fired from weapons at different ranges. The U.S. Army recruited a team of six women to program the ENIAC, followed by more women later in 1947. At the time this task was done by a Differential Analyzer and two hundred "female computers." Women were the dominant gender in programming during the 1940s and 1950s. In 1967 in an article titled 'The Computer Girls' published in Cosmopolitan magazine, Grace Hopper said "it's just like planning

a dinner, you have to plan ahead and schedule everything so that it's ready when you need it. Programming requires patience and the ability to handle detail. Women are naturals at computer programming" (Perez, 2019, p.105).

Before the war took place, American women with a college degree in math had fewer job options, such as becoming a math teacher in secondary school or performing calculations in insurance companies and other such businesses (Ensmenger, 2015). So, a job in scientific computing was considered both interesting and well-paying in the mid-1940s, and because of their relevant skills, women were actively recruited. During World War 2, women were also encouraged to take up factory jobs such as running a drill press. Due to limited opportunities in other fields, the job of a computer operator or a programmer was exciting because it was not gendered as it did not exist before the war (Ensmenger, 2015).

However, there were limitations to how much women could participate in these projects. Although women were the computers, there was a sexual division of labor in the ENIAC project—men took the role of scientists, engineers and military officers who built the hardware, carried the intellectual tasks of problem identification and solution using mathematical approaches and women were given the role of programmers to translate the plan into a form that the computer would understand. The latter was considered a low-status job and was therefore, performed by the women (Ensmenger, 2015). ENIAC programmers did not receive any professional rating until 1946 after men returned from the war. Women were excluded from receiving any engineering education or to have authority related to programming. The only involvement women had in building hardware was performing assembly line work of

components for the ENIAC. So, while new opportunities emerged, gender boundaries were also enacted (Ensmenger, 2015).

Throughout the 1950's, there were different narratives about programming and its suitability for a particular gender. Advertisements portrayed a dominant masculine view of the field which shaped the job recruitment process. Abbate (2012) quotes Jean Sammet, who became renowned for her expertise in programming languages, in her book, "In 1958, first of all, there were separate men's and women's ads . . . and I assure you that under 'Women's' there was no such thing as engineer, mathematician, programmer, or anything like it. It was clerks, teachers, housekeepers, whatever. So, I learned to look under the 'Men's Help Wanted.' . . . I had to look under 'engineering' and then look at the job description to see whether or not there was something that I thought I could do" (p. 65).

On the other hand, IBM distributed a recruitment brochure for women in 1957, entitled "My Fair Ladies" aimed at college educated women. The brochure pictured real women IBM employees who worked in programmer or researcher roles and said, "If you are attracted by the challenge of a highly important position that will make full use of your talents and aptitudes . . . you'll like IBM" (Abbate, p. 65). To tap into women's potential some employers also associated programming with "women's work" (e.g., knitting, music, cooking) to indicate that computing was natural and desirable to women (Abbate, 2012).

Programming work was considered both routine and mechanical until the 1970s. Later, it was transformed into a highly acclaimed and valued discipline by male computer experts. Part of the reason for this transition was that computers were mass produced in the late 1960s. The complexity of building software systems gave rise to the need for more computer programmers,

as many as 500,000 (Englebardt, 1965). During the 1970s and into the 1980s, there was an elevation to the job in terms of pay and status; thus, attracting men to the field. This began the stereotyping of the field as highly masculine, and also led to an emergence of stereotypes such as "computer bum" and "computer hacker" (Ensmenger, 2015). There was a difference in the personalities of each of these identities. While computer bums and computer hackers were both considered nerds, hackers were potentially dangerous in their intent. Computer bums, on the other hand, were interested in writing codes to either tinker with programs or solve puzzles with no specific objective in mind.

At the time, the image of a computer hacker was that of a young, white, male. This was further emphasized by movies like WarGames in 1983 and Steve Levy's published bestselling book *Hackers: Heroes of the Computer Revolution* in 1984. Levy wrote, "You would hack, and you would live by the Hacker Ethic, and you knew that horribly inefficient and wasteful things like women burned too many cycles, occupied too much memory space" (p.70). "Women, even today, are considered grossly unpredictable," one of his hacker heroes (PDP-6) explained. "How can a hacker tolerate such an imperfect being?" (p. 62). Levy lamented that there were no 'star-quality' female hackers. There were women programmers, but no one had taken hacking as their *holy calling* like male hackers. Levy acknowledged that there was a cultural bias against women getting into computing. To which one of his heroes said that "Cultural things are strong, but not that strong" (p. 63), and attributed the lack of female hackers to genetic or "hardware" differences. This cultural perspective helped to further solidify white male dominance in computing.

Indeed, hackers had formed an exclusively white male culture (Levy, 1984). There were stereotypical personality profiles in terms of how they talked, their working hours, food preferences, almost as if they spent all their time thinking only about computers (Levy, 1984). They also had poor hygiene. This, however, portrayed the image that hackers had conscious priorities; that they were purposefully not socialites because there was nothing more useful than hacking. Ensmenger (2015) points out "in a wide variety of periods and contexts, from the corporation to the academy to the computer center, male programmers have mobilized masculinity as a means of pursuing professional status and autonomy. Many male programmers saw the role of the eccentric and exceptional computer genius as a desirable alternative to that of a lowly, routinized, and feminized 'coder'" (p. 65). This further caused barriers for women in computing careers.

The "academy" mentioned by Ensmenger (2015) refers to the Association of Computing Machinery (ACM), which institutionalized computer science as an academic discipline by the late 1960s when computer science took a more theoretical and mathematical turn. In a 1971 report, the ACM warned that "personnel are occupying positions for which they are inadequately qualified" and this was in part due to "the lack of understanding of necessary skills and experience" (Abbate, 2012, p. 40). However, in 1973, in a study on cognitive predictors of success for computing work, the author indicated that the aptitudes and abilities needed to work as a programmer were not fully understood (Abbate, 2012; Jacobs, 1973).

In the pursuit of finding the perfect programmer, IBM commissioned a study which stated that a really talented programmer was twenty-six times more productive as compared to an average colleague (Ensmenger, 2015). This further complicated the entry of women in the field.

Selection mechanisms in the computer industry used psychometric testing such as aptitude tests and personality profiles to find the "perfectly skilled programmer." These tests were used by a majority of employers, which filtered candidates according to a stereotype of those who "work more with machines than with people." This perpetuated the notion that programmers were "antisocial, mathematically inclined, male" (Ensmenger, 2015). This psychological profile became a "self-fulfilling prophecy" as companies started to seek out such profiles (Perez, 2019). The field of computing became male-dominated and to a certain extent a barrier to participation of women (Frenkel, 1990). In the next section, I provide a reflection on gender discrimination and sexism in the technology sector that creates systematic barriers for women in their careers.

Gender Discrimination in Technology Sector: Cybersecurity & ICT

The technology sector is notorious for gender discrimination, rampant sexism and lack of diversity (Jee, 2018; Dickey, 2017; Fiegerman, 2017; Solon, 2017), resulting in continued problems with attracting, retaining and advancing women (Funk and Parker, 2018; McGee, 2018). Reed et al. (2017) found that women experience workplace discrimination, occupational segregation, and wage inequality in their research on women in cybersecurity. They reported that men are four times more likely to occupy C-level positions (highest positions in corporations), four times more likely to hold executive management positions, and nine times more likely to occupy managerial positions than women, even though women enter the cybersecurity field with higher qualifications compared to men. Of the 11% of positions held by women globally, more than half are entry-level or non-managerial positions.

Differences in representation in cybersecurity is just one area of disparity faced by women. Peacock and Irons (2017) found that men and women in cybersecurity perceived

significant differences in how they were treated with respect to recruitment, opportunities, and career growth. The female respondents in their study thought that society, including customers and clients, perceived their line of work as a "man's job," which may dissuade women from joining the workforce and/or envisioning a far-reaching career in the industry. Although both men and women generally perceived they are equally valued in the industry, this perception was stronger in male than in female respondents.

In February 2017, Susan Fowler in a blog post described her experience with sexual harassment by her boss on her first day at Uber. When she complained to HR, she was pushed to leave the team (Jee, 2018). The *New York Times* published an article stating that Google paid millions of dollars to its male executives accused of misconduct as severance packages (Wakabayashi & Benner, 2018). This resulted in massive employee protests around the globe, including Singapore, Hyderabad, Berlin, Zurich, London, Chicago and Seattle. The person who organized the walkout said that the *New York Times* article was a "small sampling of the thousands of stories we all have" (Wakabayashi et al., 2018). As illustrated in the previous section, the discrimination on multiple levels is not new. Most recently, Perez (2019) attributed the computing culture as being a misogynistic culture, making the connection between a misogynistic culture with the "mysterious lack of women."

Thanks to rigid steps taken by other women there is now a movement to address issues concerning gender discrimination and sexual harassment. The movement gained prominence after Ellen Pao claimed that she experienced discrimination during promotion, at venture capital firm Kleiner Perkins in Silicon Valley, and was excluded from meetings, after she accused a senior partner, a venture capitalist, of sexual harassment (Solon, 2017). She filed a $16-millon

gender discrimination lawsuit against the venture capital firm which she eventually lost in the courtroom. However, this initiative laid the groundwork for other women to be aware of such situations and to fight against discrimination (Solon, 2017).

Diversity and inclusion efforts have gained significant importance in the technology sector in the last decade. Companies are budgeting money for workplace diversity (Thomas et al., 2016), creating goals for bringing more women and minority engineers on board. Companies are also creating apprenticeship and internship programs (Dishman, 2017a, 2017b), partnering with historically black colleges and universities and committing over $50 million to diversity efforts (Lev-Ram, 2015), resulting in creating special C-level positions for diversity officers in organizations (Jones & Trop, 2015). In the next section, the study looks at the value of workforce diversity and why this should be embraced.

Value of Workforce Diversity

Phillips (2017), a proponent of workplace diversity, agrees with the views of John Stuart Mill, philosopher and economist, that diversity is not only a source of progress in terms of trade exchange for economic growth, but also helps in moral and intellectual growth of people. Phillips (2017) goes on to say that in current times we can say that this idea of placing different people together helps in different kinds of outcomes for our society such as "organizational and team performance, educational development, technological advancement." In her work on diversity, Phillips (2017) has conceptualized diversity in terms of "informational diversity" and "social category diversity." This is similar in essence to the conceptualization of diversity in Page and Lewis (2017) in terms of identity and cognitive diversity. Informational diversity refers to the difference in "information, opinions, perspectives, and modes of thought and action" that

are required by the team members in a group to complete a relevant task. Social category

diversity refers to the basis of categorization of people into in-group and out-group. These

categorizations can be based on characteristics of race, gender, nationality, or age or could also

be based on similar preferences such as clothing or painting.

To say that workforce diversity brings value to the organization is debatable; no such

effort is required to prove benefits of homogenous work environments (Phillips, 2017). The

value-in diversity perspective essentially means that any person who does not belong to the norm

must bring additional revenue or related benefits to the team or the organization (Phillips, 2017).

Going into a workspace with that kind of burden may be exhausting. The value-in diversity

argues that contact between employees belonging to different backgrounds allows for new

situations, which in turn leads to higher performance compared to employees in homogenous

groups (Phillips, 2017).

Proponents of the value-in diversity perspective propose that a diverse workforce is good

for the business of an organization. For example, Herring (2009) studied demographics diversity,

along both racial and gender lines. The author analyzed data from 1996 to 1997 via a National

Organizations Survey from for-profit business organizations, and found that diversity resulted in

increased sales revenue, more customers, and greater relative profits. Herring indicated based on

the study data that embracing diversity in the workplace is better for business.

Finances in a company are also influenced by diversity. In a recent study, McKinsey &

Co. (Hunt et al., 2015) found a statistically significant relationship between a firm's truly diverse

workforce and their financial performance. In this case, a truly diverse workforce meant a fair

representation of women and a mixed ethnic/racial representation in the leadership team. The

research looked at 366 public companies across different industries in the United Kingdom, Canada, the United States, and Latin America. The data analyzed were specifically from top management teams (TMTs) and financial information. Companies that were the most gender diverse were 15% more likely to have financial gains above the national industry mean. Similarly, companies that had the most racial/ethnic diversity were 35% more likely to have gains above the national industry mean.

Research also shows that organizations with gender-diverse teams perform better along significant business metrics. In 2014, The National Center for Women in Information and Technology (NCWIT) performed a comprehensive study on the impact of gender diversity on technology business performance (Barker et al., 2014). Their research concluded that gender-balanced companies, with the presence of women TMTs and throughout the organization leads to improved financial performance. Other research studies have also contributed to this finding that workforce diversity is proportional to financial gains (Krishnan & Park, 2005; Herring, 2009; Hoogendoorn et al., 2013; McKinsey & Company, 2010; Rohner & Dougan, 2012). Morgan Stanley (2016) found that highly gender-diverse tech companies had higher returns of approximately 5.4% on average on a yearly basis, compared to their peers with less gender diversity.

Another stream of research has found that gender-balance teams have superior team dynamics, improved innovation, and productivity (Doz et al., 2004; Lehman Brothers Center for Women in Business, 2008; Turner, 2009; Woolley et al., 2010), as well as better adherence to project schedules, tendency to stay under budget, and better employee performance. Other studies have found that workforce diversity is a significant contributor to productivity (WGEA,

2018; Way et al., 2016), leads to improvement in group processes and creativity (Østergaard et al., 2011), and overall performance (Caldwell, 2013) of their respective organizations.

In a study assessing the impact of female representation in TMTs, Rohner and Dougan (2012) performed an analysis of 2,360 global companies across a range of industries. They found that the sectors closer to final consumer demand (e.g., healthcare and financials) had a higher proportion of women in the TMTs. Heavy industry and Information Technology (IT) had a lower proportion of women as board members. They also found that the presence of women on the board led to higher return on equity, more stability during financial crises and global slowdowns, and better average growth. Perryman et al. (2016) studied the impact of gender diversity in TMTs on firm performance, firm risk and executive compensation. They found that firms that embrace gender diversity in TMTs exhibit lower firm risk and show better firm performance. Researchers also found that gender diversity broadens the range of cognitive perspectives for an organization, as women bring different perceptual views and potential solutions for problems by recognizing strategic opportunities and finding alternatives (Dutton & Duncan, 1987; Perryman et al., 2016; Wiersema & Bantel, 1992).

The research provides strong evidence that there is value, in multiple ways, from having a diverse workforce. The technology industry in the U.S. is not benefitting in that it suffers from a lack of both ethnic and gender diversity. *Fortune* (Mangalindan, 2014) analyzed data from at least 14 top tech companies and reported that white men dominate the scene, followed by Asian men. It is possible this follows from the hypothesis that people naturally and circumstantially gravitate to working with others of their own group; nevertheless, this has led to an exclusion of women and people of color (Black and Latinx). This is problematic, because we know that

digital innovation in today's world is spurred by tech companies, yet a lack of diversity excludes a significant portion of the population in this work and limits the potential for increased innovation.

Not all studies are as clear about gender diversity in ICT. For example, Morgan Stanley (2016) found that IT companies were mixed with respect to embracing gender diversity. That said, their research indicated that women did not fare well in terms of pay equity. To see if gender differences persist in TMTs in terms of a wage gap, Perryman et al. (2016) conducted a study and found that women received lower compensation than their male colleagues, and that an increase in female representation on the board results in a decrease in compensation difference between genders. Moving from the organizational level to a larger socio-economic perspective, women have fewer incentives and major barriers to joining the workforce, such as: cultural attitudes, education, labor market conditions, prospect of lower wages, discrimination at work, and more responsibilities at home with respect to housework and caring for children and elders (Morgan Stanley, 2016). Institutions will have to resolve these issues to offer really equal treatment to employees irrespective of their genders.

The field of cybersecurity would likewise benefit from more representation of women in their teams whether it be in academia, industry or the government. Suby (2013) in (ISC)[2] report suggested that the cybersecurity industry would benefit from increased gender equality due to the boost in the variety of personality attributes (Peacock & Irons, 2017). As indicated previously, the "personality attributes" are not always viewed in positive ways. One area in need of more attention is how to support a diverse workforce in ICT. This is also not a new idea. For example, Krishnan and Park (2005) found that the presence of women in TMTs has a direct impact on

organizational performance; however, they emphasize the need for adequate mentoring and providing growth opportunities for women at lower and middle levels of organizations to provide support for women to reach upper management positions. Sometimes, additional support for female managers is also needed, in terms of providing opportunities for relocation and better conditions for balancing work and family responsibilities (Brett & Stroh, 1999).

Companies are beginning to understand the value of diversity and are investing more money towards the cause. In early 2015, Intel allocated $300 million to remedy problems with workforce diversity (Thomas et al., 2016). The money would be used to improve working conditions for women and minorities, sponsor engineering scholarships to students in historically black universities, and support women in the game development industry. A study conducted by the European Commission in 2013 suggested that following measures be taken to encourage more women to apply and stay in the technology industry: (1) finding ways to make the digital industry more appealing to women, (2) defining clear career paths for women, (3) improving ways for female entrepreneurs to access venture capital programs, and (4) making an effort towards better working conditions in the technology sector. Regardless, any solutions and approaches to the problem require a deeper understanding of the issue and therefore, establishing a coherent understanding from the perspective of gender gap in STEM (Science, Technology, Engineering and Mathematics) fields would be beneficial. In the next section, the study looks at the reasons behind gender gap in STEM and cybersecurity fields.

Gender Gap in STEM & Cybersecurity

In discussing gender diversity in the cybersecurity workforce, it is worth considering the statistics for STEM-related occupations. In 2014, the U.S. Census Bureau reported that 74% of

students graduating with a STEM degree do not pursue STEM occupations. Furthermore, almost one-third of women intend to discontinue their jobs in science, engineering, and technology within a year. In general, this indicates there are challenges with retention in the STEM workforce, with women in the U.S. representing less than one-quarter of those employed in STEM occupations (Catalyst, 2019a). In addition, a huge gender gap exists in high technology occupations, where women account for less than 20% of those employed in such occupations (Catalyst, 2019a). For example, in 2017 women represented only 18.7% software developer and 4.2% computer network architect positions. In 2017, women in the U.S. represented only 25.5% of computer and mathematical occupations. This gap is even wider for women of color: Asian, Black, and Latinx women represented less than 7% of science and engineering occupations in the U.S. in 2015 (Catalyst, 2019a).

In certain STEM fields, such as life sciences women are better represented (Ceci et al., 2014; Su & Rounds, 2016), but continue to be underrepresented in computer science (Stoet & Geary, 2018). In the U.S., women obtain more than 50% of undergraduate degrees in biology, chemistry, and mathematics, but less than 20% of undergraduate degrees in computer science, engineering, and physics (Cheryan et al., 2017). Wang and Degol (2017) used an evidence-based approach to understand and unpack the gender gap in STEM. They reviewed research from the fields of psychology, sociology, economics, and education over the last three decades and found six plausible explanations for female underrepresentation in STEM fields: (1) cognitive ability, (2) relative cognitive strength, (3) occupational interests or career preferences, (4) lifestyle values or work-family balance preferences, (5) field specific ability beliefs, and (6) gender-related stereotypes and biases.

To understand the gender gap in STEM fields, Stoet and Geary (2018) looked at the academic achievements in science, math and reading scores of 475,000 adolescents across 67 nations. They found that countries with less gender equality have more women STEM graduates as compared to countries with high levels of gender equality. Stoet and Geary (2018) referred to it as a "gender paradox" because gender equal countries tend to promote girls' and women's engagement in STEM fields. Therefore, the authors suggest that in less gender equal countries a desire for overall life satisfaction with respect to "income and economic risk" promote girls' engagement in STEM subjects. Stoet and Geary (2018) also point out, "if absolute performance, interest, joy, and self-efficacy alone were the basis for choosing a STEM career, we would expect to see more women entering STEM career paths than do so" (p. 591).

Stoet and Geary (2018) quote an example from Finland to support their claim – a country that is gender egalitarian where adolescent girls do better in science literacy than boys and a country that is ranked second in European educational performance, has one of the largest gender gaps in STEM related college degrees. In Norway and Sweden, countries that lead in gender-equality rankings have fewer than 25% women graduating in STEM. In the U.S., women constitute close to half of the total U.S. workforce (US Dept of Labor, 2016). However, U.S. women represent only 24.7% of computer science professionals and 15.1% of engineering professionals.

To better understand the reason behind this vast underrepresentation, Ehrlinger et al. (2017) examined whether gender differences exist in how women and men perceive a prototypical individual in computer science and engineering (CS&E) and consequently, if the difference in "perception" leads to gender gaps in CS&E. They found that women participants

reported "less confidence" in their own intellectual characteristics but rated the prototypical engineer higher in intellectual characteristics compared to male participants' ratings. Relative to their male counterparts, female participants also reported less interest in future CS&E courses and careers. On examining participants' self-reported exposure to engineering, they did not find any significant difference between men and women. However, the study discusses that perhaps looking at the quality of exposure to CS&E might explain men and women's perceived differences of CS&E's prototypical characteristics.

Past research has shown that "parental encouragement" differs between boys and girls with respect to STEM fields (Ehrlinger et al., 2017; Fox et al., 1983). This might partly explain why a difference exists in how men and women perceive STEM. Gender differences in confidence also impact women's interest in STEM careers (Eccles, 1987; Goodman et al., 2002). Another factor that past research identified is "belongingness." Belongingness is a core human desire and we all desire to belong to something larger than us. Brown (2012) found that belonging and fitting in are not the same:

> Belongingness is being somewhere where you want to be, and they want you. Fitting in is being somewhere where you really want to be, but they do not care one way or the other. Belonging is being accepted for you. Fitting in is being accepted for being like everyone else. I get to be me if I belong. I have to be like you to fit in. (p. 232)

When it comes to interest, motivation, and general achievement in an activity, it is important that people find a sense of belongingness within that activity (Ryan & Deci, 2000). Thus, if women do not perceive similarities between themselves and the prototypical industry, then it is likely that they may not see themselves as belonging to that field, let alone in achieving

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success in the field. Research has shown that "perceived similarity" to computer scientists piqued student interest in computer science (Cheryan & Plaut, 2010).

Another factor influencing gender representation in the STEM workforce is commonly held stereotypes. While examining stereotypes regarding computer science, Cheryan et al. (2009) found that the perception of computer science as a "geeky" field lowered the belongingness factor for undergraduate women. Changing one's self-view is challenging, and research has shown that people tend to view new information or feedback in a manner that is consistent with a pre-existing view of self (Swann, 1983, 1987). Similarly, improving one's accuracy of self-view is challenging because people are often motivated to think positively about their self-views and perform actions to validate it, as opposed to being motivated to hold accurate views of the self (Sedikides, 1993). Thus, better efforts need to be made to rectify the situation with commonly and strongly held notions of STEM discipline, in general and the role that women can play in STEM fields.

Cheryan et al. (2017) in their research to identify why some STEM majors are well represented in terms of gender than others, introduced a sociocultural analytic model with three broad factors that explain the gender gap in computer science, physics and engineering as compared to biology, chemistry, and mathematics. The three overarching factors that deter women are: first, "masculine cultures" that indicate a lower sense of belongingness, second, "insufficient early experience with these topics", and third, gender gaps in "self-efficacy." Attrition rates is another huge concern in STEM fields. Ceci et al. (2014) in their literature based analysis of underrepresentation of women in mathematically intensive fields, found "chilly climate, biased interviewing and hiring, lack of female role models, lack of mentors, biased

tenure and promotion, unfair salary, sex differences in quantitative and spatial abilities, lower productivity and impact, stereotype threat, and sex differences in career preferences" (p. 125) as reasons for their low numbers.

Hewlett et al. (2008) have shown that attrition rates are the highest in engineering among the different STEM fields. In an effort to understand the reasons for why women leave engineering, Fouad et al. (2017) analyzed the reasons given by a national sample of 1,464 women engineers. They found that the following three reasons contribute to their departure from engineering: first, poor compensation, inflexible work environment with various demands, difficulty to strike work-family balance and also a poor working environment; second, dissatisfaction in utilization of their acquired math and science skills; third, lack of advancement opportunities and recognition at work.

In a study with a similar research interest, Buse et al. (2013) looked at individual and contextual factors that determine why some women persist in engineering careers in the U.S. They found that women who persisted had high levels of self-efficacy, a strong engineering identity and were motivated by both the challenges and novelty of their profession. They also demonstrated a strong sense of adaptability in male dominated work culture despite of discrimination and other workplace related challenges. There are studies that have demonstrated other reasons why women do not stay longer in engineering careers, such as women lack a sense of professional role confidence to work as engineers (Cech et al., 2011), women are susceptible or vulnerable to stereotype threat (Block et al., 2011), women are not satisfied with pay and promotions (Hunt et al., 2012), women think about leaving their work when occupation does not

meet their needs (AAUW, 2015). These reasons are important to consider as they could also be potentially the leading causes of women's underrepresentation in cybersecurity.

In a study to examine the necessary skills, challenges, and success factors for women in the field of cybersecurity, Bagchi-Sen et al. (2010) conducted in-person and paper-based interviews. They found that *early career barriers* emerged from social and institutional barriers, which they grouped into training and work environment. In terms of training, participants did not have the knowledge to transfer technology knowledge in business situations and also, had insufficient exposure to team work/collaboration. In terms of work environment, a 24*7 work environment was a barrier. They also faced stereotypes of being mistaken for support staff or secretary. In addition, lack of informal networking opportunities posed as a challenge for women.

For career advancement, Bagchi-Sen et al. (2010) found skills, work environment, and personal factors as barriers. For instance, gender stereotyping complicated the switch from professional to executive levels. In terms of cybersecurity specific skills, they found that technical skills with respect to security, problem solving skills (investigation and forensic analysis), 24* 7 support to protect information, and communication skills were required in the early career phase. For later career advancement, understanding cybersecurity project strategies and finding ways to relate them to both business and technical requirements, establishing and implementing security policies and auditing and reviewing security skills were required.

Women in the Bagchi-Sen et al. (2010) study perceived "success" in both tangible and intangible ways. It was important for them to perform innovative functions such as developing new solutions, process, or product to improve operations, creating risk management teams and

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following preventive routines such as preventing security breaches and performing within budget. They also indicated recognition from peer and clients as important. Among other criteria respondents mentioned, salary, designation/rank, opportunities to serve on boards/panels and in management teams, and an ability to create industry standards were considered indicators of success. With respect to career advancement, Bagchi-Sen et al. (2010) found the following factors to be crucial:

> For career advancement, critical skills include teamwork, organizational loyalty, and client relationships. In cybersecurity, hard and soft skills—such as solving problems to manage risk and effectively communicating with vendors and clients—complement each other. Career advancement is directly related to acquiring new technical knowledge and communication skills; that is, to knowing the four Ps of product, process, people, and policy. Among the key soft skills are the abilities to manage relationships within and outside the organization and to be assertive in decision-making without alienating clients, vendors, and peers. (p. 30)

In the next section, the study looks at the initiatives taken by organizations to improve gender representation in cybersecurity.

Initiatives Taken to Improve Gender Representation in Cybersecurity

There are several recent initiatives that are focused on addressing diversity in cybersecurity. To address the shortage of cybersecurity professionals in the nation, CyberSeek (n.d.) has developed an interactive career tool. The tool includes an interactive cybersecurity workforce heat map and cybersecurity career pathway. The workforce heat map provides a picture of supply and demand for cybersecurity jobs in all states and metropolitan areas in the

U.S. The career pathway shows key job roles within cybersecurity, associated skillsets and credentials and the necessary transitions between these roles. CyberSeek was created in collaboration between Burning Glass Technologies and CompTIA. It is supported under a grant by the National Initiative for Cybersecurity Education (NICE), a program of the National Standards and Technology in the U.S. Department of Commerce.

NICE – the partnership between the government, academia, and the private sector, is focused on creating a foundation for cybersecurity education, training, and workforce development. Through this strategic partnership NICE creates conferences and events such as NICE Conference and Expo, NICE K12 Cybersecurity Education Conference, monthly webinars, Cybersecurity Career Awareness week every year. NICE has also published a Cybersecurity Workforce Framework that describes the different domains and associated job roles and functions in the field.

Several organizations have put together programs to educate and create employment opportunities to promote more people joining the cybersecurity workforce (Morgan, 2019). For example, there are several scholarships listed on the NICE website, offered by different organizations such as Computing Research Association, CyberCorps, Exabeam Cybersecurity Scholarship, (ISC)[2], ISSA Education Foundation Scholarship, SANS, Snort Scholarship and Warrior to Cyber Warrior for veterans. SANS, (ISC)[2] and Computing Research Association have special scholarships for women as well.

Women in Cybersecurity (WiCys) conference, in their press release for their 2019 Conference, mentioned that their goal is to broaden female participation in the field (WiCys, 2019). The conference was founded in 2013 by Dr. Ambareen Siraj from Tennessee Tech

University as a National Science Foundation project. Today this organization is supported by Cisco, Facebook, Palo Alto Networks and the Security Industry Association. The conference creates an opportunity for women students and organizations to interact and understand more about job and recruitment opportunities. WiCys also provides scholarships and grants to students and faculty to attend its conferences. Other such associations and conferences include Women's Society of CyberJutsu (WSC) – a nonprofit for women in cybersecurity that provides training, mentoring and networking opportunities, Women in Security and Privacy (WISP), Executive Women's Forum (EWF) – has a focus on security, risk management and privacy (Morgan, 2019).

Summary

As the study participant Sherry's quote suggests, in the beginning of this chapter, cybersecurity is a relatively new field that has quickly become important in today's digitally connected world. Cisco – the technology and networking company, defines cybersecurity as "the practice of protecting systems, networks, and programs from digital attacks. These cyberattacks are usually aimed at accessing, changing, or destroying sensitive information; extorting money from users; or interrupting normal business processes" (Cisco, n.d.). Cybersecurity's roots lie in the wider field of CS&E and ICT. While there is a huge demand for skilled workforce in cybersecurity there is a supply gap in the global workforce (Cyberseek, n.d.; Reed et al., 2017). Cybersecurity is also a field that is less diverse with women representing about 24% of the global cybersecurity workforce ((ISC)[2], 2019). The intent of this study is to address diversity, equity, and inclusion along gender lines by understanding the larger context of women in STEM careers, in general and cybersecurity, in particular.

To come to cybersecurity and understand the status quo, the literature review presented in the sections above looked at the history of women in the field of computer science broadly. The brief review of early history of computing led to the finding that women played a significant role in the development of the field. For instance, women contributed to the development of first programming languages, and first electronic computers—ENIAC to automate ballistic computations (McGee, 2018). Women took to the profession in the 1950s and 1960s as there were few barriers to their entry and advancement (Ensmenger, 2010; McGee, 2018). However, with professionalization of the field barriers for women began to enact. Professionalization created an elevated status for programmers, resulting in higher wages, social status, and greater autonomy (Ensmenger, 2001). This also meant that corporations began to determine who was eligible to find employment and advancement opportunities based on an 'ideal' image of computer programmers (Ensmenger, 2001, 2010; McGee, 2018). This professionalization, which raised the status of the field, created entry barriers to women, designating the field as "most stereotypically male professions, inhospitable to women" (Ensmenger, 2012, p. 237).

Today, there is an abundance of research that examine the barriers and supports for women to both enter and advance in the field of ICT. As per NCWIT, Women hold only 25% of computing roles in the U.S. (Ashcraft et al., 2016). Thus, indicating that women are disproportionately missing in the job scene despite the growth in computing jobs overall. According to a National Science Foundation (NSF) 2019 report, more women are earning STEM degrees in the U.S. For example, women obtain more than 50% undergraduate degrees in biology, engineering, and physics (Cheryan et al., 2017). However, when segregated based on field of study, women earned 19% of degrees in computer science bachelor's degrees in 2016 as

compared to 27% in 1997 (NSF, 2019). The indication is better at the master's level – women earned 31% of master's degrees in computer science as compared to 28% in 1997 (NSF, 2019). There are additional concerns with a "leaky pipeline," where only 38% of women who majored in computer science are employed in the field as opposed to 53% of men (NSF, 2019).

The reason can be partly attributed to a misogynistic computing culture (Perez, 2019). The technology sector is known for gender discrimination, sexual harassment, and lack of diversity (Jee, 2018; Dickey, 2017; Fiegerman, 2017; Solon, 2017). Women in cybersecurity experience significant differences in recruitment, advancement opportunities, and career growth (Peacock & Irons, 2017). As per 2017 Pew Research Center poll, 50% women reported they had experienced gender discrimination at work (White, 2020). The numbers are even higher for women with post-graduate degrees (62%) and those in computer related professions (74%) and male dominated workplaces (78%) (White, 2020). There is also a huge pay gap between men and women in STEM occupations, with women earning 87% of what men earn (White, 2020). This is even wider for black women in STEM who earn 62% of what men earn (White, 2020).

Research based on a comprehensive review of evidence-based literature across STEM fields, has shown that underrepresentation can be attributed to several factors such as cognitive ability, relative cognitive strength, occupational interests, lifestyle values or work-family balance preferences, beliefs about skills and abilities, and gender-related stereotypes and biases (Wang & Degol, 2017). In studies of women in engineering careers, researchers have found that those who persist have high levels of self-efficacy, adaptability to male dominated work cultures, strong engineering identity, and are motivated by the challenges and novelty of the profession (Buse et al., 2013), confidence in engineering tasks, confidence in navigating workplace culture, and

confidence in ability to manage life roles (Fouad et al., 2011), and experience better workplace supports than those who leave (Fouad et al., 2016). Those who leave lack a sense of professional role confidence (Cech et al., 2011), do not have resources to overcome stereotype threats (Block et al., 2011), are not satisfied with pay and promotions (Hunt et al., 2012), and do not think that their workplace meets their needs (AAUW, 2015). In terms of cybersecurity careers, Bagchi-Sen et al. (2010) found that social and institutional barriers posed challenges for early career individuals, such as 24*7 work environment, insufficient early exposure to collaborations, insufficient networking opportunities, and being faced with stereotypes. Recent research has suggested that it is "income and economic risk" for a better life, that promote girl's engagement in STEM, and that it is not only a result of self-efficacy and interests (Stoet & Geary, 2018). Thus, the literature reveals socio-cultural, institutional, economic factors that support and deter women in both educational and career pathways in the field.

Limited participation of women in the field of computing and thereby, cybersecurity limits the advantages that an otherwise diverse workplace can experience. Proponents of workplace diversity have discussed the benefits of a diverse workforce. For example, researchers have suggested the need for informational and social category diversity (Phillips, 2017), similar to identity and cognitive diversity (Page & Lewis, 2017) for businesses. Research has demonstrated the relationship between diversity in workforce and financial performance (Hunt et al., 2015; Barker et al., 2014). Other studies have shown the relationship between gender balance teams and superior team dynamics, improved innovation, and productivity (Doz et al., 2004; Lehman Brothers Center for Women in Business, 2008; Turner, 2009; Woolley et al., 2010), improvement in group processes (Østergaard et al., 2011) and overall performance of their

organization (Caldwell, 2013). Research also indicates that women bring perceptual views by offering alternative solutions and recognizing strategic opportunities (Dutton & Duncan, 1987; Perryman et al., 2016; Wiersema & Bantel, 1992).

In sum, the lack of diversity in the technology sector, including cybersecurity is not new, but there is an increasingly urgent need for growth in the cybersecurity workforce and the social impetus to address gender diversity issues in the technology sector overall. While several initiatives have been undertaken to address the needs, a deeper understanding of the problem and issue is required before contemporary solutions can be innovated and implemented. In the next section of this chapter, I present the theoretical framework used as a focal lens to understand this research context.

Theoretical Framework

A career can be thought of as "a sequence of related work experiences and activities over the span of a person's life" (Wang & Wanberg, 2017, p. 546). This involves career management where people navigate through different events related to career development such as identifying a career of interest, making a career choice and pursuing that career for success, as well as transitioning events such as loss of a job or search for a new job (Wang & Wanberg, 2017). However, Richardson (1993) believed that a focus on career alone ties in too closely to the occupational structure and ignores the work done outside this structure. Most importantly, it restricts the understanding of women's career development as the consideration of familial factors is disregarded in this view. Thus, an expanded consideration of life careers is important where career development is understood in conjunction with "the multiple and interacting strands and trajectories of development that make up the texture of lives over the life span" (p. 431). A

more central focus on the individual lends itself to a view of giving equal importance to work in occupational as well as non-occupational roles (Richardson, 1993). More recently, the social

Meaning Making of Work Experiences

Social Cognitive Career Theory

- Social Cognitive Variables: *Self-efficacy, Outcomes Expectations, Personal Goals*
- Career Outcomes: *Interest, Choice, Performance*
- Contextual Supports and Barriers (school and workplace): e.g., *parental support, learning environments, advancement opportunities, job availability, financial support, discrimination, and so on*

Gender and Gender Role Socialization

Wholehearted Living

- Embracing vulnerability, developing shame resilience, courage and living a Wholehearted life
- Engagement in work and workplace
- Connection to others

Feminist Standpoint Theory

- Lived experiences of women in cybersecurity
- Gendered academic and workplace experiences
- Conscious reflection on power structures

Figure 2.1

A Visual Depiction of the Theoretical Framework

contexts arising from market work (work done in the public sphere and in preparation at educational institutions to earn a pay), personal care work, personal relationships, and market work relationships have also been considered as how people construct their lives (Richardson, 2012).

The theoretical framework of this study is interdisciplinary in nature and draws in theories from vocational psychology, gender studies, and social work (see Figure. 2.1 above). The framework uses social cognitive career theory to study factors that predict engagement in terms of career interest, choice, and performance in cybersecurity career; feminist standpoint theory to understand the challenges encumbered in our socio-cultural environments; and Wholehearted living to shed light on vulnerability, resilience, and courage in sustaining and thriving at cybersecurity careers. The overall goal is meaning making, both in life and career, to gain a holistic understanding of women's career development in cybersecurity. As a narrative study, this research also considers stories as a way through which humans articulate their understanding and make sense of their everyday lives (Chen, 2011; Patton & McMahon, 2014). Each of the theories included in this framework are described in the sections that follow.

Social Cognitive Career Theory

Social Cognitive Career Theory (SCCT) is consistently used in identifying factors that impact girl's and women's career choice in STEM careers (Fouad, 2007; Hackett & Betz, 1981). The SCCT uses a social cognitive framework to understand career development (Lent, Brown, & Hackett, 1994; Lent & Brown, 2006, 2013). It holds a constructivist view of the individual as an agentic being who can actively shape their career and is "designed to explain individual

variability in career interests, choice and performance" (Patton & McMahon, 2014, p. 105).

SCCT focuses on three interlocking processes: development of career and academic interests;

enactment of career choice; and achievement of performance outcomes. SCCT explains how

three social cognitive variables – self-efficacy beliefs, outcome expectations, and personal goals

– interact with personal variables such as gender, race and ethnicity, health status, and

socioeconomic status as well as environmental variables that serve as facilitators or barriers and

provide related learning experiences (Foley & Lytle, 2015; Patton & McMahon, 2014; Lent &

Brown, 2006, 2013).

The three cognitive-person variables highlighted in SCCT are: self-efficacy beliefs,

outcome expectations, and personal goals (Lent & Brown, 2013). *Self-efficacy* refers to an

individuals' beliefs to "organize and execute courses of action required to attain designated types

of performance" (Bandura, 1986, p. 391). Self-efficacy beliefs are acquired via the following

sources: (a) personal performance accomplishments, (b) vicarious learning, (c) social persuasion,

and (d) physiological and affective states. Self-efficacy is considered to be a constantly changing

set of beliefs linked to a specific performance domain and interacts with personal, behavioral, as

well as environmental factors. *Outcome expectations* regarding academic and career choices

refer to beliefs with respect to consequences from following a set of actions. They are derived

from a variety of direct and vicarious learning experiences such as personal experience from

engaging in past endeavors, second hand information acquired from observing others in the

family, community, or media sources (Lent & Brown, 2013). *Personal goals* refer to

determination or intention to engage in a certain activity to produce a desired outcome.

Establishing goals help individuals' to "coordinate, direct, and maintain their own behavior, and

thereby be agentic in their behavior" (Patton & McMahon, 2014, p. 102). For example, strong self-efficacy and outcome expectations in musical performance may lead an individual to nurture music-relevant goals such as intention to practice music, seek out opportunities to perform, and perhaps also pursue a career in music. Successful pursuit of personal goals may influence self-efficacy and outcome expectations in a positive way.

SCCT suggests that self-efficacy and outcome expectations predict interests, which, in turn, predict choice actions and choice actions then predict performance (Fouad, 2007). If a person perceives that they have the necessary skills to work in an occupational area (i.e., self-efficacy) and believe that engaging in that occupation will result in a positive outcome (i.e., outcome expectations), then the person will develop an interest in that occupational area and exert the necessary effort towards the desired goals (Lent & Brown, 1996; Singh et al., 2013; Turner et al., 2019). Experience of positive or negative events, new experiences, and factors such as new types of jobs, new technology, will also stimulate interests. Thus, career choice is a function of career and academic interests, self-efficacy, and outcome expectations, which make certain career paths more appealing (Lent & Brown, 2013).

The SCCT model also considers other variables: person (gender, race, health status, and socio-economic status), environmental (distal and proximal contextual affordances), and learning experiences (Lent & Brown, 2013). Personal variables such as gender may effect career decisions, as gender role socialization may influence self-efficacy and outcome expectations (Buse et al., 2013; Lent et al., 2005). Research has shown that gender role socialization biases the self-efficacy beliefs and outcome expectations that boys and girls have around male or female dominated professions, often culturally appropriated for their own gender (Hackett &

Betz, 1981). Thus, it is necessary to consider gender and ethnicity as fundamental to life experiences that include access to learning opportunities, reactions for performing certain activities, and future outcomes they anticipate (Lent & Brown, 1996, p. 315).

The *distal* factors are depicted as contextual factors stemming from one's background that affect learning experiences, which in turn leads to the development of career related self-efficacy and outcome expectations (Lent & Brown, 2013). Distal factors may include lack of parental support, poor learning environments, gender-based or race-based effects on schooling and learning opportunities, opportunities for skill development, academic role models (Fouad, 2007). The *proximal* factors are factors that come in play during active engagement in educational and career related decision making. Proximal factors may include emotional and financial support for selecting a career related option, job availability in a field of preference, sociostructural barriers such as discrimination are all proximal factors. Experiences of discrimination can be considered as learning experiences that predict self-efficacy (Foley & Lytle, 2015). Strong environmental supports and weak barriers in relation to the preferred career path, will result in career interests "blossoming" into personal goals and thereby, being implemented. Studies have shown that family support (Ferry et al., 2000) and acculturation (Tang et al., 1999) have distal contextual influences on career choice while financial and racial barriers have proximal influence (McWhriter et al., 2007) on the implementation of career choice (Singh et al., 2013).

Buse et al. (2013) conducted a qualitative research study using SCCT to understand individual and contextual factors that differentiate women who persist in engineering careers versus who do not. The study analyzed interview data from 31 U.S. based engineers in total, ten

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of whom had left engineering career and 21 had persisted for 21 years on average. The authors found that women who chose to stay or persisted in the field had high self-efficacy beliefs, a sense of identity as an engineer, felt a sense of work engagement in tackling technical problems and novel work and learning opportunities. They adapted to the male-dominated culture and thrived despite difficulties in the workplace, including discrimination. Those who left the field felt the workplace barriers more strongly, were more likely to be married with children, and also felt they were pushed into engineering.

Fouad et al. (2011) used SCCT lens in conducting a study to explicitly look at environmental supports and barriers that may have influenced women in engineering fields to either stay or leave the field. They interviewed 11 former and 14 current women engineers. Women who left the field cited the following reasons: need to care for children, a dislike towards engineering tasks and environments, as well as inability to move into roles with more opportunities. Women who remained in the field mentioned they found family friendly work policies, and some had to compromise career advancements for family responsibilities. Women in both groups described experiences of gender discrimination.

Fouad et al. (2016) conducted a similar study to examine differences between women engineers who persisted in the field versus those who left engineering careers. They used a combination of theories: SCCT and integrated model of career change. The study was conducted with women participants who had an undergraduate engineering degree. The authors contacted alumni offices across 30 universities in the U.S. A total of 5562 women participated in the study and completed an online survey. However, only two random equal size groups were finally selected: 250 women currently working in engineering, and 264 women who previously worked

in engineering. They found that the two groups of women were similar in three self-efficacy domains: tackling engineering tasks, ability to navigate organizational climate, and managing multiple roles. However, those who persist in engineering careers find more support from their organizations, in terms of advancement opportunities and better understanding from their managers of their work and family roles, and have higher levels of occupational commitment.

Bernstein (2011) designed an online program called CareerWise, to help STEM female graduate students build resilience to career barriers and supports, such as working with advisors, balancing work and non-work domains, negotiating university and departmental climates, coping with delays in progress toward graduation. A study conducted by Bekki et al. (2013) reported after a randomized control trial of the program that it was an effective intervention to bolster resilience, coping efficacy, and problem-solving of STEM female graduate students.

SCCT is developed on a social cognitive framework and reflects a constructivist approach. It places an emphasis on human agency (Lent & Brown, 2013). According to SCCT, individuals actively make meaning on the basis of their exchange with the environmental conditions and are therefore, not static and influenced beings rather active agents who "create their own reality through construal process" (Lent & Fouad, 2011, pp. 73-74). Even though SCCT derives empirical support from logical positivism it is created on the assumptions of constructivism and as a constructivist vocational psychology, SCCT has a focus on personal meaning making (Patton & McMahon, 2014). Brown (1996, 2002) presented the following assumptions of personal meaning making within constructivist psychologies: (a) every aspect of the universe is connected and it is not possible to separate subject from object and people from their environments; (b) there is no absolute truth and human action is not reducible to laws or

principles, and cause and effect cannot be inferred; (c) human behavior is best understood only in the context in which it occurs; (d) the subjective frame of reference is the only true source of knowledge and individuals define themselves and their environments based on the events in which they participate.

In sum, using SCCT as a lens in this study will help to understand the educational and career behavior of women working in the field of cybersecurity. It will help to explain their development of career interest, various educational and occupational choices, as well as achievements of academic and career success. In addition, SCCT will also highlight the contextual factors that pose as facilitators or barriers in their career development.

Feminist Standpoint Theory (FST)

Feminism is the belief that all genders must have equal rights and opportunities (Smith & Gayle, 2018). It recognizes that gender-based injustices have been in existence in society for a long time and continues to develop in different forms. Feminist theories allow gender to be used as a lens for analysis and offers tools to examine injustices and discrimination based on gender (McCann & Kim, 2017). In particular, this study uses feminist standpoint theory to understand the structural issues related to gender in academic and workplace experiences of women in cybersecurity.

Feminist standpoint theory (FST) came into existence as a feminist critical theory in the 1970s and 1980s. FST studied the relationship between knowledge production and practices of power (Harding, 2004). It challenged the assumption that feminism is a political movement and such a movement could only pose obstruction to knowledge production. FST was a means to empower oppressed groups, acknowledge and value their life experiences, and develop an

"oppositional consciousness" (Collins, 1989). According to Harding (2004), standpoint epistemologies that are grounded in socially situated knowledge require a "stronger objectivity" as they contextualize the knowledge in history and social life. Standpoint theories argue that we must "start off thought" in a research context based on the lives of the marginalized people as this creates special kind of knowledge with a more objective picture of the entire social order (Harding, 1992). This core idea of maximizing objectivity by revealing more truth can only enhance empiricism rather than cause any harm. To understand this better, we can look at an account of epistemic privilege that explains what about being marginalized gives oppressed people a privileged point of view (Elliot, 1994):

> Person A approaches a building and enters it unproblematically. As she approaches, she sees something perfectly familiar which, if asked, she might call The Entrance. Person X approaches the same building and sees a great stack of stairs and the glaring lack of a ramp for his wheelchair. (p. 426)

The experience of person A is that of entering a building through the entrance without any difficulties. Whereas the experience of person X is of realizing that the absence of the ramp is a barrier or an inconvenience to entering the building. Thus, the role of social location can give us extremely different views of reality.

In her book *Whose Science? Whose Knowledge?* Harding (1991) describes a standpoint as distinct from a perspective:

> Only through [struggles by and on behalf of oppressed, exploited, and dominated groups] can we begin to see beneath the appearances created by an unjust social order to the reality of how this social order is in fact constructed and maintained. This need for

struggle emphasizes the fact that a feminist standpoint is not something that anyone can have simply by claiming it. It is an achievement. A standpoint differs in this respect from a perspective, which anyone can have simply by Opening one's eyes. (p. 127)

FST has different takes but "they are all grounded in one central and founding idea: Knowledge is socially located and arises in social positions that are structured by power relations" (Hallstein, 1999, p. 32). FST has the following central tenets: the situated knowledge thesis, the epistemic privilege thesis, the achievement thesis (Crasnow, 2014). The thesis of situated knowledge assumes that knowledge is socially situated, and that truth can be best discerned from those who are at the margins such as women, African Americans, Latinx, people who are poor and so on (Crasnow, 2014). So, knowledge produced by and for these groups can give researchers unique perspectives rich in cultural, social, and political aspects. According to the FST and in the context of the current study, we use the metaphors of the "insider/outsider" for women in cybersecurity who have "double-vision" (Crasnow, 2014; Smith, 2004). Double-vision is the ability to see from the position of a professional worker in the field and also from the position of the marginalized group (Crasnow, 2014).

The thesis of epistemic privilege is understood as a combination of situated knowledge and epistemic privilege, where a standpoint is not trivialized as a perspective. According to Harding (2004), FST

intends to map the practices of power, the ways the dominant institutions and their conceptual frameworks create and maintain oppressive social relations. Secondly, it does this by locating, in a material and political disadvantage or form of oppression, a distinctive insight about how a hierarchical social structure works… Third, the

perspectives of the oppressed cannot be automatically privileged… Finally, standpoint

theory is more about the creation of groups' consciousness than about shifts in the

consciousness of individuals. (p. 31-2)

Thus, a standpoint is achieved by a group rather than an individual from life experiences based

on social location. For instance, when individual women have experiences of sexual harassment

at work, they may interpret that experience as "accidental, or imagined, or deserved" (Intemann,

2016, p. 265). However, when multiple women report similar instances then the similarity of

their experience become consistent with collective experience and women are able to see

patterns of oppressive arrangement (Intemann, 2016). It is also important to note that even

amidst this sameness there is a difference in individual experience based on other social

categories such as race, class, geographic location, work location, and so on. This is because

gender norms and cultural expectations vary according to these social locations (Intemann,

2016). Finally, the third element of FST as an achievement thesis is the process of an individual

coming to have a group consciousness that is political in nature.

Standpoint theorists believe that people who are in positions of subordination have an

epistemic advantage regarding evidence, inference, or hypothesis that might go unnoticed

otherwise. Marjorie DeVault (1999), a sociologist, in her research on standpoint theory discusses

the case of Elizabeth Stanko, a criminologist who has studied the strategies women employ to

avoid sexual assault. When Stanko asked participants to name the things that they do to keep

themselves safe, the women shared various activities that were earlier not considered as self-

defense such as choosing where to live, deciding when and where to go for a walk, choosing a

time to for grocery shopping or the laundromat, deciding what clothes to wear, and so on

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(Stanko, 1997; Crasnow, 2014). Here, as a researcher and a woman Stanko played the role of an insider/outsider. It allowed her to broaden the concept of self-defense by collecting evidence from women's experiences. It also allowed Stanko to understand the power relations that shape the daily life experiences of women.

Parson (2018) conducted a study using FST on higher education experiences of women pursuing undergraduate studies in math and physics. Parson (2018) focused on the lives of women, their experiences, and related activities in STEM alongside the "institutional policies, practices, and procedures that coordinated their work within a place of neoliberal higher education" (p. 29). Parson found that participants met with difficulties as STEM expectations conflicted with neoliberal institutional expectations. Although undergraduate women persisted in math and physics, they had to face stress, anxiety, and discomfort. Parson was able to arrive at the conclusion based on participant descriptions of their everyday experience. In a similar study, using the framework of FST, Parson and Ozaki (2017) found that women undergraduate participants reported characteristics of successful math and physics students such as taking risks, asking questions, putting school first as challenging and rather preferred a collectivistic study environment. The authors also reported these characteristics as reflective of a masculine STEM environment.

Allen et al. (2006) used FST to understand the lived experience of 39 female information technology (IT) employees. They looked at comments made by 39 female IT employees in relation to workplace barriers resulting in voluntary turnover. Researchers found that voluntary turnover decisions were made by work schedule flexibility, responsibilities towards family, stress related to work, quality of the job, and lack of consistency in workplace policies. Perceived

barriers to promotion were linked to lack of respect, ageism, stress, and work schedule flexibility. Smith and Gayles (2018) conducted a constructivist case study using feminist standpoint theory to examine the gendered academic and workplace experiences of graduating senior women in engineering. They found that women experience instances of implicit bias in academia and instances of implicit bias, sexism, and sexual harassment in the workplace, more often through internship experiences.

Feminist standpoint theorists view women as agentic beings who make meaning of their own lives within their particular social location of sex, race, gender, class, nature of work and so on (Allen et al., 2006). Reflection upon the lived experiences results in a standpoint and not just an accumulation of those experiences. Paying attention to the concrete circumstances and lived experiences of professional women can help to both generate insights and raise new questions pertaining to education and the workplace. It can also reveal ways of moving forward with diversity, equity, and inclusion efforts by adopting the standpoints of professional women and their journeys of hope and despair in the field.

Wholehearted Living

The theory of Wholehearted living helps us understand that professional women are agentic, strong, and resilient individuals who actively make career decisions in different stages of career development (Brown, 2010). Brown, a research professor in social work and a storyteller, has spent two decades studying human experiences of courage, vulnerability, and shame. Brown

(2012) asserts that vulnerability is the birthplace of all good things in life including courage, shame resilience, joy, love, and belongingness.

A common thread of Wholehearted living runs through all of Brown's work, which she describes as a life lived with vulnerability, shame resilience, and Wholeheartedness. To come to the concept of Wholehearted living, Brown (2012) engaged in a multi-year study based on grounded theory research. Brown (2012) interviewed 1280 participants in total: 750 female participants and 530 male participants. The female participants ranged in age between eighteen to eight-eight years, with a mean of forty-one. The male participants ranged in age between eighteen to eighty with a mean of forty-six. Brown's (2012) analysis of the data, using three interrelated theories of shame resilience, Wholeheartedness, and vulnerability, led to the emergence of one theory that explains how people resolve their concerns with their daily lives (Brown, 2012).

Brown (2012) breaks down the following five themes found in her research on Wholehearted living: (a) love, belongingness and connection with others, (b) feeling worthy of love and belonging, (c) cultivating practices rooted in resilience, authenticity, self-compassion, intuition and faith, creativity, play and rest, meaningful work, and laughter; and letting go of what others think, powerlessness, scarcity and fear, need for certainty, exhaustion from work as a status symbol, anxious lifestyle, self-doubt and being in control all the time, (d) living a life defined by courage, compassion, and connection, and finally, (e) vulnerability is the catalyst for courage, compassion, and connection. Wholeheartedness is the journey from "What will people think" to "I am enough."

Brown (2012) defines vulnerability as "uncertainty, risk and emotional exposure" (p. 34). Vulnerability is neither good nor bad; it is neither a dark emotion associated with fear, grief, shame, or disappointment, nor is it a "light, positive experience." Rather vulnerability is the basis of all emotions and feelings. It is through decades of research that Brown understands vulnerability is "the birthplace of love, belonging, joy, courage, empathy, and creativity. It is the source of hope, empathy, accountability, and authenticity" (Brown, 2012, p. 34). Brown found that people use an "enough mandate" to free themselves from the "vulnerability armor": I am enough (valuing worthiness versus shame), I've had enough (setting boundaries versus comparison), and showing up, being seen, and taking risks is enough (focusing on engagement versus disengagement). Vulnerability is "being all in" (p. 2). We experience uncertainty, risk, and emotional exposure in our lives every day and it is not optional. But the essential question is the question of engagement and the more the engaged the more connected we allow ourselves to feel with others.

According to Brown's Shame Resilience Theory (SRT) (2006), one of the three interrelated theories of Wholehearted living, shame is a psycho-social-cultural construct. The psychological component pertains to the emotions, thoughts, and behaviors; the social component pertains to experience of shame with respect to relationships and connections; the cultural component pertains to the relationship between shame and the cultural expectations. "Shame is the intensely painful feeling or experience of believing that we are flawed and therefore unworthy of love and belonging" (Brown, 2012, p. 69). Both men and women experience shame in some capacity. There are several shame categories including physical

appearance, money and work, motherhood/fatherhood, mental health, surviving trauma, and being stereotyped (Brown, 2012).

Shame causes intolerance for vulnerability, as it breeds fear and kills the ability to engage, innovate, create, trust and be productive (Brown, 2012). The way out of feeling shame or feeling trapped, powerless, and isolated is to be resilient to it and SRT proposes personal vulnerability, critical awareness regarding socio-cultural web of shame, empathic relationships with others to discuss shame, and the ability to "speak shame" as measures to develop resilience (Brown, 2006). The web of shame is experienced as a web of socio-cultural expectations of how women are supposed to be at home, at work, or in the wider society. These expectations are imposed by the individuals themselves, or by others and further reinforced by media consumption.

Collectively, resilience research indicates that resilient people are resourceful and have good problem-solving skills, they are self-reliant and have high self-efficacy, they are likely to seek help, they believe that they can cope with circumstances and manage their feelings, they have access to social support, and are connected to friends and family (Brown, 2010; Jackson et al., 2007; Polk, 1997; Tugade & Fredrickson, 2004). Resilience is a core component of Wholeheartedness (Brown, 2010). Resilient people are also people who use hope as a thinking strategy to set realistic goals of where they want to go, remain flexible and tolerate disappointment in trying, and they also believe in themselves (Brown, 2010). Individuals gradually build resilience by overcoming adversity. They require continual training to build

resilience and prevent it from loss, analogous to a marathon runner who gradually prepare themselves to run the full distance (Lian & Tam, 2014).

Resilience is important in understanding women and their career development, as they often have to overcome barriers rooted in stereotypes, hierarchies, and deep-rooted gender as well as organizational norms (Khilji & Pumroy, 2019). To go against career barriers requires building resilience and rising above adversity (Miller, 2004). In masculine engineering cultures, women derive strength and resilience from coping strategies such as conforming to the rules, negotiating to work around the rules and defying rules to establish their own (Khilji & Pumroy, 2019). Since, overcoming challenging workplace barriers, related to gender require strength, courage, and resilience (Buse et al., 2013; Herman et al., 2013; Miller, 2004), this study assumes that it is wholehearted living that enables individuals to sustain and thrive in male-dominated work cultures. The theory of Wholehearted living allows us to illuminate women's experiences of career choice, barriers, supports, and everyday living experiences based on personal life as it relates to their career.

Brown's (2012) research on Wholehearted Living helps this study in mainly two ways: first, in understanding how women in cybersecurity *engage in their work* as researchers, managers, and leaders, either in academic or technical environments; second, how do they *navigate these workplaces* as women, despite the everyday uncertainty, risk, and emotional exposure in both these cases which are not optional. Wholehearted Living will help to focus on both the challenging nature of their work that is ever-evolving with new technologies as well as the challenging nature of their workplace where there is gender-based discrimination, name

calling, and incivility. Today, there is also a move away from the dominant assumption of women as "passive and submissive" beings to women as professional workers who have an evolved understanding of their roles and careers (Khilji & Pumroy, 2019, p. 1033; Clerc & Kels, 2013; Hamel, 2009). The lens of Wholehearted Living will help to see how women push past the discomforts and continue to engage in their work and workplaces.

Meaning Making

Meaning making refers to subjective views of an individual in both perceiving and explaining contextual events (Chen, 2002; Patton & McMahon, 2014). Meaning making in careers is represented in actions that we take in an ongoing process of career development; thus, meaning does not only exist in our minds (Patton & McMahon, 2014; Young & Valach, 2004). According to both vocational and humanistic psychology, human meaning making takes place in the following ways: (a) significance of subjectivity or phenomenology in creating life career meanings in different forms and contexts, (b) human purpose and intentionality in making sense of past experiences and projecting future plans, (c) social dimension in subjective meaning making as it is impossible to make meaning in a social vacuum, and (d) human experience and action where meanings are generated based on what has happened and what may be anticipated in moment-to-moment living (Chen, 2001).

Frankl (1963) postulated that meaning is not bestowed on people rather we actively engage in a process to search and create meaning in our lives. It is this will to meaning-making that makes us human (Frankl, 1969). Frankl (1963) asserts that meaning in life can be found in three ways: (a) by creating or doing something that seems like an achievement or accomplishment; (b) by experiencing something in nature or culture that has truth, goodness and

beauty or by experiencing love in another human being; (c) by our attitude toward suffering. Thus, from a humanistic psychology perspective, "Life only becomes meaningful when people endeavor to create, discover, and project meaning into their existential experience" (Chen, 2001, p. 321). A person is a complex entity capable of thinking, feeling, and behaving; thus, able to generate meaning based on personal experiences and project meanings on to new experiences (Adler, 1964; Chen, 2001). A key point to note is that meaning interpretation is not a static process and is often non-linear and an open and interweaving process. Thus, meaning of events can be reframed after its original formation (Amundson, 1995).

In the context of this study, the significance of both work and relationships is taken into consideration in understanding women's work experiences in the field of cybersecurity (Richardson, 2012). Significance of work has been shown to be important in meeting human needs starting from basic survival to self-direction and self-actualization (Blustein, 2019). Significance of both work and relationships with others at the workplace and in personal lives is considered to be important in how people create their lives (Blustein, 2019). In addition, being able to work without oppression and harassment is important in creating meaningful work experiences too (Blustein, 2019). The four social contexts of work and relationships are considered: market work (work that people do for pay), personal care work (care work for self and dependent others in the personal sphere), personal relationships (relationships with spouse, friends, children, parents, and siblings), and market work relationships (with mentors, bosses, supervisors, teachers, colleagues, and students) (Richardson, 2012).

Richardson (1993) has defined work as an activity "for individual success and satisfaction, to express achievement and strivings, to earn a living… to further ambitions and self-assertions... and to link individuals to a larger social good" (p. 428). According to this perspective, all work including voluntary work, unpaid work, care work, are included in the understandings of work experiences (Patton & McMahon, 2014). Richardson's (1993, 2012) view of work is rooted in social justice and feminism especially, feminist standpoint theory. Such, feminist and social justice views of work have also been considered by other career theorists such as Blustein et al. (2005), Goodman et al. (2004), and Vera and Speight (2003).

In thinking about meaning making in the context of work and relationships, Richardson (2012) suggests that people also make meaning in *life transitions* and *turning points*, such as school-to-work transition, underemployment, divorce from a partner, or death of a loved one, debilitating health disease of self or significant other in one's care, transition to parenting, transition to retirement, and so on. The interdependence of different life trajectories stemming from work and relationships in market or personal context then shapes and informs actions in other contexts (Richardson, 2012). These experiences affect market work trajectory of individuals. For instance, immigration can disrupt a person's significant life trajectories and of those with whom they are involved. In understanding these broad range of life transitions, narrative inquiry – the methodology of choice for this study, is well suited as it allows the individual to make sense of their lived experience by telling a story. According to Hoshmand (2005), individual life stories "when recounted, involves both a temporal and causal coherence" (as quoted in Richardson, 2012, p. 222). Narrative theory incorporates time in human experience that lends itself to understanding the meaning making of participants with respect to their

decision making as related to work and relationships in their experiences with career

development.

CHAPTER 3

METHODOLOGY

The number of women in the technology sector is startlingly low and the number is even lower in cybersecurity (Holtzblatt & Marsden, 2018; Reed et al., 2017). While there is a burgeoning literature on the factors contributing to the persisting lack of gender diversity in the technology sector in general, less is known about cybersecurity in particular. This narrative inquiry of women in cybersecurity sought to explore the life experiences of six women at different stages in their work experience and interrogate the nature of these experiences using gender as a lens. The study aimed to present rich and complex storied accounts depicting the different factors related to a career in cybersecurity, including their past and present work experiences and future aspirations. In doing so, this study sought to bring alive the narratives of supports, barriers, coping mechanisms, motivations, and relationships as well as many other aspects that bring meaning to work lives and help women thrive. Overall, through the use of narratives, this study focused on developing an understanding of cybersecurity as a career choice for women. I also hope that the narratives will help the readers understand what these stories reveal about cybersecurity as a profession for women. This study addressed the following research questions:

1. How do women describe their career choice of cybersecurity?

2. What are the key factors or events that influence women's career paths in cybersecurity?

3. How do women make meaning of their work experiences as cybersecurity professionals?

Rationale for Qualitative Inquiry

This study utilized qualitative research as this is appropriate for developing an in-depth understanding of experiences (Merriam & Tisdell, 2016). I was interested in listening to and understanding how my participants construct their work worlds and the meanings they attribute to their experiences. Qualitative research, as emphasized by Bogdan and Biklen (2011), is holistic as it functions on "the intersection of social context and biography" (p. 9). The specific social context in this case is the work area of cybersecurity and the life experiences of six women working within this context. Qualitative methodologies are particularly well-suited for this situation.

In terms of philosophical perspectives, this qualitative study was situated at the intersection of interpretive and critical realms. Interpretive research assumes that reality is socially constructed and that there are multiple realities and interpretations of a single event; thus, presenting a complexity of views, the meanings of which are socially, culturally and historically negotiated during interaction with others (Creswell, 2013; Merriam & Tisdell, 2016). Critical research, such as feminist research, looks beyond interpretation of people's understandings of their realities/world; the "goal is to critique and challenge, to transform and empower" (Merriam & Tisdell, 2016, p. 10). Researchers using a critical lens work from the belief that power relations mediate everything, and they focus on confronting injustices in society.

In qualitative research, it is possible for different philosophical perspectives to intersect such as the use of critical ethnography or that of feminist poststructuralist lens in a research study (Merriam & Tisdell, 2016). For example, interpretive research seeks to understand a

phenomenon, while critical research aims to uncover conflict and oppression (Crotty, 1998). This study aimed to use the power inherent in both of these worldviews – interpretivist and feminist orientation. I sought to first understand the lives of the participants and then to interrogate their experiences using gender as a lens for analysis. A combination of the two approaches lent towards making recommendations for diversifying the cybersecurity workforce and empowering women in the field.

Research Design

The chosen methodology for this study was narrative inquiry. An inclusive description of narrative inquiry is one that Bhattacharya (2017) received during a personal communication with Jeong-Hee Kim, the author of the book titled *Understanding Narrative Inquiry*:

> Narrative Inquiry is a storytelling methodology in which a story(ies) of a research participant(s) is researched as a way of knowing. Narrative inquiry has been established in different disciplines including psychology, education, law, medicine, sociology, anthropology, and more, opening the door for the synergy of interdisciplinarity. Using narratives and stories as phenomena to understand what it means to be human, narrative inquiry utilizes inter-disciplinary interpretive lenses with diverse approaches and methods, all revolving around the narratives and stories of research participants. Etymologically, narrative means narrate (to tell in Latin) and gnarus (to know in Latin). Hence, narrative inquiry is used as a way of knowing that catches the two sides of narrative, telling as well as knowing. (p. 93)

Narrative inquiry is broadly considered as the study of stories (Polkinghorne, 2007). Here the object of study, also known as the narrative phenomenon, could be related to a certain event,

experiences, or stories in relation to the world in general (Bhattacharya, 2017). Since people

shape and interpret their lives and those of others in the form of stories, researchers using

narrative inquiry explore, understand, and construct stories based on participant's retelling of

their experiences.

Connelly and Clandinin (2006) explain that "to use narrative inquiry methodology is to

adopt a particular view of experience as phenomenon under study" (p. 375). Stories are

important for understanding of phenomenon and thus, have social implications. No two stories

are the same, and regardless of how unique a story is it provides a perspective on human

existence. It is by considering both the particular and the general, within and across stories, that

we learn about interpretive capacities of humans and elements related to historical, discursive,

linguistic, social, cultural materials that shape these interpretations (Freeman, 2016).

Interestingly, plotting of stories, which are never static, is also evident in the potential for human

change (Freeman, 2016).

By arguing that human story telling is important and worth it, narrative research in the

social sciences has created interpretivist theories of action. For instance, anthropologists,

sociologists, psychologists, educators, and various other academic disciplines such as literary

criticism, history, philosophy and organizational theory have all used narrative research to gain a

deeper understanding of experiences (Polkinghorne, 2007). The narrative turn in the human

sciences started in the 1960s but gained momentum in the mid-1980s challenging realism and

positivism (Riessman, 2008). In her work, Riessman (2008) lists several "facilitating conditions"

starting in the 1960s that shaped the narrative turn – shifts in Western thought, epistemology,

technology, and social practices.

Riessman (2008) also documents the beginnings of narrative research as presented by

other scholars: (1) Susan Chase, in Chicago School of Sociology, where investigators studied life

histories and experiences of different groups of people such as Polish peasants and tenant farm

women; (2) Kristin Langellier, locates the beginning in four specific movements – critique of

positivism and the realist epistemology, "memoir boom" in literature as well as popular culture,

"identity movements" aiming for emancipation of marginalized groups, and a rise in exploration

of personal life leading to therapeutic culture; and (3) Corrin Squire, locates the turn in the

interest in Western thought such as interest in language, biographical accounts, the visual and the

unconscious, reflexivity, intersubjectivity and a trend in interdisciplinarity. A cross-disciplinary

move that transformed narrative inquiry was the appearance of *Interpreting Women's Lives* in

1989, a volume that included work of scholars in anthropology, history, literacy and others. The

editors of this volume identified the group as the Personal Narratives Group. This led to a

decentering of the female subject from a realist position to a narrator-interpreter relation.

With the major contributions of Labov, Waletzky, Bruner, and Polkinghorne, the

narrative research opened up to several possibilities and cross-disciplinary research. Access to

technological advancements such as cameras, television, and more recently the internet, and

other streaming technologies have made possible new ways of exposing people to large

sequences of events. Today there are many types of narrative inquiry such as thematic narratives,

biographical study, autoethnography, life history, oral history, arts-based narratives such as

poems, ethnodrama, documentary, and performances (Bhattacharya, 2017).

In conducting narrative inquiry, a narrative mode of thinking is employed. Narrative

thinking is a "heuristic process that requires skill, judgement, and experience" (Robinson &

Hawpe, 1986, p. 111) which allows for "open-endedness, construction and various kinds of uncertainty" (Kim, 2016, p. 157). There are three elements in narrative thinking: (1) the narrative schema, (2) prior knowledge and experience of the storyteller, and (3) a range of cognitive strategies (Kim, 2016; Robinson & Hawpe, 1986). The storyteller constructs the narrative schema using important information related to an incident, identifying elements that constitute a story such as who, what, where, and when. The storyteller uses prior knowledge and experience; and then uses cognitive strategies such as "selecting, comparing, inferring, arranging, and revising the past knowledge and experiences" (Kim, 2016, p. 157). Thus, guiding the storyteller's judgment in the narration of the story. There are two principles in narrative thinking: (1) that people construct the self in relation to their experiences and make meaning of experiences by communicating them using narration, and (2) personal narratives are social in nature even when elicited as individual and unique (Chase, 2003; Kim, 2016). This act of narrative thinking elicits a story that helps to makes sense of the actions of the storyteller and those in relation to the storyteller.

Narrative thinking lends itself to the concept of *emplotment*, where a plot is conceived as the design and intention that shapes a story and gives it direction and/or meaning (Freeman, 2016, p. 32). The plot imitates *praxis* also understood as the Aristotelian practical domain of action (Freeman, 2016) which constitutes a way an action unfolds, events and characters that intersect with these actions. However, it is important to note here that theorists differ in how they constitute a plot with different purposes and sources. As humans we are always engaging in emplotment of events in our ordinary life experience narrations, but are unaware of its operation except for "the reality that it produces" (Polkinghorne, as cited in Freeman, 2016). Narrative

thinking requires emplotment to discern the interconnected material that creates our life accounts (Freeman, 2016). It is, therefore, essential to understand what to plot and how to frame our narrative thinking in a research context. Freeman (2016) posits that:

> The strength of narrative thinking is in its ability to make visible the interpretive capacities of human agents in relation to their actions, interactions, beliefs, and practices. As such, narrative thinking is not only considered an important way to understand human action and experience, but has become a core component for critical, emancipatory research. (p. 43)

> Considering narrative inquiry "is a reasoned and mindful integration of theoretical and technical devices to the understandings nurses, physicians, teachers, and other practitioners require to accomplish their respective social missions" (Thorne, 2008, p. 12), it is also well-suited for understanding the life stories of women within the profession of cybersecurity. Using both narrative and thematic formats, findings in this study bring out individual stories as well as trace commonalities across participant narratives.

Research Context

In this section, I present the details of participant recruitment as well as provide a brief description of the conferences that I visited and from which I recruited participants. I recruited 12 participants for this qualitative research study (see Figure 3.1). However, considering the nature of this study design as well as the richness of the data from all 12 participants, six participant narratives were considered for this study — Lisa, Mariah, Angie, Alicia, Krista, and Sherry.

Of the 12 participants, I had personally met Alicia and Angie at an international security conference, Conference A, held in the U.S. in 2017. I had spoken to them at length around the issue of gender diversity and their own experience being in the field. When I contacted them later to participate in this study, they accepted my request over email correspondence. At this conference I also had the opportunity to speak with other women in the field with various levels of experience and background in cybersecurity. Of the remaining 9 participants, Malia was a referral contact of an existing participant whom I later met online at the time of the interview. I recruited the other 8 participants – Lisa, Mariah, Sherry, Krista, Justine, Meryl, Jenna, Pauline and Dina, by posting a recruitment letter on the social media page and to the listserv of Conference B—a large cybersecurity conference for women based in the U.S. (see Appendix B).

In early 2018, soon after these postings, I had the opportunity to attend Conference B in person. I sat through seminars listening to talks on issues around diversity, hiring, feminism in cybersecurity, and so on. I also had the opportunity to listen to special sessions by speakers working at prominent tech organizations in the industry and the government. I spoke with women from the U.S. as well as other countries who are employed in the U.S. in cybersecurity. I also spoke briefly, with women behind the counters at the job fair that this conference had organized. These experiences broadened my knowledge and understanding of the issue at large. During both of my conference visits, I was able to gather information occurring naturally at the site which reinforced my understanding of the context and put me in a better place to receive participant stories during interviews for this study (Patton, 2015).

All Participants

CONFERENCE A	CONFERENCE B
ALICIA	LISA
ANGIE	MARIAH
	SHERRY
	KRISTA
	JUSTINE
	MERYL
	JENNA
	PAULINE
	DINA
MALIA (REFERRAL CONTACT)	

Participants Selected for this Study

Angie   Lisa

Mariah   Alicia

Krista   Sherry
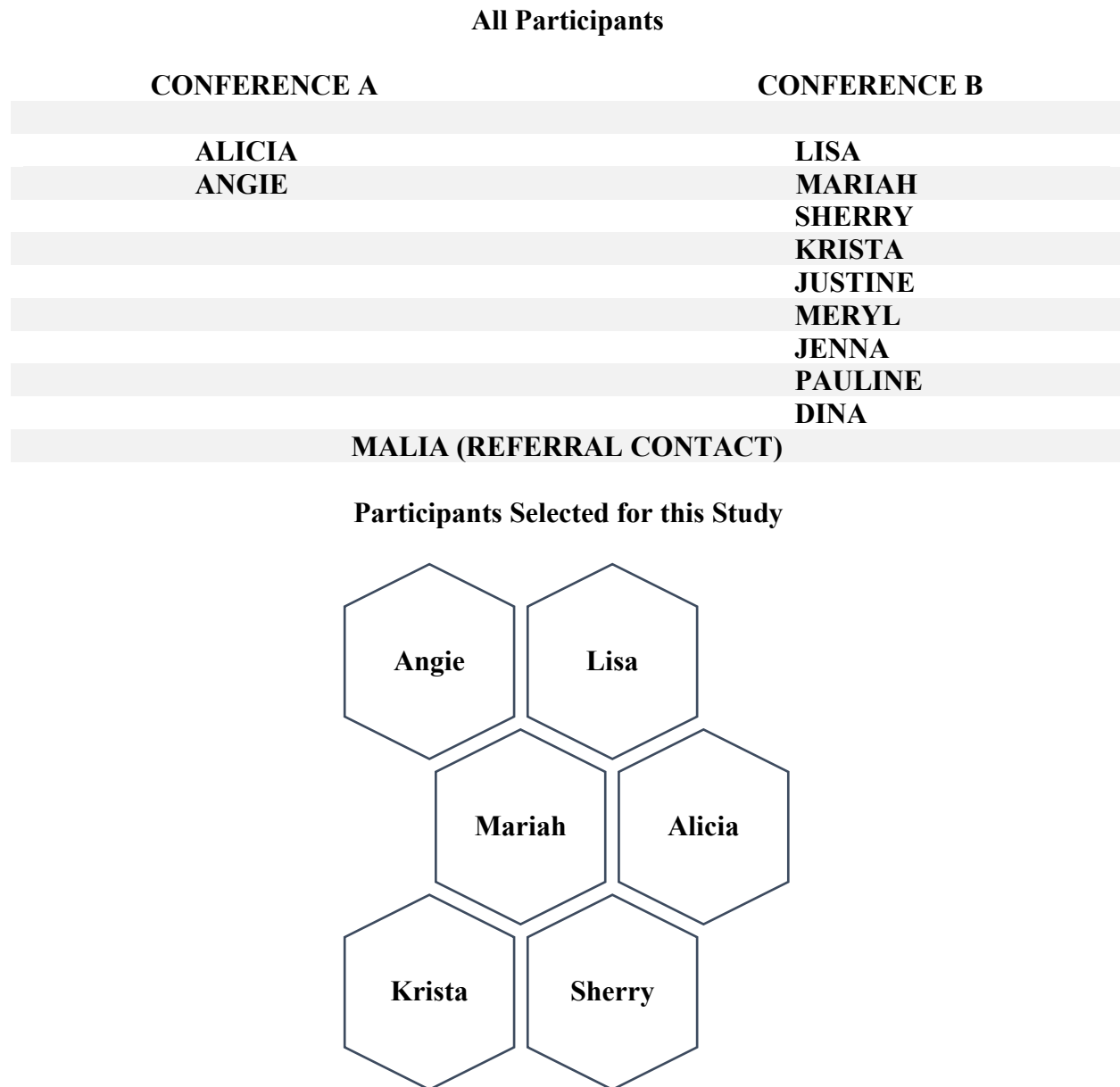
Figure 3.1

Study Participant Names

Soon after my visit to Conference B, I received an overwhelming response to my

recruitment email and post. More than 20 women volunteered to do interviews. After reviewing

their backgrounds and current occupation, I restricted the pool to the 9 participants mentioned

above in the table (see Figure 3.1). Thus, overall, 12 participants – 2 from Conference A, 1 from snowball sampling and 9 from Conference B, were selected based on their work experience in the field of cybersecurity across academia, industry and the government. For the purposes of this narrative inquiry, I narrowed down the focus to only 6 participant interviews – Lisa, Mariah, Angie, Alicia, Krista, and Sherry. Together, they represent a range of experience in the field as well as global perspectives. Of the six participants, Alicia is based in a European location who visits the U.S. frequently for conference related work, Angie has recently moved to the U.S. and Lisa, Mariah, Krista, and Sherry are each based in the U.S.

Data Collection

A research interview is a process in which a researcher and participant take part in a conversation specifically, focused on questions pertaining to a research study (Merriam & Tisdell, 2016). This person-to-person encounter in my study unfolded via a semi structured interview format—with a mix of both more and less structured questions, flexibly used in terms of wording and order to elicit specific data from the participants (Merriam & Tisdell, 2016). Since every person views the world differently and has different life experiences, a semi structured format for the interviews was developed. This allowed me to respond to any emerging information specific to the participant's worldview with additional questions. As this form of interviewing requires a list of questions to be determined ahead of time, I created and shared the questionnaire with my participants before the interview.

The interview protocol consisted of several types of questions to stimulate different types of responses from interviewees such as *experience and behavior questions* to get information about actions, activities and behaviors of a person (e.g., tell me about a typical day at work),

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opinion and values questions to know of their beliefs or opinions about something (e.g., does gender pose a barrier in working in the field of cybersecurity?), *feeling questions* to know more about the affective aspects of something (e.g., how did you feel about that incident?), *knowledge questions* to understand factual information about a situation, *sensory questions* specific to seeing, hearing, touching and so forth, and *background or demographic questions* to get information related to education, number of years of experience, and educational background (Merriam & Tisdell, 2016; Patton, 2015). I also asked probing questions to the participants as and when necessary to arrive at a more detailed response.

Data collection started in March 2018. Participants received two documents prior to the interviews – an informed consent form (see Appendix C) and a recruitment letter providing a clear description of the study (see Appendix D). As Creswell (2014) suggests, researchers have a duty to provide participants with consent form informing them of their rights and decision to participate in the study. Thus, a proper protocol was followed during the interviews (see Appendix E). Participants were requested to read and sign the consent form before the interview commenced. They were also briefly walked through the consent form at the beginning of the interview. In cases, where consent forms were not sent back by the participant before the actual interview, they were obtained soon after the interview via email correspondence.

Participants were given the interview guides in advance, as they were worried about any unforeseen conflict with their respective organizations. I conducted all 6 interviews via a video conferencing service of their preference such as Zoom, Google Hangout, or WebEx. As we were located across different geographical locations, this seemed like the most potent approach. I asked for each participants' preferred mode of doing the interview. Although video conferencing

was used during the interview process, only audio was recorded using QuickTime Player and voice memo on my iPhone. This was to ensure that I had an original and a backup copy of the interview. Additional backup copies were saved in Google Drive. During the interviews, I made sure that the environment was most conducive for clear communication. I conducted them from home and my participants were either at home or at their work location with minimum to no disturbance. For instance, Alicia connected from her workplace while Angie, Krista, Lisa, Mariah, and Sherry connected from their homes. In all these instances, the participant was seated in isolation, thus, respecting the decorum of a formal interview.

All 6 interviews lasted for approximately 60 mins (see Appendix F). I transcribed a few interviews on my own, and used transcription services such as Rev and Temi for others. In both cases, I re-read the transcripts and checked for errors. As for data sanitization, I assigned pseudonyms to the participants, names of places and organizations, school, college, spouse names, etc. Transcriptions are stored locally in my computer and for backup in cloud storage such as Google Drive and iCloud.

Data Analysis

Based on Bruner's two modes of thought, Polkinghorne (1995) posits two modes of analysis in narrative inquiry: (1) the analysis of narratives, or the paradigmatic mode of analysis, and (2) the narrative analysis, or the narrative mode of analysis. Polkinghorne (1995) distinguishes between the two modes as such:

> Although both types [analysis of narratives and narrative analysis] of narrative inquiry
> are concerned with stories, they have significant differences. The paradigmatic type
> collects storied accounts for its data; the narrative type collects descriptions of events,

happenings, and actions … that produce storied accounts…. Both types of narrative

inquiry can make important contributions to the body of social science knowledge.

(Polkinghorne, 1995, p. 21)

In the following sections, I present the two modes of analysis in further details.

Analysis of Narratives or Paradigmatic Mode of Analysis

The analysis of narratives depends on paradigmatic cognition, using which humans

organize experience finding an order and consistency while remaining attentive to general

features that are then classified into categories (Kim, 2016). Here, there is an attempt to identify

individual details and fit into a larger pattern. This paradigmatic way of understanding human

experience helps the researcher "to locate common themes or conceptual manifestations among

the stories collected as data" (Polkinghorne, 1995, p. 13). Paradigmatic cognition "produces

cognitive networks of concepts that allow people to construct experiences as familiar by

emphasizing the common elements that appear over and over" (p. 10). In this form of thematic

narrative analysis, "content is the exclusive force" (Riessman, 2008, p. 53) and thus, narrative

scholars aim to keep the story or sequence intact for interpretation (Riessman, 2008). Two types

of paradigmatic modes of analysis are feasible: first, using prior theory to guide the interpretation

of stories; and second, using an inductive approach to derive concepts from the data (similar to

the grounded theory) (Kim, 2016).

In the analysis of narratives, findings are arranged around description of themes that are

found to be common across individual participant stories. During analysis there is a specific

focus on attention to the relationships among categories. Paradigmatic analysis aims to produce

common knowledge based on evidence found across the stories and hence, tends to underplay the uniqueness of each story.

Narrative Analysis or Narrative Mode of Analysis

Based on Bruner's narrative cognition or narrative way of knowing, narrative analysis aims to synthesize participant experiences "into a coherent developmental account" (Polkinghorne, 1995, p. 15). It attends to both the particular and special characteristics of an experience thus, "noticing the differences and diversity of people's behavior. It attends to the temporal context and complex interaction of the elements that make each situation remarkable" (Polkinghorne, 1995, p. 6). In order to do so, narrative scholars create stories by integrating events and happening into a temporally organized coherent whole within a thematic thread called a plot (Kim, 2016). A method known as narrative smoothing, to fill in the gaps between events and actions, is used to make participants' stories coherent, engaging as well as interesting to the reader (Kim, 2016). The purpose of this mode of analysis is "to help the reader understand why and how things happened when they did, and why and how our participants acted in the way they did" (Kim, 2016, p. 197).

In this study, I used a combination of the two modes of thinking to create narratives and arrive at themes across participants by looking at commonalities across their experiences. I began the process by re-reading the interview transcripts to examine the raw data and get a sense of participant stories, followed by coding and recoding the data based on research questions, linking codes to create categories of data, creating themes by finding an emerging pattern in each category and finally, representing the data in the form of narratives (Creswell, 2007; Kim, 2016). This process is iterative in nature and required much deliberation. I organized the data around the

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stated research questions and incorporated different events and actions into a meaningful whole. While the paradigmatic mode of analysis focused on the generation of themes, the narrative mode of analysis focused on the development of the individual accounts of participants incorporating each research question. In attempting to answer the research questions identified for this study, I used a combination of the two modes of analysis. First, I analyzed the data with respect to every individual, and second across individuals.

A similar process was followed during the analysis of the interview transcripts for each participant. To construct participant narratives, I worked on the themes for one research question at a time. For instance, in creating the career choice narrative – the first research question – I analyzed participant descriptions of events and actions leading up to their career decisions and their present-day work experiences either in academia, industry, or the government. Since it seemed appropriate to present their career choice narrative as a single coherent account, I analyzed and presented it as such. For each of the other two research questions, I focused on generation of themes and categories. I referred to the literature and the theoretical framework to do so, and repeated the process to uncover as many themes and categories as possible. Finally, using themes and categories, I built a longer narrative for each participant for the second and third research questions. I also arranged the data in a chronological order, as far as possible. In instances, where narrative smoothing is necessary, I filled in the gaps and used brackets to indicate my own words. I tried to retain the narrative accounts based on the participant's spoken language as appropriate. But also cleaned up the language wherever necessary. In the end, focusing on presenting the participant's position accurately. I continued to use the same

technique, until all the themes and questions were answered for each participant. Please refer to Chapter 4 for the findings generated as a result of this analytic process.

A systematic process was also followed for analysis of the interview data across all participants. Since the first research question was analyzed using the narrative mode of analysis, this time I engaged in paradigmatic mode of analysis to generate themes and categories across all participants. The second and third research questions, were already analyzed using a combination of narratives and themes at the participant level. Therefore, during this phase of generating findings across participants, I analyzed the common categories and notable differences within each theme and category identified at the individual participant level. Please refer to Chapter 5 for the findings generated as a result of this analytic process.

Validity and Reliability

To ensure trustworthiness of this qualitative study, several strategies to maximize validity and reliability, also known as credibility and dependability, were used (Merriam & Tisdell, 2016). Validity and reliability in qualitative research can be achieved by paying careful attention to the conceptualization of the study, ethical practices in data collection, analysis, interpretation and presentation of findings (Merriam & Tisdell, 2016). Further, two forms of rigor can be applied to the study in terms of its methodology and interpretation (Lincoln et al., 2011). In conducting this narrative research, I practiced rigor by making it methodologically pliable and created interpretations that can be trusted. A good narrative researcher must tell an engaging story (Creswell, 2013) and, as in all good qualitative research, "meaningfully interconnect literature, research, questions/foci, findings, and interpretations with each other" (Tracy, 2013, p. 230). It is worth noting here that narrative research aims to produce storied texts and they "serve

as evidence for personal meaning, not for the factual occurrence of events reported in the stories. Yet the meanings reported by the stories are responses to life events, whose descriptions need not be discounted wholesale" (Polkinghorne, 2007, p. 479).

Another indicator of data validation in qualitative research is to spend enough time and look purposefully for variety in establishing an understanding of the phenomenon (Merriam & Tisdell, 2016). It is my understanding that I have achieved that by reading the literature and also talking to people in the field on different occasions. During the time that I conducted my interviews, I visited two cybersecurity conferences to speak with women and attended sessions addressing gender diversity and talent gap in the field. I looked for interviewees across different occupations, across age groups and backgrounds all within the wide realm of cybersecurity. This gave me an opportunity to hear women's experiences in working in the field. This is also how I engaged in triangulation, a common strategy for data credibility or internal validity, of data by using multiple data sources – collecting data at different conference sites and interviewing and speaking with people with varied experiences and backgrounds.

Related to data credibility or integrity is another measure called researcher positionality to see how the researcher is affected by the research and also affects the research (Merriam & Tisdell, 2016). I have included a separate subjectivity statement that includes my position and thoughts about this research. Another measure of validity is peer examination or peer review where a colleague familiar with the research can scan the raw data to see if the findings are possible (Merriam & Tisdell, 2016). I engaged in this process by having a colleague of mine look over the data and analysis. I also utilized the strategy of maximum variation by purposefully seeking diversity in selection of participants to allow for a range of responses and findings.

In qualitative research, reliability is not a goal per se, because replication of a study will not yield similar findings. As is indicated by Tracy (2013), "because socially constructed understandings are always in process and necessarily partial, even if the study were repeated (by the same researcher, in the same manner, in the same context, and with the same participants), the context and participants would have necessarily transformed over time—through aging, learning, or moving on" (p. 229). However, this does not discredit the original study and interpretations of the same data can be continued to make until new research presents a new set of dependable findings (Merriam & Tisdell, 2016).

Methodological Limitations

Limitations to narrative research might arise due to a disjunction between the meaning of an actual experience versus the storied account of the experience. This can happen due to following reasons: (1) limitations of language and its structure in capturing the actual felt experience, (2) limitations to availability of all of the meanings related to an experience through reflection only, (3) resistance to fully reveal the felt meanings of an experience due to social desirability, and (4) co-construction of storied text depends on the interaction between the researcher and the participant and depending on how the researcher is perceived this may affect the story (Polkinghorne, 2007). Narrative research does not aim to get at generalizable findings and therefore, this research used only a small set of interviews—six in total. As data was collected and analyzed, I worked to overcome the limitations by carefully listening to the stories,

reviewing the recordings and transcripts multiple times, and having a colleague also analyze a sub-set of the interviews.

Ethical Considerations

Stake (2005) suggests "qualitative researchers are guests in the private spaces of the world. Their manners should be good and their code of ethics strict" (p. 459). I did my best to follow and maintain such an ethical code during the interviews. Being a novice researcher in a foreign land, I tried not to ask any leading or probing questions beyond a certain level of comfort both for me and for my participants. I was mindful of my voice intonations and body movements, clothing as well as speech, to both portray a friendly demeanor and to signal that all responses are welcome. I understand that interviews are extremely personal, and participants tell us their stories of both joy and suffering, which may make them feel that their privacy is at risk. So, I tried to take on the position of a listener and a learner without judging the individual for what they shared, only posing questions that seemed necessary for the study.

I also worked to make the interviewee as comfortable as possible during the process. I began the interview by thanking the participant for taking the time and spent a few minutes building rapport. I told them briefly about my background, current research interest, transition from Information Technology to Education Technology and Career Development. I walked them through the informed consent form and made sure they understood the terms in the form. The Institutional Review Board (IRB) of the University of Georgia approved this study (see Appendix G) and I complied with the ethical principles stipulated by the IRB.

If participants had questions regarding confidentiality, I clarified that for them. Confidentiality is an agreement to protect the participant's privacy (Kim, 2016). To ensure

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confidentiality, I assigned pseudonyms for participant names, locations, organizations, schools, laboratories, and so on, to protect any identifiable information about the participant. I also explained that they had the freedom to stop the interview at any point. In doing these interviews, I practiced relational ethics to obtain data and maintained "a deeply human, genuine, empathic, and respectful relationship to the participant about significant and meaningful aspects of the participant's life" (Josselson, 2007, as cited in Kim, 2016, p. 103) I found that participants were comfortable in talking with me and answering questions. In instances where participants felt uncomfortable using a certain video conferencing tool, I used what they were most comfortable with. If they agreed to only audio recording, I conducted the interview that way. In terms of scheduling the interview and any other correspondence, I used my UGA email id. After every individual face-to-face interview, I sent my participant an email thanking them for their time and willingness to share their personal stories with me.

Researcher Subjectivities

According to Fine (2006), strong objectivity is "achieved when researchers work aggressively through their own positionality, values and predispositions, gathering as much evidence as possible, from many distinct vantage points, all in an effort *not* to be guided, unwittingly, by predispositions and the pull of biography" (p. 89). In my pursuit of understanding "herstory" in cybersecurity, I have often taken the position of an inquirer. I believe that by only keeping an open mind can we see beyond our assumptions, listen closely and see with more clarity. I view my research journey as life altering. It has changed me in a manner that I was not necessarily ready for. Over these last couple of years, I have grown in my commitment to advancing gender equity and in my growth as a feminist. Perhaps there is no

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better way to sum it up than to quote Octavia E. Butler, "All that you touch, you Change. All that you Change, Changes you" (1993, p. 3).

Over the years, through the many life experiences, trainings, and scholarship, I have learned to discern micro-aggressive behaviors and unjust practices rooted in power dynamics. On the outset, it might sound simple. But I will emphasize that these experiences are both difficult to encounter and then to process. In developing this bravery, and in shaping my behaviors and expectations about the world, many feminist authors have played an influential role. Here is a short list: bell hooks, Brené Brown, Chimamanda Adichie, Gloria Steinem, Jhumpa Lahiri, Michelle Obama, Rebecca Solnit, and Rupi Kaur. Feminism to me is as simple as "a movement to end sexism, sexist exploitation, and oppression" (hooks, 2000, p. VIII). I believe that given the equal opportunity, women have the ability to contribute to any field, achieve their true potential, and fully participate in the making of society. I believe that women, and all humans, must have the freedom to express their individuality. Additionally, each of us have a responsibility to interrogate individual, institutional, and socio-cultural oppression and work towards social change. For instance, gender inequity in the technology workplace should be challenged. Today's technology workplaces lead us in innovation that shape our daily lives, and when we fall short in creating equal opportunities for women to be represented then we are leaving women out of power, important conversations, and decision making.

With every passing phase I have seen my own involvement grow in this research project. Starting with thinking about the research topic and questions, then taking a deep dive in understanding the literature, followed by personal visits to two large cybersecurity conferences to speak with women, listening to speakers at the conferences, and finally, doing in-depth

interviews with 12 women, have given me leverage to work closely and with a purpose. As feminist theorist Sandra Harding believes, research that is based on women's actual experiences produces "strong objectivity" and I was interested in learning and re-presenting those experiences as stories to my readers. Interviewing these phenomenal women and hearing their hopes and joys, struggles and frustrations, certainly have led to an increased understanding of my personal and social positionings in the research and in this world.

Incidentally, I did not choose to work on this context, rather it happened to me and I call it *serendipity*. Although I have an advanced degree and work experience in Information Technology, I do not necessarily consider myself an insider in the cybersecurity community. Mostly, because it is its own field that requires a different kind of specialty and skillset. It is also a high-risk work environment that not many women get to or are interested to participate in. In sum, I would say that a combination of factors drew me to the study and formed my subjectivities: (1) prior experience in working in the technology space as an engineer, (2) uncovering systemic issues related to implicit bias, sexism, sexual harassment, and several other micro-aggressive behaviors in academic and workplace settings, (3) a personal belief that nothing about a cybersecurity job says *men only*, (4) addressing talent gap in the cyber space and finally, (5) a personal interest in seeing more women enter the field and those who have already made it, seeing them sustain and shine. Together these reasons have contributed to my motivation in continuing to do this research. I end this statement with a few lines from Maya Angelou's stirring poem, *Still I Rise,* because it speaks to me about resilience:

Just like moons and like suns,

With the certainty of tides,

Just like hopes springing high,

Still I'll rise.

CHAPTER 4

FINDINGS: CAREER NARRATIVES OF INDIVIDUAL WOMEN IN CYBERSECURITY

In this chapter I present the findings, which includes participant narratives as well as themes identified within each participant's narrative account. The narratives are derived based on interview data with participants. In total, six participant narratives are presented and analyzed. Participants include Lisa, Mariah, Angie, Alicia, Krista, and Sherry. The participants are spread across a continuum in their number of years of experience in the field – Lisa, has the least experience number of years of experience in the field and Sherry, has the most. The results from this study are presented in two parts – the narrative account of each individual as it relates to the three research questions designed for the study in Chapter 4 followed by analysis across participants to find commonalities and notable differences in their narratives in Chapter 5. In both chapters related to the findings, elements from the theoretical framework are interwoven leading to a more coherent understanding of the data and generated themes. Throughout this chapter, I use excerpts from participant data and also include my personal reflections and ponderings based on my research journal. To bring further clarity to the reader, I present an outline of the structure followed in this chapter:

For each participant (e.g., Narrative Account of Lisa):

- Brief introduction to the interview, setting, and the participant

- Participant description of educational degrees and work experiences leading up to a career in cybersecurity and beyond. This is the response to RQ1 (e.g., Lisa's Career Choice Narrative).

- Participant descriptions of key career influential factors as generated themes such as "intrinsic factors," "extrinsic factors," "interpersonal factors," and "work environment factors." This is the response to RQ2 (e.g., Lisa's Key Career Influential Factors). Definition of each theme is indicated below:

Intrinsic Factors: This theme represents factors emanating from the self to engage in a cybersecurity career choice such as self-efficacy beliefs, interest, performance accomplishments, and so on.

Extrinsic Factors: This theme represents associated rewards and enactment of values such as recognition, valuable career skills, money, job stability, and so on.

Interpersonal Factors: This theme represents the role of others in providing support in the career path such as role of mentors, colleagues, family, and friends.

Work Environment Factors: This theme represents supports and barriers related to the field, and academic and technical workplaces such as gendered environment, aggressive environment, flexibility to work from home, accommodations during pregnancy, and early parenthood.

- Participant descriptions of meaning making of work experiences, including market work and personal care work, generated categories such as "career as meaningful work," "career as motherhood," "career as gendered experiences," and so on. This is the response to RQ3 (e.g., Lisa's Career Meaning Making).

- A short conclusion of individual participant findings.

The findings of the study based on each participant data are organized and presented as per the visual representation in Figure 4.1. Each colored rectangular box represents a theme identified in the study, e.g., "intrinsic factors" is a theme. Each dotted rectangular box represents a category identified within a theme.
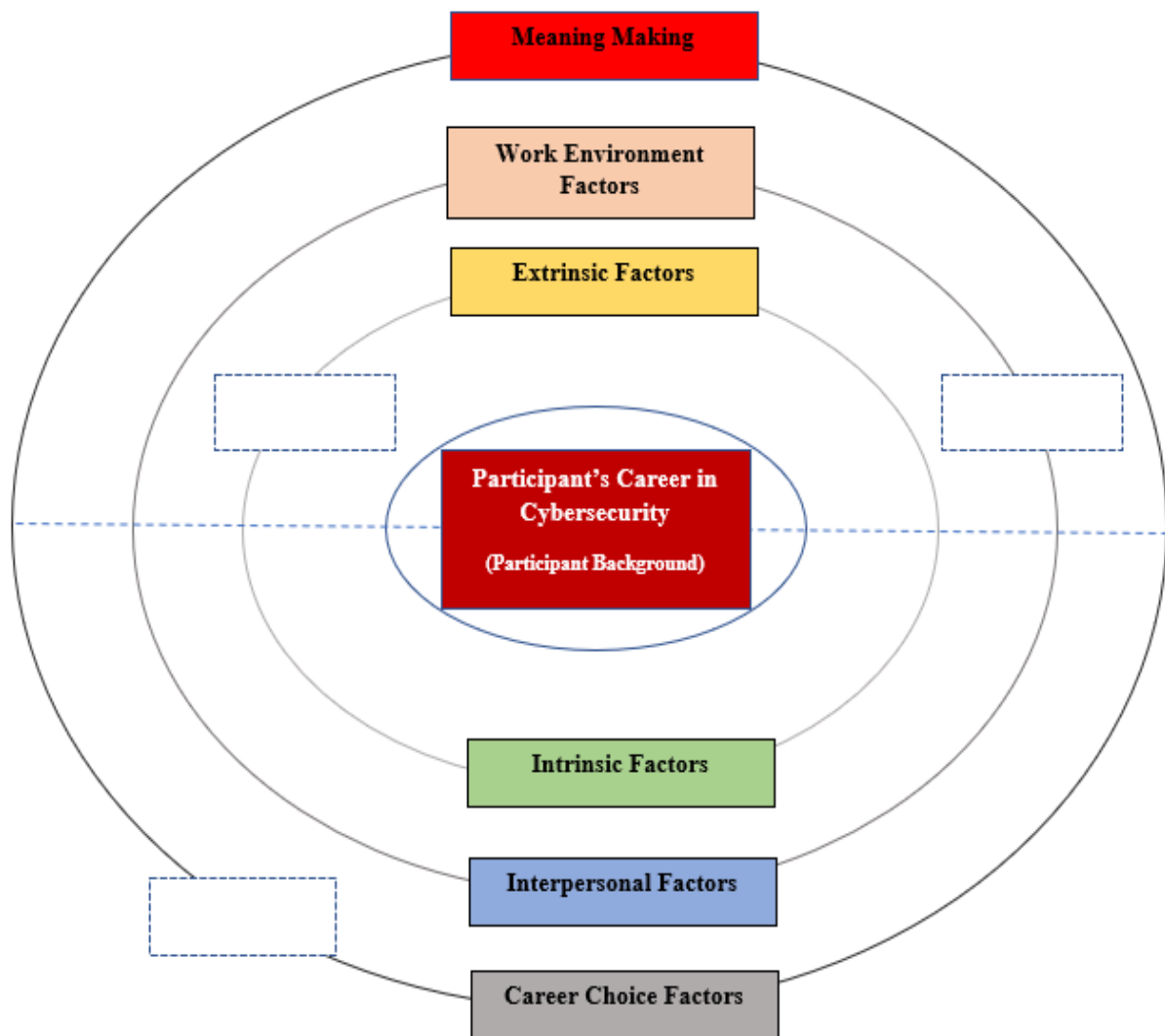
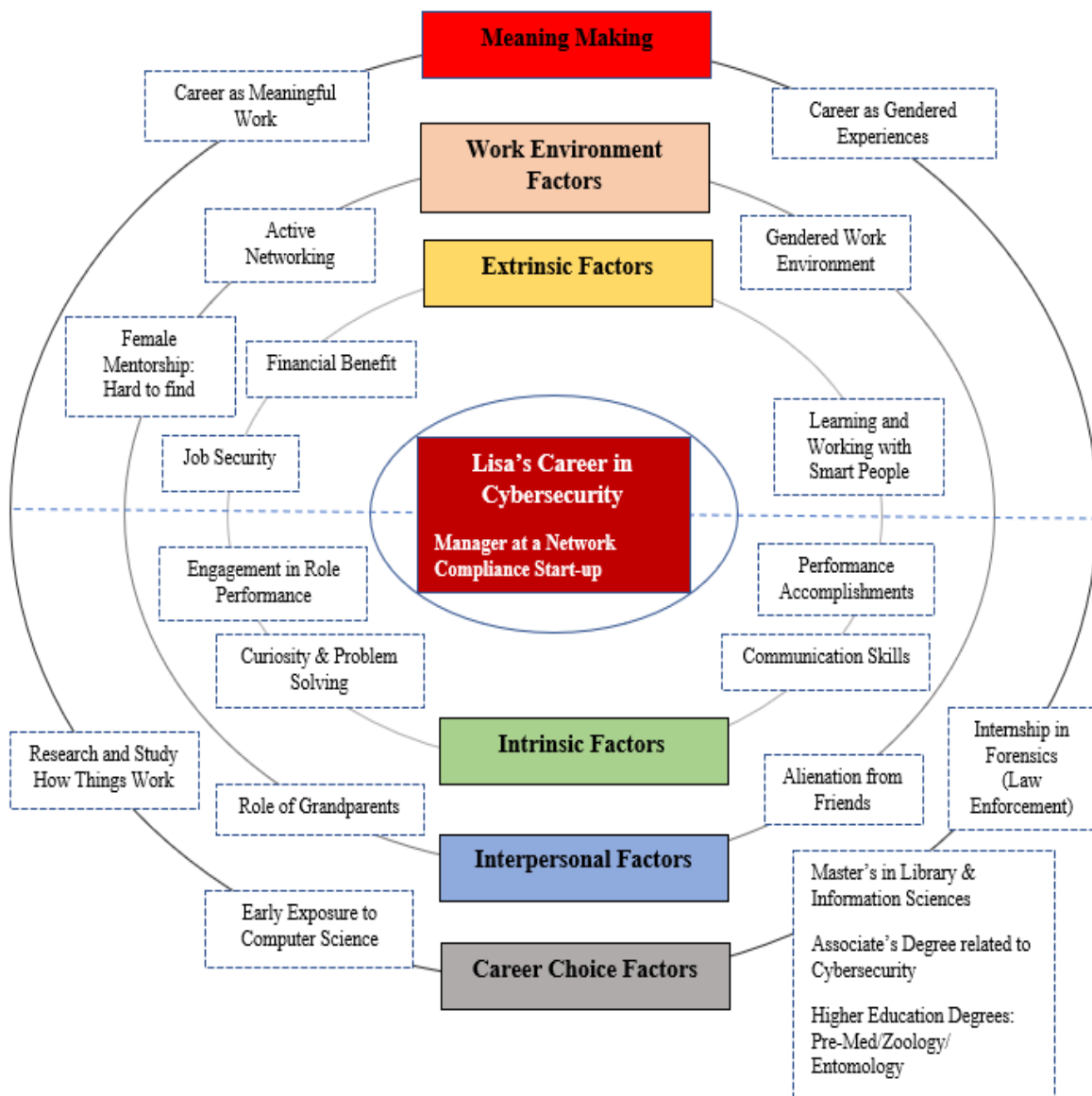**Figure 4.1**

Visual Representation of Study Findings

I begin with Lisa and present the findings for each participant as per the structure mentioned above. A pseudonym is ascribed to each participant.

Narrative Account of Lisa

Lisa and I also met online for the first time during this interview. I found our interactional exchange to be enjoyable and more importantly, a great learning event for me both as a researcher and an interviewer. Lisa was interested to meet me in person for the interview. She was visiting the south for a conference and work, so it seemed possible for her to "swing by the campus" at UGA. However, the plan did not fall in place and we decided to meet online. We scheduled to meet early in the day via Google Hangouts. Thankfully, there were no technical interruptions and we were able to start on time. She was at home and so was I. The interview did not feel hurried at any point and we had enough time to touch upon all of the interview questions in the protocol. Her responses were very moving and inspiring, as she generously shared her personal story. The more she shared the more the challenges rooted in gender became apparent. Her narration is one of both hope and despair. I found her choice of language very interesting too. In the following sections, I share the elements from this interview. For a visual representation of Lisa's career in cybersecurity refer to Figure 4.2.

Lisa's Career Choice of Cybersecurity

Lisa works at a start-up whose primary focus is on providing network compliance for financial institutions. Her office is located in a major city in the U.S. Lisa manages an all-male team of red and blue "security guys," she told me. As Lisa and I began to talk, I asked her for a brief account of her journey leading up to her current job. Slowly, Lisa traced her career back to

Figure 4.2

Visual Representation of Lisa's Cybersecurity Career

when it all started. In fact, she took me back to her high school days when she picked an interest

in computer science. She was "very interested in computer science" and took classes for 3 years

in her high school. She told me that her school was relatively small, and it was "in the middle of a corn field" but they offered some courses in computer science. As I listened more, her explanation for why she felt "comfortable" in the computer science lab struck me as surprising. As Lisa said:

> *I knew I was not one of the cool kids. I am taller than everyone, taller than most of the guys. So, I was just very comfortable functioning outside the norm. I think that kind of helped me work in computer science. I mean, I did not care! You are talking late 90s, you know, tall nerdy female, in the computer science lab. I was okay with that!*

Based on what Lisa shared, it appears that there may be a combination of computer science stereotypes and gender role socialization propelling her desire to be in the computer science field further (Lent & Brown, 2013). It made me wonder about the shame we experience with respect to body image and respond to the cues we pick up from our environment in terms of what is considered "cool" (Brown, 2006; 2012). Lisa shared she had a bad experience with the computer science teacher. The teacher extended unprofessional behavior towards her. For example, bringing gifts and staying in the classroom longer to chat with her. When Lisa's mother got a hint of what was occurring, she took up the matter with the school administration, Lisa said. The school administration then decided to move Lisa "from the classroom," instead of taking the necessary action against the teacher. Lisa described:

> *What happened in high school was the teacher involved in computer science classes started doing inappropriate things. Moreover, the school administration's answer to that was not to remove the teacher but remove me from class. Eventually, he changed jobs*

and went to a different school and uhh… was found guilty of additional inappropriate

activities there.

This incident appears to have left a strong impression on her mind, both about injustices and the need to hold people accountable, as Lisa brought it up several times during the interview. I was moved by Lisa's willingness to give me access to such an intimate part of her life.

After completing high school, Lisa changed her trajectory from computer science to agriculture. Lisa told me, "when it came around for me to go to college, I kind of wanted to do something else, so I ended up in zoology and horticulture." She graduated with a degree in zoology and moved on to a degree "program in entomology." After completion of her studies, Lisa spent some time at a foreign location working as "a bug hunter" for a while and then moved back to the U.S. to pursue higher education in library and information sciences. As her studies progressed, Lisa came across new avenues in the field where discussions emerged on topics related to "privacy, information management, knowledge management, deep and dark web research." Lisa shared it is by exploring that thread she gained an interest in cybersecurity (Lent & Brown, 2013). Lisa said:

At that point, it became apparent that I needed more technical skills. So, while I was

enrolled in this master's program, I found a local community college that had a computer

and network engineering program. So, I enrolled at that one simultaneously. So, I started

learning about networking, computer hardware. Eventually, the courses evolved into

security and forensics. And that is you know, when I really became interested.

I was very thrilled to hear that just by attending to lectures and willingly exploring security, Lisa was able to transition. But I was curious to know more. Lisa told me she

simultaneously enrolled for an associate degree in security and network engineering in a community college nearby, while still pursuing a masters' degree in library and information sciences. I pondered and thought to myself, "so this is how she found her way back into what she had left back in her high school in the middle of a cornfield." Lisa took the necessary After graduating with her master's degree and while still finishing up on her associate degree, Lisa started looking for jobs. She "noticed" she was eligible "for a lot of internships." So, Lisa applied for a suitable internship at a law enforcement office. She said:

> *I never thought about going into law enforcement, but you know, it does not hurt to put in an application. You know, you do not win, if you do not at least try!*

Lisa accepted the offer and continued to volunteer at the law enforcement office for 2-2.5 years. At the time, Lisa was still working on her associate degree while providing care for her husband, who was suffering from a life-threatening disease. Sadly, "he passed away," she told me and paused momentarily. My heart sank thinking about the cruelty of life. I could not fathom the pain in losing a husband at such a young age. I softly apologized for her loss, but did not want to interrupt her narration. Lisa continued and shared she started looking for a full-time job after his demise. By then she had earned both a master's degree and an associate degree. Lisa said:

> *Fortunately, I got in touch with this gentleman in the digital forensics classes, and I see him post something on LinkedIn one day. He instantly messages me and says, "Hey, are you still over at the [law enforcement] office?" I said, "No! Yes, but I am looking for a new opportunity" (smiles). He goes, "we have an opening for a position as a security engineer, would you be interested?"*

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After receiving news about the job vacancy from her classmate, Lisa applied for the job and received an offer. She considers herself "very fortunate" to learn about the job opening because she "needed a job" and that is how she "got into security engineering and information security." During the time of this interview, Lisa was still employed in the same organization.

In sum, Lisa developed an interest in the field when courses in another field developed towards security. She set a personal goal to gain more technical skills in security and took the necessary actions towards that goal such as enrolling in an associate degree. Lisa then completed her courses leading to successful graduation in both master's degree and associate degree. An intention to follow a career path in cybersecurity led her to seek an internship position at a law enforcement office and then a full-time job in security engineering (Lent & Brown, 2013).

Lisa's Key Career Influential Factors

Intrinsic Factors

Curiosity and Problem-Solving. I asked Lisa, what draws her to the field of cybersecurity. She shared the field supports her scientific curiosity to know "how things function." Additionally, it allows for real-time problem-solving, as Lisa said:

> *That is the fun part about vulnerability management—you get to call people and remediate stuff actively! So, that is why I am taking CRISK [industry certification], because I want to go down that kind of career path*

Before entering cybersecurity, Lisa was "a real bug hunter" studying zoology and entomology. This puts her in a unique position to draw parallels between the biological sciences and the technical sciences. This is also reflective of her belief in her abilities as she transitioned from one STEM field to another. Lisa said:

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You know, in all these fields, in all the STEM, it is about how things function. Be it mechanically or biologically, what drives things, what makes things ticking. And so, just kind of meeting that curiosity was always there. So, you know, I was literally a bug hunter for a while, but then, you start working with computers, and you still get that underlying foundation of what is happening. It is just that desire to research and study things.

Communication Skills. Lisa pointed out the role of communication as crucial to not only her job but also to that of other security professionals, including early career professionals in cybersecurity. As someone who manages a security team handling financial institutions, her mantra for excellent communication is "breathe, do not panic." Lisa insisted spiraling into a panic situation is not a good approach to working in this environment. Moreover, Lisa also shed light on how excellent communication skills necessitate her everyday working situations. For instance, in clarifying the demand for correct information, in understanding the scope and nature of the problem, and in reaching out to those who can address the situation, good communication is absolutely crucial to work effectively. Lisa emphasized "communicating the job well" is a necessary skill to work in the cybersecurity space. Here Lisa is focused on the skills and abilities required to perform her job well and her own proficiency in effective communication influences her self-efficacy beliefs in the field (Lent & Brown, 2013). As she said:

Make sure you understand, the first thing you always do is confirm. Be understanding of what the person is actually asking for: are they making the correct information demand? I do that a lot with my customers and even with people in our own company. Because even things within our own company product shift so quickly. People may not understand

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what they are asking for… Just because something may look like it is on fire, it is not

actually on fire! Even on simple questions, make sure the scope is correct.

Performance Accomplishments. This quote sums up Lisa's growth in cybersecurity in

the short-term that she has spent in the industry from volunteering to managing a team:

I start off as an intern volunteer at the law enforcement office. I joined my current firm as

a security engineer and in less than a year, I was promoted to a security operations

manager. So, I run the security personnel, both the red and blue teams.

Lisa appears to have worked both towards career choice goals of working in the security space

and also performance goals of doing well in the field (Lent & Brown, 2013). She gained her

technical knowledge in cybersecurity mostly through an associate degree in security and network

engineering. As someone working in the industry, Lisa likes to study for industry certifications

because they signify the credibility of skills and allows the test taker to learn new concepts and

their applications. Lisa also shared she finds it "empowering" to communicate her achievements

to her male coworkers. I was very intrigued by this. As I reflected, I understood that the

underlying problem is rooted in gender and the hurdles women face in the field. Lisa pointed out

it is "petty in some ways," but it shows the effort she takes to learn and grow. Considering the

asymmetry in power between genders in technology workspaces, earning credentials could be

emotionally uplifting. As Lisa said:

You know, what I really love to do? Not everyone on the team is as motivated as I am. As

I said, I like doing the certifications because I like studying for them and its fun for me…

What is really fun for me, that I would say empowering is when I do something extra, that

the guys have not done. And you know, I take on a new certification, and then I get to talk

about it, and they are just kind of stuck there listening.

Engagement in Role Performance. As Lisa talked about her typical day at work, it became clear that her job responsibilities are widespread. In her role as a vulnerability manager, Lisa shared "every day is different." "You never know what fires you are going to put out," she said. Lisa manages a range of events in her work day starting with "daily intel report," "checking on client accounts," "special projects," "special requests" from clients, "working with the c-levels, going over their presentations, checking their data," "back-end calls" with team-members and clients, "large scale security events" and is also "in-charge of press releases." Lisa also works on "recruitment" where she personally visits conferences and recruits people for her team. Additionally, she takes time for self-development to read up on cybersecurity or management and leadership related materials either by taking up a course, certification, or the Harvard Business Review. While Lisa works in a leadership position, she tries to keep up with her technical knowledge:

You do not want to be the paper person, you still want to know the technical stuff, how

stuff works.

Extrinsic Factors

Associated Rewards: Financial Benefit; Job Security; Valuable Skills; Learning, and Working with Smart People. Lisa shared she enjoys a few associated rewards that come with her job. She appreciates the income opportunity and employee benefits which contribute towards the payment of her "bills and mortgage." She also draws comfort from being employed in a space where her "skills" are relevant and "valued," and where there is job stability.

Moreover, she gets to be acquainted with "smart people" who are involved in creating "fascinating stuff." Granted, her job and her interests are not always relatable to others, but Lisa told me that it is still worth it because it brings her the satisfaction that she seeks. Lisa is also a voracious reader and books adorn her living space. So, she considers the field to be a great fit as it always offers something new to read up on. Lisa said:

> *I am proud that I am part of this industry, I get to work with smart people, and you get to work on this really fascinating stuff, that no one understands, and you cannot relate to many people. But that is fun! You know, one of the big appeals of going into library science, is that you get to read books all day (laughs). I love books. I've books in every room of my house. I love learning stuff. If you are okay with that, then you are in a great field.*

The positive outcomes that Lisa has experienced from participating in the field of cybersecurity work as positive reinforcement that further propel her interest in the field and maintain the career choice (Lent & Brown, 2013).

Interpersonal Factors

Role of Grandparents. Lisa indicated the role of her grandparents in inspiring her to pursue the STEM field. She briefly mentioned both of her grandparents took part in the second World War. While we did not talk about the relationship she has/had with her grandparents, the evocative nature of their presence in her life became evident during the interview. Lisa thought back over her grandfather's "progressive" views about women and career. Even though he

belonged to a different generation, her grandfather was supportive of women pursuing scientific disciplines as well as women going into teaching professions. As she said:

> *Both of my grandparents were involved in World War 2. And so, my grandfather was really an advocate for women going into the sciences, very progressive. I mean, even for a gentleman for his era, he wanted women to go into teaching, go into sciences.*

Alienation from Friends. Lisa expressed her sadness in becoming "an alien" to her friends. She has drifted apart from her set of old friends as a result of life and career choices, but it is further amplified by her choice of cybersecurity. Lisa mentioned it is difficult for her friends to relate to her work which creates a distance between them. They no longer live in the same city, but are connected via social media. Lisa said:

> *You know, sadly, one of the things that I struggle with mainly is that I am an alien to my friends. You know having left [my hometown], we are friends on Facebook and all that, it is whenever I post stuff about some cool article I see, and I say, "this is the greatest thing ever, this is going to fix everything." Then it is just sort of crickets. But someone throws the picture of a burger or something and yay, everyone likes the burger!*

Lisa lamented the loss of connection and further said that she does not have kids or pets to share pictures of online, which might be of interest to some people. That said, Lisa pointed out she is still "proud" to be able to put up "intellectual and nerdy" stuff and to be part of the security workspace. Restrictive environmental conditions such as lack of support from friends can moderate career choice, but it appears that Lisa weighs in on the positives and is confident in her career choice (Lent & Brown, 2013).

Work Environment Factors

Active Networking. Lisa pointed out irrespective of gender, networking is an essential factor in career development. She mentioned making conscious efforts in actively building connections with others in the field. Lisa insisted upon it and said that that is how opportunities come by. Living in a big city, Lisa considers herself "fortunate" to be able to visit conferences and make new connections as well as build on the old ones. Lisa also serves on the advisory board of her community college. She said:

> *So, yeah, there are opportunities. In some ways, you cannot sit around and wait for things to happen, you have to make them happen yourselves. That is not because you are female or male; that is just how the world works.*

As a word of advice, Lisa encouraged women who are new to the field to do something similar: to be seen at events, to speak up, communicate, ask questions, talk, and be friendly. Lisa added one should "not be discouraged" because they are the only ones representing their gender in the room and rather, use it to their "advantage." As she said:

> *Also, do not be a wallflower, ask questions… A lot of the times you are going to be the only women in the room, you know, kind of work with that to your advantage. Introduce yourself, try to be friendly, you know, all eyes are on you because you are the only female and just remember that.*

Lisa has developed an understanding of how best to navigate this workspace despite of challenges rooted in the male dominated culture and encourages others to do the same (Buse et al., 2013). There is an underlying message that one has to break the barrier themselves and make their own path.

Gendered Work Environment. Lisa shared her moments of disruptive experiences at work, such as being put into uncomfortable situations, talked over in conversations, handling aggressive men, and learning to establish boundaries. Lisa told me she makes "a joke" about "handling egos and not security professionals." There are times when she has to play the mediator between her male team members, she told me. As a combative measure, she now "subscribes to the Harvard Business Review" to equip herself in being skillful at such conversations. Lisa understands the work environment and in successfully navigating such scenarios creates learning experiences which in turn revise her self-efficacy beliefs (Buse et al., 2013; Lent & Brown, 2013). As Lisa said:

> *Some of the things that I have noticed in my career here, is that you will be railroaded in conversations. So, one of the things I did this year, was that I got the subscription to Harvard Business Review on how to start handling these trickier situations… Learning how to work with aggressive men and that's kind of one of the things, where there is lot of money, there is lots of egos.*

Lisa then directed my attention to specific precautionary measures that women must take, especially while attending cybersecurity conferences. She shared some conferences tend to showcase diversity and therefore, if there are women participating at the conference there are very high chances of women getting "clicked" or being asked for "sound bites." Some conferences that are open to all are notorious for incidents of mistreatment of women and thus, women should be self-conscious about their "clothing" when at such places. Lisa also added women should be bold enough to "speak up" if someone misbehaves. Although Lisa is not worried about herself because she is six feet tall, she suggested women should learn "some self-

defense" moves if that would make them feel comfortable. During the entire interview, Lisa expressed an underlying concern with the unfair treatment women receive in the field. Based on her input it appears that women in the field are vulnerable, but they must demonstrate courage and be mindful of their actions (Brown, 2012). Lisa said:

> *Life is not fair, because you are female at the conferences, pay attention to how you are dressed… If someone does do something inappropriate, be prepared to handle that. You know, I certainly do not want to think of the worse, if it feels better, go to a self-defense class. But if something happens, do not stand by ideally, handle the situation because you are just setting up that person to do it more in the future. Like I said, people need to be held accountable if inappropriate things are going on.*

Female Mentorship: Hard to Find. Receiving guidance from a mentor can be invaluable for a less experienced person in the field. Lisa pointed out she seeks such a relationship with an experienced female mentor towards her professional development. Unfortunately, she has not been able to find a female mentor yet, and is not confident of finding one soon either. Kelan (2012) proposed that junior women need senior women role models to envision themselves in leadership positions.

Lisa seeks the "wisdom" of a woman "who has been in the field longer" to perhaps ideate workplace and career behavior. Additionally, cybersecurity being a male-dominated industry comes with its unique set of challenges for women. Thus, having in-person communication with a female mentor can be purposeful in terms of sharing knowledge and experiences in various regards. Fortunately, Lisa shared she had received some useful advice from "older gentlemen" in the field, with experiences of over 20-30 years. These are experienced men in the field "who are

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willing to communicate." These men had also shared their disapproval of the unfair treatment of women currently in the field. Although Lisa appreciates the communication with the "older gentlemen," she feels strongly about the absence of a well-structured female mentorship in the field. As she said:

> *You know, I would like a mentor. Finding strong female mentors in the field is so hard because they are so few, and then they have very little time. But I think finding a strong female C-level mentor would be very valuable. I do not think I am going to find one anytime soon. I see that as a challenge because it is always best to get words of wisdom from someone who has been in this longer than me.*

Lisa's Career Meaning-Making

Career as Meaningful Work. Lisa's meaning making from working in the field comes connecting her deep love for learning to the field, and from building meaningful connections at work. Lisa spelled out her appreciation for constant learning afforded by the field. She "loves to read" and does not shy away from "trying new things." Out of a sheer interest in learning, Lisa had enrolled for an associate degree in security and network engineering while completing a master's degree in library and information sciences. At the time, people close to Lisa "thought she was nuts," for getting another degree. However, Lisa was sure of her decision and committed to trying something new. Being a learner, Lisa considered all that learning to be valuable. Cybersecurity is a great field for her because it is "ever-evolving." There is always something new on the horizon requiring you to be in a "constant learning mode." As Lisa noted:

The continuous learning opportunity in this field—you have to be willing to take that on. As I said, the problems in this industry are not going anywhere, anytime soon. They are more than happy to change, and they always do.

In addition to her desire for learning and working in the field, Lisa talked about her belief in building valuable human relationships at work (Brown, 2012; Gilligan, 1982). She lives into the value of connections by practicing it in real-time, Lisa said. In her role as a team leader of a group of male security engineers, Lisa is acutely aware of the demanding nature of work the field entails. She explained the constant complexity and dynamic nature of the field can create unhealthy stress levels. Thus, as a leader, Lisa functions from a place of care and believes in practicing "decency" and "respect." She makes it a point to ask her subordinates if they need to talk, take some time off, visit family, take care of personal issues or work from home. Thus, demonstrating the important of relationship building at work and the caring nature of her connection with others at the workplace (Blustein, 2019; Brown, 2012; Richardson, 2012). Lisa pointed out this approach to life became even more critical after the passing of her husband. She strongly believes "becoming a martyr for your work is over-rated" and tells her team-mates that "family comes first." She also assures her team-mates in saying that if they need to attend to critical family affairs, she will "back them up" for their absence from work. Lisa said:

But you know, it is just that nurturing thing of, how is your stress level, do you need to work from home, do you need anything? You know, it is that kind of mentality that do not be a jerk; we are all in this together. If you need to work from home, you are sick, that is okay, you should not be chastised for that. If you need time off, okay, we will take your clients.

Career as Gendered Experiences. Lisa's career narrative throughout the interview had a strong undertone of gender and gender-based realities that she had experienced and sees being practiced in the field. She shared critical junctures from her life as a young girl to a grown-up woman now working in a leadership position in a male dominated industry.

Lisa believes she was subject to sexism at the workplace. She deeply expressed her struggle in receiving funding from her organization for a security-based technical training. At first it was difficult to know if her request was rejected based on the availability of funds, as she was told, or gender discrimination. However, when Lisa learned that two junior male members, who had spent less time at the organization, received funding for the same technical training, she was convinced that it was discrimination after all. This appears to be an issue with gender bias as well as equity at the workplace. To get clarification on the situation, Lisa approached her superior:

> *One of the things I pointed to one of the other chiefs is that you know, "it is really odd that this other gentleman, got two junior guys on the team money for SANS training. But he never got it for me when I asked. There was no funding, even though I had been in the company much longer."*

The situation was such that it required her to speak up, but the endpoint was unknown. I asked her how she reached an agreement on this matter. Lisa described opening up the conversation as a discussion and then wrapping it within the blanket of "optics." Her resilient attitude paid off, and she received her due diligence: funding for training. But she admitted to it being "a difficult game to play." Interestingly, Lisa also pointed out the person-in-charge for approval of the training is "threatened" by her "qualifications" which made matters more complicated. This is

discriminatory behavior resulting from aversion towards a woman with higher qualifications (Glick & Fiske, 2001). She engaged in meaning making on the basis of this exchange with her environment and took the necessary steps to address and overcome the barrier (Lent & Fouad, 2011). She demonstrated vulnerability, courage, and resilience in this particular situation (Brown, 2012). She developed a resilience based coping strategy to negotiate and establish her own rule (Khilji & Pumroy, 2019). Lisa said:

> *I went to one of the chiefs, and I said, "Hey, from an optics perspective, it looks a little odd that all the men in the team have been sent to SANS training, and the one female has not. What kind of statement exactly are you trying to make with that?"*

Lisa shared a second personal experience that seems central to her understanding of structural gender inequalities. An early experience with gender-based mistreatment led Lisa to develop a strong standpoint of holding people accountable for improper behavior. Lisa drew parallels between her high school experience with the computer science teacher and the notorious incidents of men misbehaving with women in the field. During the interview, Lisa reflected on the high school incident and condemned the school administration's response to move her from the classroom instead of dealing with the teacher "aggressively." Due to the lack of proper action and thoughtful consideration, Lisa had to face the repercussions. Lisa said:

> *You know, looking back when you are young, and you are confused, you do not have much say in what is happening, "should they have moved him out of school? Absolutely, instead of pulling me out of the classroom." It is an unfortunate story, and it is unfortunate that the school was not aggressive!*

This incident had ramifications. It moved Lisa from computer science for a very long time. Instead of following that career path, she then decided to choose pre-med for her undergraduate studies. The learning experiences gained through this incident revised her self-efficacy and outcome expectation beliefs which took her on a different career path (Lent & Brown, 2013).

Lisa shared she sees something similar happening in the cybersecurity field as well and there is a need to change those cultural norms from perpetuating further. For instance, there is now a focus on designing conferences for women, where men are also able to participate. While Lisa recognizes the effort in creating such forums for women, she is convinced that it is not the best way forward. She indicated when the goal is to "integrate women," then both men and women should be a part of conferences. Excluding men means to "lose a significant amount of power in the think tank," she said. Lisa believes that the right response should be to bring those who hurt women to justice and hold them "accountable" for their actions. Because otherwise the diversity efforts are "isolating women" and further "allowing people to get away with bad behavior." She added "there are no easy answers to the problem," but we need to find another way to do this. This is another critical reflection that Lisa is making with respect to the field and the problem of gender diversity. She views this as problematic for her and other women in the field. Lisa said:

> But I am not a fan of that, "Hey, let us start our own thing [women centric conferences] because other people over here are not corrected on their behavior." Because, for one thing, it separates women and we want women to be integrated. Second, it allows people to get away with their bad behavior. So, that is my thought on this issue. There are no

easy answers to the problem. I am very sensitive, very sensitive to this drive of isolating

ourselves.

In this next section I present a brief conclusion of Lisa's narrative account based on the major findings in the study.

Conclusion

Lisa had an early exposure to computer science during her high school. She was very interested in computer science and liked spending time in the lab. So, she continued to learn the subject for three years in high school. However, an unfortunate incident with the computer science teacher set her on a path to pre-med instead. She went on to earn educational degrees in zoology and entomology and worked as a "bug hunter" in Mexico. After a while, Lisa decided to change course and come back to the U.S. to study even further. This time she enrolled for a graduate degree in library and information sciences. Slowly, her courses evolved into security related topics and that is when she gained an interest in cybersecurity. To gain further technical skills in this area, Lisa enrolled for an associate degree in a security related field at a local community college. As a result, Lisa was able to find an internship opportunity in forensics at a law enforcement office. After working there for a few years, Lisa got an opportunity to work as a security engineer and finally, gain an entry into the field. Within a year she was promoted to a security operations manager.

Along the way Lisa indicated that several factors helped her to continue working in cybersecurity such as an interest in computers, a curiosity and love for problem-solving, performances accomplishments, and engagement at the workplace. She also enjoys some of the associated rewards within the field such as financial benefit, valuable career skills, continual

learning opportunities, and working with smart people on innovative technology. In terms of inter-personal relationships, she mentioned the inspirational role of her grandparents in pursuing a career path in STEM all along. However, she expressed sadness in feeling alienated from her friends back in her hometown.

Lisa talked about some of the imminent challenges she sees in the field. For instance, her inability to find strong female mentorship and navigating a gendered work environment. She generously spoke about her own experiences with gender discrimination and shared her concerns with how women get treated in the field. She also shared the efforts she takes to actively network with others. Interestingly, she expressed her concerns with women only conferences and thinks that these efforts are possibly isolating women more than integrating them with men in the field. Based on this interview, it appears that Lisa makes meaning of her work experiences through engagement in meaningful work and building relationships with her coworkers and clients in her role performance as a manager. She also finds an alignment between her love for reading and the nature of the field.

In the next section, I present the narrative account of Mariah and related findings.

Narrative Account of Mariah

Mariah and I met online for the first time during this interview. She was seated comfortably across from her computer with a monitor display to her side. I was dressed in the same pale green kurta I had worn for all of my interviews, with a little bit of embroidery detail. She was dressed in a subtle colored shirt looking bright and ready for the day. Our meeting was scheduled for 9:30 a.m. in the morning. It was a working day and I was mindful of our time. Thankfully, there were no technological issues and we began the interview right on time. As in

all my interviews, I started with a little background information about myself and the project, and then moved on to the consent form and participant rights. I asked Mariah if she had any
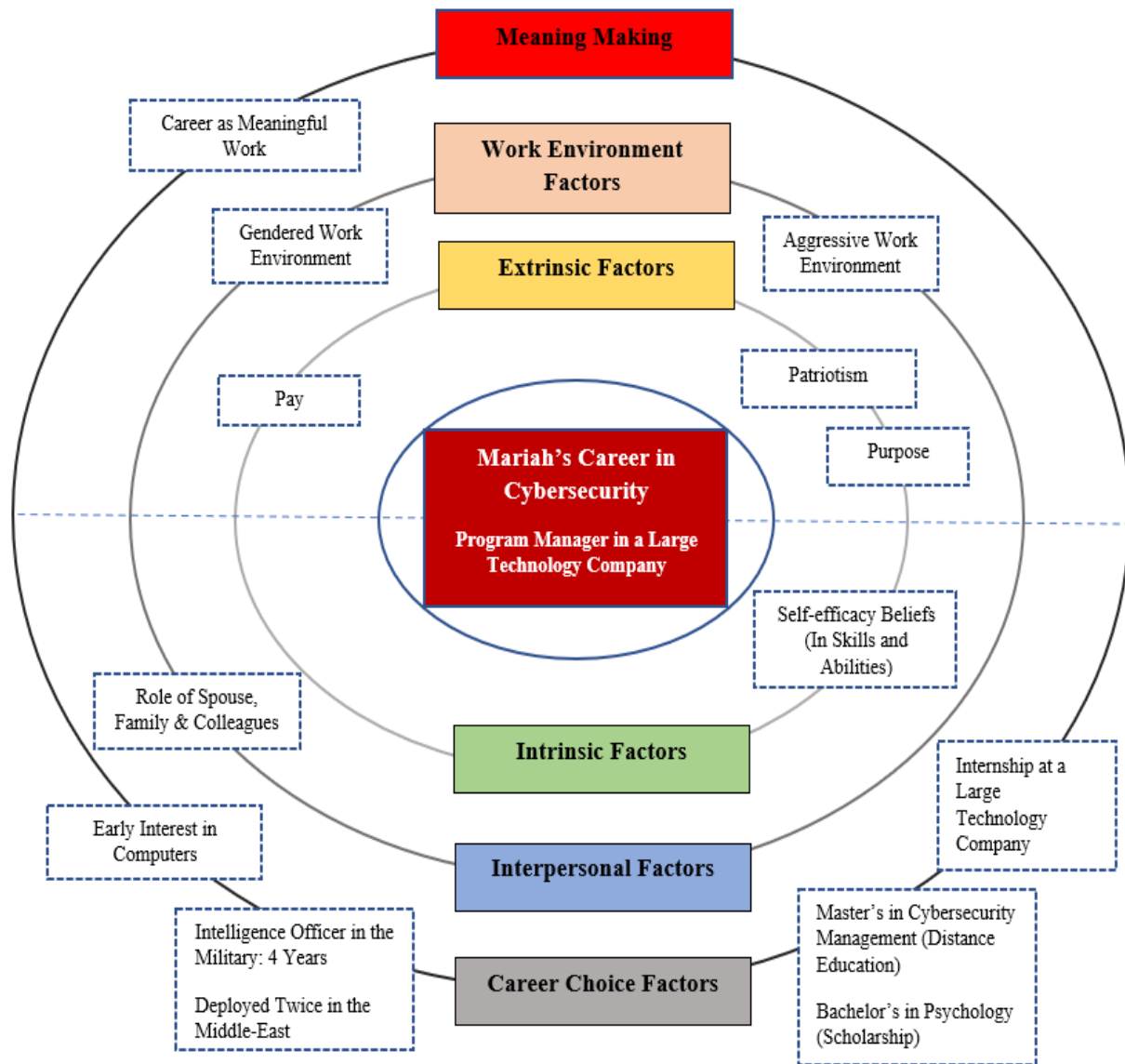
Figure 4.3

Visual Representation of Mariah's Cybersecurity Career

questions before we formally began shaping the interaction. She said we could proceed, and we dived right into the interview. During the time of this interview, Mariah was 29 years old and had recently had a baby. For a visual representation of Mariah's career in cybersecurity refer to Figure 4.3.

Mariah's Career Choice of Cybersecurity

Mariah traced her career choice of cybersecurity back to her bachelor's degree in psychology and work experience in the military. She explained how everything felt like a "logical next step" rather than a significant transition at any point in her career development. Mariah indicated during her childhood, she found herself surrounded by computers. She also had an interest in them; however, when it came time to go to college, she decided to do something else. I was curious to know why she did not pursue that which she was so interested in. Mariah replied her mother worked as an IT manager and had a strong influence on her undergraduate education decision. This appears to be a distal contextual influence on her career path (Lent & Brown, 2013). She suggested Mariah should pursue a degree in anthropology rather than computer science. However, anthropology was not available at her university and as a result Mariah picked psychology instead. Mariah said:

> *When I told my mom, I wanted to major in computers in my undergrad, she said I would be bored (smiles). So, she said I should do anthropology. I did not have anthropology available at my school, so I did psychology. I enjoyed psychology very much and really liked it.*

Mariah pointed out her undergraduate degree was supported by a scholarship program to go straight into the military after graduation. Therefore, after completing her undergraduate studies in psychology, Mariah took up a career in the military. While in the military, Mariah worked as an "intelligence officer" with different types of intelligence capabilities, including "human intelligence, signals intelligence, and counterintelligence." She was the most fascinated by signals intelligence, Mariah told me. It is through this experience that she learned how "computers work." Mariah indicated "learning a lot" during her time in the military. She also deployed at a foreign location twice, where she worked on more intel operations, this time "strategic and tactical" intel as well:

> *I deployed for nine months in XYZ city doing that, and over the 4-year course of my military, I did that twice. I was able to do strategic intel and tactical intel. Umm, so, looking at it from multiple perspectives.*

Before her second deployment, Mariah decided to pursue a master's degree in a related field. She looked up courses for a distance learning program and had a choice to choose between strategic intelligence versus cybersecurity management. Mariah chose the latter because it "sounded better," she said:

> *Before my second deployment, I decided to get my master's degree, and so I was looking at the program for strategic intelligence. I knew that I wanted to stay in that kind of general field. As I was looking through the programs, the cybersecurity one looked the most interesting, and so that is just how I got into cybersecurity. I was about to click*

strategic intelligence but thought Nah cybersecurity sounds better. I did most of it [the

degree work] when I was in the army.

Mariah finished most of the distance learning program in cybersecurity management while

serving in the army. She also worked as an intern at a large technology company in the U.S.

After completing the internship and gaining some experience working in the security domain as a

project manager, Mariah accepted an offer from another large technology company. After

working for 2.5 years, Mariah indicated that she got promoted as a manager of all other security

managers in the firm. Mariah said:

> *Before I got out, during one of my semesters, I was able to get an internship with a large*
>
> *U.S. based tech company and worked for their security as a project manager and got*
>
> *pretty good experience there. When I got out of the military, I wanted to decompress a*
>
> *little bit. My current organization then hired me. I started here at the end of my program,*
>
> *necessarily the same thing—Information Security Manager.*

Mariah's Key Career Influential Event

2013: The Year of Security Breaches. As we talked about Mariah's career and life

experiences, she began to tell a story that left me quite amused. I know from personal experience

that job employments can react to market conditions. So, when Mariah shared her story of

external events leading up to monumental change in her career aspirations, I was completely

hooked. Mariah reflected on the time when she enrolled for a master's degree in cybersecurity

management. She was not even sure if she would get a job, Mariah told me. She decided to

enroll in the program because it had piqued her interest. She was not yet sure of an available job

opportunity upon graduation. Mariah asked herself, "are there even jobs out there?" Incidentally, it was the year of security breaches, she said. Companies like "Target" were affected, and quickly "events unfolded, and conversations around security emerged." Suddenly there was a significant demand for security jobs resulting in lots of job opportunities. As a result, "the environment enabled" her to "want to continue forward" (Lent & Brown, 2013). Mariah said:

> *I started the master's program around 2014: I decided on it at the end of 2013. That is the year when Target and Lowe's and others [were affected], it was the year of breaches, right? So, I selected the program, and I was going to my first semester thinking to myself, "Is this the right thing?" Then all of that happened, and then following that was a ton of opportunities.*

Mariah's Key Career Influential Factors

Intrinsic Factors

Interest and Congruence in Career Choices. Mariah shared she "always had an interest in computers." However, her path to cybersecurity was paved through military intel and a psychology major. Mariah explained the strong alignment of educational and career choices leading up to her current work: first, an undergraduate degree in psychology; second, a career in military intelligence; third, a master's degree in a related field; fourth, an internship in security domain in the industry; and finally, a full-time job in "civilian intelligence" in the industry. All these learning experiences were meaningful and everything "stair-stepped" well for Mariah.

Each degree and work experience a "logical step" to the next. I asked her if at any point it felt like a transition in her career. Mariah responded:

> *Uhh... as much as a transition, I would expect every phase in life to be. So, I never felt like I was changing careers. It kind of felt like it was the next logical step for me… I mean, I really enjoyed intel. I wanted to stay in that kind of realm. So, it kind of stayed, it stair-stepped really well for me—military field intelligence and then my civilian intelligence.*

Successive goal setting in terms of career choice goals and performance goals helped her to finally secure a career in cybersecurity (Lent & Brown, 2013).

Self-efficacy Beliefs. Mariah explained she gained career relevant skills through educational and work experiences, both in terms of people management and computer platforms. During her time in the military, Mariah discovered her ability to "quickly learn platforms," both software and hardware, she told me. She also performed well on assessments— "passing tests quickly." Although Mariah does not consider herself to be a subject matter expert, she is good at "driving change," concerning operational inefficiencies, she said. Based on what Mariah shared, it appears that she has a good grasp on her capabilities and interests that eventually, helped her to form self-efficacy beliefs (Lent & Brown, 2013). As she said:

> *I would say that my core skill set is people management and understanding platforms. I can understand software platforms and hardware platforms really quickly, which is what I started doing in intel. I was able to pass my tests pretty quickly and certify different things…. I will not consider myself a subject matter expert of anything. I am good at*

driving change where I can see problems and inefficiencies and drive progress to change those things. Umm… and then in Intel, I learned to communicate risk to stakeholders effectively.

Extrinsic Factors

Pay, Purpose, and Patriotism. Mariah is motivated in her current career pursuit by extrinsic factors such as a good "pay," "feeling like having a purpose," and "patriotic reasons." She briefly touched upon money but did not elaborate on it. However, Mariah spent a considerable amount of time talking about purpose and patriotism and how they relate to her career. I thought that her explanation of patriotism in this regard was also evocative of social responsibility: to keep products "safe and secure" for use by customers in their supply chain. Mariah emphasized that customers buy their technological products because they have a "need" and any harm "could set them back in their development." She added, "security is the defense of any company." Mariah said:

> *Yeah, definitely pay! Umm… I think feeling like I have a purpose [is motivating]!... Otherwise, you know, for patriotic reasons. If something goes wrong and our supply chain gets breached then all of the people who work in the supply chain in external companies who are using our product, it could set them back in their development. You do not just buy a product; you buy a product because you have a need and the need needs to be filled.*

Additionally, Mariah shared when she does her job well, it creates a ripple effect on other employees being safe in the organization's cyberspace. This also motivates her to continue to

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work in this space. An ability to enact her values of patriotism and finding purpose in her work help promote further maintenance of her career choice (Lent & Brown, 2013).

Interpersonal Factors

Role of Spouse, Family, and Colleagues. Mariah explained the influential role played by a host of people including, her spouse, parents, extended family, and colleagues. For instance, her husband has a background in Information Technology (IT), and that has helped her move forward. That said, Mariah also pointed out she never received any specific guidance from anybody about specific career-related directions to take or certificates to earn. As she said:

> *Umm... my husband also has a background in IT, and he does not do it anymore. However, he has some background in it. I am not like alone in my endeavor at home. It is not like I am a doctor, and he is entirely different. That helped promote me in the right direction.*

Mariah shared the role of her family in career decision making; both in determining an undergraduate major and now in her everyday managerial work. As mentioned earlier, Mariah talked about her interest in computers growing up. She saw her mother work as an IT manager and, as a result, was surrounded by computers at home. However, when it was time to decide on a college major, her mother suggested anthropology as she thought Mariah would find computers "boring." So, Mariah changed her mind. Unable to find an anthropology major at the university, she went ahead to get a degree in psychology, and loved studying the functionality of human brain. Mariah said:

But when I told my mom I wanted to major in computers in my undergrad, she said I would be bored smiles. So, she said I should do anthropology, and I did not have anthropology available at my school. So, I did psychology. I enjoyed psychology very much. I really really liked it.

In her managerial position, Mariah finds support from her family too. They support her, knowing that she works hard, Mariah said. Now and then, Mariah talks to her father seeking management advice—mostly on "managing personality conflicts" at work. Mariah said:

I mean, my family supports my career decisions, primarily like, I mean, I work hard, so my extended family kind of supports my work. I talk to my dad; he is in management. He works a blue collared side, he is a pipefitter, but he is a general foreman. So, he and I talk about management stuff and kind of personality conflicts: what you do in specific scenarios. So, I mean, I get support from my entire community, which is really great!

Aside from her immediate family, Mariah also finds help through a networking event that her company organizes for women in leadership roles. They facilitate an event for female leaders, employed in different roles, to get together as a cohort four times a year. Additionally, they also meet once every month. There are opportunities for women to meet for coffee and discuss things in person or use the group chat seeking advice, Mariah told me. Through this effort, Mariah has been able to make good friends with one other female colleague. As she said:

I am friends, like close friends, with one of the women now. So, we try to get together a couple of times every quarter for dinner with our husbands' because everyone gets along really well.

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Contextual affordances resulting in social support influence career choice actions and create the necessary learning experiences which further influence self-efficacy and outcome expectations (Lent & Brown, 2013). Mariah's positive experience with support from others seems to have created facilitating conditions to stay in the field.

Work Environment Factors

Aggressive Work Environment. Mariah described the impact of bad management practices on employees' "productivity" and their "sense of confidence." She has observed that in the security realm, there are "a lot of smart people in the room," and they are all "very intelligent." But what happens, as a result, is that instead of people "building each other up," they tend to cause hurt—all in the pursuit of proving their intelligence, she implied. It then creates a scenario where each person is waiting to "say their piece" and "no one is listening." Mariah pointed out that this is not only an unproductive conversation but one that can "tear you down." She then suggested that such a work environment where there is a lack of respect for individuals cannot expect people to function at their best even when there are provisions for career growth in place. As a result, it leads to security engineers leaving the workplace, which is problematic since there are so few to begin with. As Mariah said:

> *That is so draining for anyone. You do not want to go to work and let your self-confidence be torn down every day. No one is going to stick around in any field that does that, like that is a lot! So, I think that as much as you want people to work harder in the company and move around and move up, if the atmosphere and the environment are*

unforgivable, so that is like, "you mess up," "you are stupid." No, you are not gonna

keep talent that way!

Mariah indicated she practices yoga and mindfulness, in general. It was interesting to me because it seemed reflective of her own management practices as a program manager. Mariah shared she has learned from living with her husband that because she tends to "overthink everything" does not mean that he thought about it too. She has adopted that attitude with her "male colleagues" as well. If she is being too pointed in her conversations with someone, she reminds herself that may be she was being too aggressive. Mariah said:

I try to be mindful. I try to practice mindfulness and be very mindful of thoughts: what is

going on, what am I thinking, what does my external environment look like, am I

overthinking this, or do not say anything.

Mariah also pointed out the conundrum in her "female brain" directing her to be mindful if she is too aggressive, yet the need to be assertive to be an "effective leader." That as a manager she can ask people to work on something without having to apologize. She shared:

The other day through an instant messaging program I said, "Hey, I need you to do

this." He responded, "Well, I do not really like doing someone else's work." I did not

say, "Oh, I'm really sorry, I know that you work hard, I need it to get done." Instead I

just said, "Thank you!" Well, I do not need to offer an explanation. I just need you to do

your job, point blank.

Mariah discussed the need to claim your achievement at work; a sign of resilience at the workplace (Brown, 2012; Khilji & Pumroy, 2019). She clearly explained the importance of being

"upfront" about making an ask for what you deserve. Mariah talked about a personal experience from her first year in working at her current organization. After the completion of their year one assessments, Mariah was told she performed well compared to others. However, she did not receive any kind of raise for her performance. At the time, her organization did not have a policy to give raises of any kind to one-year-old employees. Mariah did not buy into the policy and made a resolve to ask her superiors for a raise. After all she had proven her merit. Mariah defies rules to establish her own and practices resilience in the workplace (Khilji & Pumroy, 2019). Mariah spoke to her manager:

> I went to my manager and said, "well you are telling me that I am the best on the team so why wouldn't I get a raise," and he said, "well, that is just not how it works." I said, "does that matter because if you are putting me in the top, then you are telling me that I am worth it. So, make it worth it!"

Mariah suggested that not every woman would be brave enough to make that move, and that is where she thinks the "barrier comes into play." Based on what Mariah shared, it appears that speaking up for what you deserve is essential to sustaining in such work environments.

Gendered Work Environment. Mariah painfully yet openly discussed the difficulties concerning gender that she has either experienced herself or has observed in the field. She began by talking about the interpersonal skills needed to work effectively in a male-dominated work environment. For instance, Mariah is always mindful of her actions, such as "not over apologizing," being sure to "negotiate for salary," and speaking up whenever necessary. She used the word "boisterous" to describe herself for these circumstances. She insisted "you kind of

have to be." Mariah shared she has learned how to maneuver the work environment through her cumulative experiences in gendered organizations (Buse et al., 2013). She believes that following such a practice has helped her get a better pay and timely promotions. However, she worries about early career women in this field. Mariah said:

> *Personally, I have worked with men my entire life. I mean my entire professional career, I have worked in male-dominated industries, and so, I try to be cognizant of things like over apologizing, like negotiating for salary. Things like that, I try to be very cognizant about and not do it. So, I think that I get paid better than my peers, and I know I have been promoted quickly. So, I am not worried about myself, because I am kind of boisterous, because you kind of have to be boisterous to stand out and say.*

Mariah talked about being excluded from networking opportunities. She described how gender prohibits her from socializing outside the workplace. She shared unless "one is a male or behaves like one," there is a rare chance that they would be included in a social event. It could be because men are unsure of the nature of the relationship to establish with female co-workers outside of work, she suggested. Additionally, Mariah also shared men have openly told her that they do not "dislike women," "just do not like working with them." This is a hostile form of sexism characterized by an aversion towards women (Glick & Fiske, 2001; Smith & Gayles, 2018). At this point I was both confused and angry. Perhaps it should not have come as a surprise, but it did. I raised my eyebrows and looked at her in surprise. She said such behaviors and mindsets are clearly problematic, even more so for critical work-related factors such as promotion. She worried that a lack of development of a healthy and unbiased social connection

with female employees might interfere with how men make promotion decisions for women subordinates. Here she is critically reflecting on men bonding with other men leading to favorable outcomes such as promotions; thus, hindering women in promotion at the workplace. As Mariah noted:

> *So, the barrier is that if you promote people if you have a good feeling about them and are unable to develop that social feeling with certain other people uhh… with women, then I see it as a hindrance to promotion.*

As we talked, more stories of gender discrimination popped up in the discussion and this time with respect to hiring. Mariah shared she plays an active role in recruiting women, especially at security conferences. So, it strikes her as a definitive problem when she sees clear discrimination in the hiring process. While there are on-going talks and efforts to give more opportunities to women and hire them as it seems fit, gender discrimination affects the outcome of that effort, Mariah told me. She shared when men do the hiring, they tend to hire those that are like them. Thus, disadvantaging women in the process. Mariah also indicated perhaps recruiters are not looking at the right places to hire women, because women with the necessary qualifications exist to work in the field. Mariah said:

> *I hear all these comments from other managers, "well, there are just no women engineers." That is not just true! Because, if you look at the graduation rates at colleges, there are women, you are just not finding them. You are not reaching out to the right places or you do not know how to look at them as a candidate!*

Mariah also talked about discrimination in hiring for technical versus managerial roles. And she sees this as "one of the biggest challenges." Mariah shared men hire women for program or project manager roles, which is stereotypical of roles that women have traditionally taken on that includes organizing and managing. Thus, overlooking the woman "as a candidate." This also appears to be a systematic problem rooted in gender where experienced men in the field choose how women should exist in the field and occupy what types of role. There is also discrimination as men view women as less competent for technical roles. Mariah said:

> *One of the biggest challenges I see is how you hire people! And humans hire people that are like them. So, when men hire or are doing all the hiring, they hire men, and then what I have seen is that they hire women in PM [program or project manager] roles because it makes sense for them. They want to do technical work.*

Mariah critically reflected on the challenges of bias that are enmeshed in these work environments. Issues with discrimination in hiring and discrimination in promotion need careful consideration when our goal is to integrate women and help them persist in the field.

Mariah's Career Meaning-Making

Career as Meaningful Work. Mariah fondly remembered the time when she and others came together to address this particular incident— "a famous virus" that had severely impacted their organization. She described that everybody came together to address the issue and worked as a team—not worrying about job titles and descriptions. She pointed out she is "lucky" to be working with "some great people" who "just come together" in times of need. Together they were able to mitigate things that "could have hit their organization much worse than it did." It

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was during this critical juncture that she realized the value and importance of her work. Mariah said:

> *It was kind of like masterminding enough, and everyone was getting things done as quickly as possible, be as helpful as possible. Even if it is not in their job description, it is "hey, everyone needs to help right now, and that is totally fine!"*

Mariah felt "empowered" during that experience as well in knowing that what she does really matters. She shared it is difficult working in a security position to know how much risk they have averted or how that translates to "value" in terms of money. Unfortunately, the value becomes apparent only in the event of a breach, she said:

> *So that was kind of really empowering for me because I got to see results. Normally, when you are on the prevention side of it, you do not know what you have prevented... So, you know in moments like that it is really empowering because what I do really matters.*

Mariah explained her keen interest in solving some pertinent issues at work and discussed the initiatives she has started towards finding problem resolutions. This act of creating meaningful projects appears to be a way to make her work more meaningful (Frankl, 1963). For instance, Mariah has started "an initiative of risk measurement" to effectively communicate risk to customers in the event of a security breach. Her goal is to communicate risk in a manner that makes sense to business owners and to those on the operation side of things, Mariah said. Thus, to communicate with business customers in terms of monetary losses in the event of a security breach rather than talk in terms of technical jargons. Mariah said:

As of recently, I have started an initiative of risk measurement, so risk quantification. So, we kind of sit there and brainstorm, it is kind of evolving, ever-evolving in how we communicate risk in a way that is efficient to us people who are discovering risks and to the business owners, who only care about money.

Secondly, she is working with her team on using tools that can predict vulnerabilities and risks well before they hit a security breach. This ties into the issue of how the organization is "investing resources," and not overworking them, Mariah said. Thus, creating the necessary automation where possible and lifting that additional workload from people. This solution, she said, would enable security engineers to find time for their professional growth in terms of conference visits and studying for certificates. Thus, Mariah's projects are geared towards her clients and her subordinates so that they are benefitted in meaningful ways. Mariah had mentioned that "risk" is a topic that is very close to her heart. Starting her own initiatives on a worthwhile topic exemplifies occupational commitment, a high sense of self-efficacy and a disposition to work on challenges (Buse et al., 2013; Fouad et al., 2016; Wynn & Correll, 2017). Mariah said:

There is not a vast number of people with experience in cybersecurity. So, when we are doing anything we are sitting here as managers saying how we think about this person as an individual. They are not just machines, even though we want them to do assessments. But "Hey, look, we need to give them a break! They cannot be doing this every day without having to develop themselves."

Mariah explained she also offers guidance to women exploring career options within the field of cybersecurity, mostly during recruitment events at women-focused security conferences. I did not know of this prior to the interview, and was therefore curious to learn more. Mariah shared she talked to women explicitly about the environmental supports as well as the nature of cybersecurity work itself. In terms of supports, Mariah indicated talking about the availability of "maternity leave, wonderful family time," ability to focus both on work and family, and perks like "paid voluntary back time." She also helped them think about their current work roles and technical skills, to see how they might switch to cybersecurity. For instance, if they were working as a program or project manager in a different field, she would guide them with the necessary material to read up on security. Mariah said:

> *I did speak to a lot of young women at the cybersecurity conference about them thinking how they do not know how to get into the field or especially tell them, "Hey, you have a technical capacity, you are also a great planner, trainer, organizer...to me you sound like a project manager or a program manager!"*

Thus, Mariah would encourage women to expand their technical capabilities and leverage their current work experiences to switch over to cybersecurity. At the same time, she would also caution them to be willing to work at a computer all day and to not be afraid to explore computer processes.

In this next section I present a brief conclusion of Mariah's narrative account based on the major findings in the study.

Conclusion

In her early years, Mariah was very interested in computers. Thanks to her mother's employment in the IT field, Mariah found herself being surrounded by computers. However, in terms of college education Mariah decided to get a bachelor's degree in a different field based on her mother's suggestions. Supported by a scholarship, Mariah went to college to get a degree in psychology to go into the military straight after. She served the country for four years. During her time in the military she gained her training and work experiences as an intelligence officer. She was deployed twice in the middle-east as well. It is during her second deployment, that Mariah enrolled in a distance learning program for a master's degree in cybersecurity management. She completed the program during her time in the military to then begin an internship in a relevant domain in the industry. After her internship experience, Mariah found a full-time job employment as a cybersecurity program manager in a large technology company.

Mariah discussed several factors that have influenced her career path. Her personal makeup in terms of abilities, interest, and alignment of educational and career choices all helped her take the next steps in her career development. She also demonstrated high self-efficacy beliefs. Mariah indicated she finds motivation to work in the field from a combination of factors such as pay, purpose, and patriotism. Mariah also shared she finds support from her spouse who has experience working in the IT industry, from her father in discussing management related issues, and also through programs that her organization offers for women in leadership positions. She indicated being very good friends with one woman she met through the program.

Mariah also shed a light on several issues that she sees in the field, for instance with gender discrimination in hiring, bad management practices, and so on. She acknowledged that she has worked in male dominated occupations and therefore, has a fair understanding of how to navigate the field. Based on this interview, it appears that Mariah makes meaning of her work experiences in relation to meaningful work. For instance, she has started her own initiatives with risk quantification for finding better ways to communicate risk to stakeholders and improved resource utilization by automating processes so security engineers can find time for themselves. As a manager, Mariah thinks of her coworkers as people who also need dedicated time to develop themselves and their skills. Interestingly, this also seems like a caring practice being extended to coworkers by finding a solution through automation to offload work demands. Mariah briefly indicated practicing mindfulness with her colleagues as well.

In the next section, I present the narrative account of Angie and related findings.

Narrative Account of Angie

Angie and I first met in person at a large international cybersecurity conference held in the U.S. It was her first semester in the U.S. as a post-doctoral scholar. At the time, I did an informal interview with her about the topic of women in cybersecurity and her specific experiences. We shared a meal together, offered by the conference, and bonded over a cup of herbal tea. A few months later, when I contacted her for a formal interview for the dissertation study, Angie agreed to be a participant. This time we met online via a video conferencing tool. Although I had some idea about her journey into the field, I chose to follow the same interview protocol that I used for all other participants and hear her story in-depth. The interview was

scheduled to be in the evening. Both of us were at home; I was in my home office in Athens, and Angie was seated on her bed at her university location. She was dressed up in a striped t-shirt and her hair roughly tied in a bun. Unfortunately, we had a few technical difficulties going into the interview, but after some trial and error we managed fine. I walked Angie through the consent form, and we got right into the interview. In the following sections, I discuss Angie's experiences and my personal reflections based on her account. For a visual representation of Angie's career in cybersecurity refer to Figure 4.4.

Angie's Career Choice

Angie described her career choice of cybersecurity as a series of steps related to educational degrees and job choices. She explained her choice of bachelor's degree in informatics as driven by a combination of personal performance accomplishments in high school and vicarious learning from career-relevant models available in her social-cultural environment (Lent & Brown, 2013):

> *So, I had really good grades in high school. Because at that moment, students with the best grades (smiles) went to study informatics and become an engineer. So, I did the same, and I followed the trend.*

Later, while at the university, Angie found herself performing "a little bit better" in specific security-related courses such as "Cryptography 1 & 2" and thus, planned to further pursue higher studies in the field.

Angie shared she received a scholarship for a master's degree in security, which gave her the needed financial support to construct her career trajectory. "I did well there," Angie said.
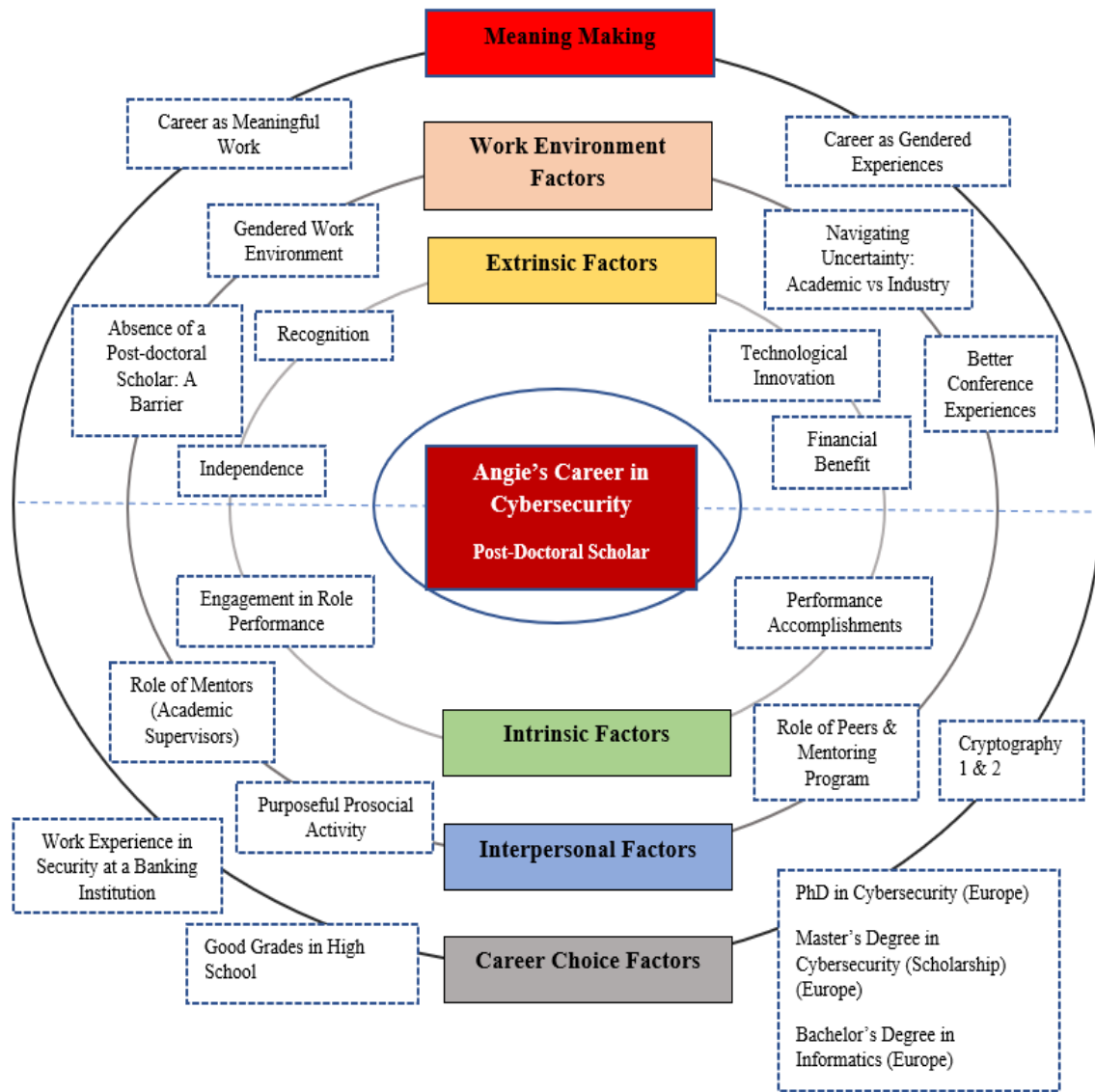
Figure 4.4

Visual Representation of Angie's Cybersecurity Career

After completion of her graduate studies, Angie was keen to explore her options in the industry

and see "what type of offers" are available for someone with her qualifications. Angie also

wanted to "see" how she would perform in an industry setting. After "applying for different positions" Angie received an offer to work in the security division of a banking institution. As she said:

> *So, I applied for different positions and got accepted for a position at UIO Bank (in Europe) in their security team. At the time, I started working more on the practical side [of cybersecurity], because we were doing penetration testing, more hands-on incident response, malware testing, etc. Uhh... so I liked it there [at the Bank] a bit, but I wanted to try something that I was not familiar with, something that I had not learned (yet), something that I had to study.*

The curiosity to learn propelled a desire in her to pursue further studies. Thus, Angie set a new personal goal for herself (Lent & Brown, 2013) and moved to another European city to pursue her doctoral degree. She discussed her personal experiences during the doctoral program more in detail later in the interview. After completion of her security focused doctoral degree, Angie accepted an offer to further proceed with her training as a post-doctoral scholar at a university in the U.S. Angie pointed out she was "very lucky because," she "had two very good advisors." She explained that one of her mentors was "a woman and she was the leader of the team." Angie said:

> *We had a very good collaboration, and she suggested that I do [post-doctoral research work] obviously here at my current university. And that is how I met my current supervisor! He was actually happy with me, in the sense that, I did well when I came here*

to visit [during my doctoral studies]. So, he offered me a post-doctoral position and that

is how I am currently here.

Based on Angie's experiences during doctoral studies, it appears that environmental supports, such as mentorship, directly influenced her career choice goals and actions (Lent & Brown, 2013). The process of making a career choice in cybersecurity thus, involved choosing a goal to become a scientist in cybersecurity, taking the necessary actions towards goals such as completing courses related to security, and the subsequent consequences of actions such as successful graduation in undergraduate degree, master's degree, as well as brief work experience (Swanson & Fouad, 2015).

Angie's Key Career Influential Factors

Intrinsic Factors

Performance Accomplishments. Angie explained successfully completing her doctoral dissertation as an accomplishment. "It is my best work so far," Angie said. She described her doctoral journey and experience as one of immense learning and growth. Angie said:

The dissertation writing is a growing process, it is a learning process and it is a process

that gives you a lot of stress and a lot of self-doubt.

At the time of this interview, I had begun working on my dissertation project and found myself paying close attention. In a way, her words inspired me. Angie pointed out a doctoral degree comes with its unique set of challenges including mental anguish and huge investments of time.

However, persevering through it all gives her the confidence that she "can do anything." This experience influenced her self-efficacy beliefs in the field (Lent & Brown, 2013). As Angie said:

> *It (Ph.D.) did not inspire me, but it really made me understand that if I can get a Ph.D., then I can do anything. Because it is a very hard process. I still think to this day that, it is the hardest mental challenge for us as a person, because of duration and difficulty. And if you can do this, then you can do anything.*

Angie also exuberated self-confidence that appears to have come as a result of her performance accomplishment through the doctoral degree. She shared "there is not a skill that you cannot learn" and if you have completed a doctoral dissertation, "then you should not be afraid of anything else." According to SCCT, past performances as well as persistence in pursuing of goals influence self-efficacy beliefs and outcomes of future behavior (Swanson & Fouad, 2015). Angie's confidence in growing strong through the dissertation process instilled a belief in me. In interviewing Angie, I realized that I was learning in more ways than I had anticipated, both as a researcher studying the context of women in cybersecurity and as a doctoral student.

Engagement in Role Performance. Angie indicated she has complete autonomy over her work, in her current position as a post-doctoral researcher. Angie said:

> *There is nobody telling me you have to do this, this, and this…*

Angie makes her own decisions about what needs to get done on a particular day. She "tries to get up early, because the more you stretch it, the more goes later into the day." Angie then goes into her office to plan and "set her tasks" for the day. To keep a tab, Angie indicated she keeps a

running list of on-going tasks. This also helps her to know that she has "done something during the day and not wasted the whole day doing nothing." Sometimes certain tasks get more challenging, need "extensive research" and a lot of effort. As she said:

> There are times when X is due, and X has other little Xs, let us say. Then one of this little Xs cause a problem. Then I try to research extensively online about the little X. Sometimes, it works and sometimes it does not. Because, you know, it takes a lot of time to try different approaches.

Her statement resonated with me as a scholar because research whether in computer science or social science can move much slower. Angie suggested she persists and continues to work on her own to resolve the task. However, if she gets "stuck for a couple of days," then she reaches out to her peers. If her peers are also unable to help, then Angie reaches out to her supervisor for guidance. Angie insisted that that happens only after a week of trying and not making progress. She said:

> Sometimes, I feel like I am stuck for a couple of days. Then I ask someone from the team and more or less, they will help me, you know, look at it from a different way and I get a better insight. If this does not work, then I go to my supervisor. But I go to my supervisor only if I am stuck on a problem for one week!

Thus, Angie engages in establishing personal goals such as producing a conference presentation or a scientific paper and takes the desired effort to accomplish those goals. She begins by setting tasks for every day and proceeds from there. It is possible that strong self-efficacy and outcome expectations lead Angie to nurture performance goals and take the

necessary effort. In a reciprocal manner, successful pursuit of goals via necessary efforts may then influence self-efficacy and outcome expectations in a positive manner as well.

Extrinsic Factors

Associated Rewards: Recognition, Technological Innovation, Financial Benefit, and Independence. Angie explained she is motivated by a range of other career related outcomes: recognition that comes with being a scientist, working with top notch technology, receiving a financial benefit, as well as leading an independent life. She weighed in on some of these factors more than others. For instance, Angie indicated she is mostly motivated by the "recognition" that women get working as scientists, "especially, because there are so few women in this field in the U.S." I was a bit surprised by what she said next. Interestingly, for her recognition as a scientist weighs in more for a woman than for a man. I was interested to know why, and Angie shared it is because women have to fulfil other societal pressures or "extra things" as well. Angie described:

> *In the U.S. women can get recognition very easily if they are good [at their work]. Especially, because there are so few women in the field here. So, if they do good work, chances are they will be recognized very early. And this is a good thing, because I think when a woman becomes a scientist, she is recognized, and it carries more weight than when a man is recognized. Because woman have to have these extra things that they need to bring to the table. They have to take care of their homes; they have other social pressures that they need to take care of. This is something that a man does not have to worry about. So, this motivates me to be recognized.*

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Angie also hinted at some of the other rewards she appreciates such as "working on something interesting" like "cutting-edge stuff in security." Also, the financial benefit and independence that comes with the job. This way Angie does not have to rely on her parents and can "do well" for herself. She said:

> *Also, now in XYZ city, if you are in computer science, there is also a big financial benefit in that. So, this also motivates me, not as much as the other two. But it motivates me because I do not want to live off my parents. I want to be independent and do well for myself.*

Career related rewards and values such as recognition, independence, money, and participating in technological innovations are contained within the socio-cognitive variable of outcome expectations in SCCT (Lent & Brown, 2013). It appears that Angie considers these values as important and they are being fulfilled by pursuing a career in cybersecurity.

Interpersonal Factors

Role of Mentors. Angie and I talked about people who made a significant contribution to her career. She explained the substantial role played by her doctoral degree advisor. Angie told me she considers herself "lucky" to have worked with "very good supervisors" meaning her doctoral and post-doctoral supervisors. The lead researcher of her doctoral lab, her supervisor, was a female and she provided her with the needed guidance in technical areas that she could pursue. Granted, Angie had to do "a lot of work" and improve her technical skills, but "it was not something" that she could not do. Mentoring experiences have been considered to make important contributions in career development (Allen et al., 2006; Kram, 1985; Noe, 1988;

Scandura, 1992). Research also suggests that through mentoring experiences junior women view senior women in the field as role models (Kelan, 2012). Angie said:

> *Mostly, I was lucky enough to have very good supervisors in all the steps of my academic journey or let us say career, because I am in my early stage. They pointed me in the right direction, which was also applicable for me because it was not something I could not do. It was something I could do with a lot of work. And as I saw that I was getting a bit better at it, I kept going. But it is more or less, you know, in a thesis setting, the supervisor encouraged me to, you know, to progress.*

With the encouragement from her advisor, Angie "kept going" and was able to work on "pretty practical stuff with relation to cloud security." She considered herself "pretty low level" at the beginning but with the "help" of her supervisor she was able to move along and configure high level systems. Angie said:

> *I was not at the level of hypervisor [, yet] and it was quite technical in that I had to write a lot of complex technical code. This can be a little discouraging at times because these systems are hard to configure and also hard to find your own pace. So, I was lucky enough to find a supervisor who helped me a lot in this.*

As mentioned earlier in her career choice narrative, Angie also discussed the networking efforts of her advisor during research training. Initially, during doctoral studies Angie got an opportunity to visit the U.S. and work at a security focused lab. Later, she was able to secure a position as a post-doctoral scholar in the same lab. Angie mentioned she also performed well during her first visit and that helped to create a good impression on her current supervisor.

Role of Peers and Mentoring Program. Angie described the importance of peer interaction; especially, that of her fellow post-doctoral scholars at work. I could relate to her as social network with peers can be very helpful in several ways including exchanging or solidifying ideas. Angie "connects" well with her peers as they also have "other technical experience" in areas related to security. "This is our little group that helps me grow technically," she said. Earlier, Angie pointed out she approaches her peers on occasions when she finds herself "stuck on a problem" for days.

Additionally, Angie directed my attention to a mentoring program at her current workplace. She described that the program is designed to help in areas such as professional development, combating conflicts at work and receiving general advice. The mentoring program also allows an individual to select a female mentor from a different department. Thus, leaving no room for "conflict of interest." Angie shared the program is helpful for someone like her who is not from this country and therefore, has additional "challenges" to meet. Angie said:

> *Also, there is a mentoring program in the lab that I signed up for. I do not know how this*
> *will work, yet. But there is a mentor who can help you to navigate things in your career.*
> *So, I want to try that and see. I see that as a good initiative and yes, a good place to start,*
> *especially for people who are not from here and have all these extra challenges.*

Purposeful Prosocial Activity. Angie discussed her need to have a "social connection." Angie shared she tries to "maintain a balanced lifestyle" and "keep a social life." As someone who is new to the place, and away from her family Angie seeks "support" from others. Being an immigrant myself, I could completely empathize with her in this regard. At one point, Angie

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chuckled and suggested there is a stereotype about computer scientists being "socially awkward," which she recognizes to be "true" and yet, tries to actively break it. It has been her experience that spending time with others puts her in a better "mood" to approach her work. Angie even went further to say that had she been living and pursuing her scholarship back in her hometown in Europe, it would have been completely different. Angie said:

> *I try to maintain a balanced state. And you know, I just came here, so there is an extra challenge for getting support. Whereas, in [my hometown] everything would have been much easier, because I have my friends and my family there. But here I try to keep a social connection, because it helps me to not work in a bad mood, you know!*

As a young woman pursuing advanced studies in cybersecurity, Angie was able to find support from her mentors as well as peers in her academic and work environment. These contextual affordances in turn may have influenced the continued development of her self-efficacy beliefs and positive outcomes and a further development of interest in the field (Lent & Brown, 2013). In addition, Angie actively tries to find social support from a wider social network as she lives far apart from her parents and friends.

Work Environment Factors

Absence of a Post-doctoral Scholar. Angie pointed out the challenge in not having a post-doctoral scholar working alongside her during doctoral work. She reflected and said that

having a senior scholar would have helped her make the necessary "progress" in "producing more papers." Angie said:

> *One thing that I think would have helped is a post-doc working with me on the same field. We would have made progress much faster, instead of me meeting with my supervisor every week and him helping. If I had a post-doc working on my side on research development, then I think we would have produced more papers and things like that.*

It made me think about the pressures in academia to publish scientific papers. I too silently agreed that such a collaborative relationship between a doctoral student and a post-doctoral scholar would be very meaningful towards individual career growth. Angie talked more about the particular challenges in academia later in the interview.

Navigating Uncertainty: Academia vs Industry. Angie shared the uncertainty facing next steps in her career. With an advanced scientific degree there are broadly two avenues to choose from, Angie said. But the most important thing seems to be an ability to assess the different options and reflect upon one's own merit, challenges, resources, and interest. For instance, Angie described the uncertainty in choosing between a career in the industry versus academia. In her explanation, Angie weighed in on the hardships of an academic career such as the need to produce enough scientific research papers, "getting published at top conferences," and putting in the "time and resources" when success is "not always guaranteed." Angie said:

> *If I want to stay in academia, I have to produce a lot of papers, which means being able to publish at top conferences. And publishing at top conferences can be a very*

demanding task. It takes a lot of time and resources and it is not always guaranteed. So,

this is a challenge that I need to produce more papers.

There is an additional layer of challenge with respect to her being an international scholar. Angie said, "I need to do very well in my job to stay in this stuff, to stay here in America." She also pointed out to stay in a research position with her current advisor, she would "need his backing" and have to "write proposals." Likewise, a career in the industry has its own challenges because one has "to be good at a specific technology," Angie said. The prospect of which appears to be "scary." I wondered why and she responded that skills earned in academic research may not match the "technical efficiency of a senior engineer." However, Angie seemed clear that if she chooses to be in the industry, then she would like to "do research," "try new things," and then take it from there. Angie said:

> *But mostly [the challenge] in academia, is that I've to produce a lot of papers. In the*
> *industry, I have to be good at a specific technology. And this is scary for me because I do*
> *not know if I have the same technical efficiency as a senior engineer, let' say at Amazon.*

Bandura (1997) comments that career decision makers must come to terms with the fact that there will be uncertainties in terms of capabilities, stability of interest, alternative occupations, and identity development. In Angie's case it appears that she is thinking about the uncertainty between a career in academia versus industry and pondering upon her skills as well as challenges in making a career choice.

Better Conference Experiences. For researchers, a conference is an important place for both knowledge dissemination and networking. However, representation of women at security

conferences is low which limits their ability to take advantage of such gatherings. I remember, Angie and I touched upon this topic during our in-person meeting at the conference as well. I asked Angie for her ideas to improve conference experiences for women. Angie suggested one-day workshops for women at major security conferences as a great event idea. Based on her personal experience, she said it is helpful to "know that there are all these other women working in the field." Additionally, Angie suggested offering travel grants to female scholars could provide "extra motivation" to both apply and attend conferences. She said:

> *I think that the workshop is a really good idea: because it is good to know that there are all these other women working in the field. Something else that other conferences do, is they give travel grants to women. This should also be included because it is a good initiative. This could bring extra motivation to apply and to attend, you know!*

Gendered Work Environment. Cybersecurity is a field with a high concentration of men and notable gender discrimination (Reed at al., 2017). Angie expressed her agony with respect to mistreatment of women in the field. I asked if there is any way that women could prepare themselves to be in this field. To which Angie responded that a woman cannot be "a hundred percent prepared to feel comfortable" in this field. That "there will be moments, when you will feel uncomfortable, for sure." But one has to "know" that they are in the field because they are "worth it," and they are not there "to be criticized because of their gender." Angie shared people are more critical of women than they are of men in the field. She said:

> *But you have to know that you are there because you are worth it, and you are not there to be criticized because of your gender. And if they would extend you the same criticism*

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as they would for a man, which is not always the case, they tend to be harsher towards

women.

As I listened, I wondered how encountering such moments could hurt one's sense of belongingness and disrupt their attitude towards work and the field (Hatmaker, 2013). Being criticized because of gender or sexual orientation is not a fair basis for judgement. However, in gendered occupations, such as engineering, there is an underlying stereotype that men are more suitable for these jobs (Hatmaker, 2013).

Angie talked about another important issue pertaining to the unintended effects of gender representation in the field. She expressed her disappointment with the widespread perception that women's presence in the field is a result of representation rather than capabilities. Angie said, "they say we are in the field because we have percentages in the representation as women." By "they" she refers to the men in the cybersecurity community. Angie pointed out it is an unfair assumption to make because it means that "women who are less competent take the jobs of men who are very competent." She views this as a "big obstacle" for women, because "it is the dominant perspective." Angie insisted this outlook needs to change because the field should create equal opportunities for both men and women. This is another example of implicit bias to form judgments and perceptions of women in the field (Greenwald & Banaji, 1995; Heilman, 2012). Women who cross the professional boundaries of gendered occupations such as engineering encounter resistance from coworkers, subordinates, as well as superiors and their gender identity precedes their engineering identity (Hatmaker, 2013). I pondered upon the dilemma as Angie said:

The other part is of course, we are very few women, very few. This gives us a double-edged sword. Because, big companies, want more women, and that is how it should be, because we are under-represented. But, on the other hand, you face, I do not want to say sexism because it is not so apparent in most cases. But in some cases, let us say, it is a man community. This also affects how women exist and go about in this field. We should change that because, it should not be a man community, it should not be closed, it should be 50-50. That is how it should be.

Experiences with discrimination either directly or by receiving secondhand information of widespread discrimination in the field can be a barrier to career choice (Lent & Brown, 2013). While Angie discusses her gender-based concerns in the field, she does not show any turnover intentions. It might be because of her advanced degrees and research and training experiences. However, she worries about achieving a true sense of belongingness in the field and that seems to be a matter of concern.

Angie's Career Meaning Making

Career as Meaningful Work. Angie reminisced about her doctoral dissertation as she shared her most memorable project with me. She is "very fond" of her dissertation work as it is her "best work so far," Angie said. To hear that Angie's dissertation is something she rejoices in, inspired me to be hopeful towards my own work in the doctoral journey. Angie mentioned she is still "attached" to her dissertation research as she "publishes on that work." Angie makes meaning of her doctoral degree work as a project that she is keen on and sees as an achievement (Frankl, 1963). She further makes meaning by associating her research with the future work of

another student. She "gladly" indicated her doctoral research being carried forward by another doctoral student in her past lab. Angie finds it "interesting," as she said:

I am really glad that what I did, was a start for other people to continue [working] on. Because right now my old team has another student who is working on that and continuing what I did. That to me is very interesting!

Angie pointed out she finds her post-doctoral research work interesting as well. As Angie had only recently begun her extended research and training, she could not share in as much detail as she could with her doctoral research work. Angie insisted that while research projects can bring joy, they can also be challenging. They require us to be disciplined in our approach and make little contributions every day. Angie explained her own process:

So, there are phases when I do not make as much progress as I want, and I am not as productive as I would like to be. Then I have to set some very specific time frames. For example, from this time to this time, I will do only work and no social media. So, I have to be really disciplined. And in this hour, I do the smallest amount of work and then I see that I have made progress.

Career as Gendered Experiences. Angie explained her experiences with gender in overcoming traumatic sexual mistreatment and resisting a culture of "never enough." I was moved by her narration and at the same time able to resonate with her. Gender-based experiences can be deeply personal and sometimes even uncomfortable to share with others. In addition to some of the bitter experiences, Angie also hinted at the societal expectations from women in doing equally well at home and at the workplace.

The first account relates to her supervisor during master's degree. From my personal experience and scholarship, I know that supervisors play a key role in providing support and guidance during a critical higher education experience. However, there are unfortunate times when supervisors behave in inappropriate and unprofessional manner leaving students in utter chaos. Angie indicated she had an experience with sexual harassment while pursuing her master's degree and it "was one of the worst things that happened to" her. Angie shared her male advisor made "flirtatious" comments to her. She did not know how best to respond to this situation. Angie was intimidated and afraid of retaliation, she said. She was unsure of "what to say, what to do" and "felt bad" about what she was experiencing. Almost helplessly, Angie expressed she had "no agency and no power." Research has shown that sexual harassment is widespread in science and engineering fields and over 50% of women report such incidents (Hewlett et al., 2014; Smith & Gayles, 2018). This is also an account of vulnerability where Angie felt emotional exposure and uncertainty both in terms of her own feelings as well as her studies (Brown, 2012). She was worried about the negative implications from handling the situation. This incident also reflects the mismatch in power structure between a female student and a male professor. Angie said:

> First of all, I did not know what to do, because you see, it was a situation where I had no agency and no power. If something went wrong, then I was the one that would be screwed. Because maybe I would not graduate or be graded poorly in my thesis and I did not want to do that. But, on the other hand, I was feeling bad as to, you know, what to say, what to do.

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Angie then reached out to a female colleague for counsel. This particular person was pursuing her doctoral studies at the time. With her help, Angie was able to take the right steps and get past that situation. The experience made her realize that such incidents are more pervasive than she had earlier assumed. Angie said, "I now understand that it is not that uncommon. One way or another there will be some dude that will make a comment, which will be not acceptable." As a result of her own experience with sexual harassment in the academic setting, Angie is now willing to help any woman in need. She shared it is your female colleagues who are in a position to best help in such circumstances. Thus, showcasing solidarity or sisterhood behavior with other women to support and help by virtue of gender identity (O'Neil et al., 2018). It appears that Angie has developed courage and shame resilience from being in a position of vulnerability. As Brown (2012) suggests, vulnerability gives birth to strength, courage, and resilience. Angie said:

> *Yes, actually now I will help another woman, where she wants or thinks I can help her. Because this experience taught me that your own peers, your own female peers, can relate to you better than anybody in this situation. And I want to be able to do that for other women as well.*

Angie exhibited enormous courage in both confronting the situation and seeking help from another student to resolve the situation. Speaking about her experience and seeking resolution helped her in becoming strong and resilient (Brown, 2006). It is this resilience that gave her the courage to share the traumatic experience with me for the purposes of a research study.

The second account lies along the lines of gender and being a woman in the society. Angie emphasized the need to resist a culture of never enough (Brown, 2012). She said, "people expect so much" and reflected how societal pressures vary for men and women greatly. For women, even today, there is a need to be good at a whole host of things to feel complete: to be "recognized at work," to have a "family and raise children," to "be a good wife," a "good mom," and "a good cook," Angie said. The list is endless. Unfortunately, it is not the same for men, she said. Angie expressed her disapproval of this culture and chuckled that if she could do it all and do it "equally well" then she would be "Intel's new multiprocessor model." Based on what Angie shared it appears that resistance to such cultural grand narrations of being a woman and bringing humor into it is an act of shame resilience (Brown, 2010). Angie's narration is also indicative of the need for women to now do equally well at home and at work (Richardson, 1993). As Angie said:

> *For a woman, she has to feel recognized [at work]. Even today a woman does not feel complete if she does not have a family and does not raise children. Whereas for a man it is not the same! Well, I guess, we should up the percentage of being successful at work. How much does a certain percentage count in terms of a woman feeling complete? Because, right now, "Oh, you have a family, you have a baby, so now you are 70 percent complete," if I could say that. Although this is a rough percentage, but this counts so much. And to be a good researcher, it matters that you are good at what you do. People expect so much!*

In this next section, I present a brief conclusion of Angie's narrative account based on the major findings in the study.

Conclusion

Angie's narrative indicates that her career in cybersecurity began with an undergraduate degree in informatics. She explained that when students in her hometown earned good grades in high school, they went on to study informatics. So, that is what she did too. After completing her undergraduate degree, Angie received a scholarship to pursue a master's degree in another country. Following which she secured a job position to gain relevant work experience in the field. However, a desire to study further led Angie to pursue a doctorate degree specializing in security. This time she moved to another European country. After completing her doctoral degree, Angie moved to the U.S. for post-doctoral research and training at a security focused lab in a large university in the west coast.

Angie mentioned several factors that have helped her to stay in the path. Beginning with her performance accomplishments, effort at personal goals, a motivation to gain recognition in working in the field, an ability to live independently, and so on. In pursuing her work, Angie finds social support through mentors and peers who also provide her with the needed technical guidance. Angie also indicated challenges that she faced in her academic environment with sexual mistreatment. Angie also reflected deeply on the gendered nature of the occupational field, and commented on the challenging social expectations from just being a woman in the world. As someone who thinks deeply about the issues of low representation of women in the field, Angie suggested some ways to improve conference experiences for women. Additionally,

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as a young scholar she hinted at some of the challenges in deciding between a career in academia versus the industry and the unique demands of each of these career paths. Based on this interview, it appears that Angie makes meaning of her work experiences in relation to meaningful work as well as her gendered experiences as a young woman in the field.

In the next section, I present the narrative account of Alicia and related findings.

Narrative Account of Alicia

I met Alicia at a security conference in the U.S. where I was conducting my field research. Funnily, it was a male security professional from Denmark who suggested that I speak with Alicia. And for that I am very grateful. That evening, Alicia and I spoke for over an hour. We bonded so well, and laughed so much that when it came time to recruit participants for the dissertation study, I had to ask her. Alicia was more than willing to share her experiences with me and serve the bigger cause behind the study. She had told me during our first meeting that there is a lot of conversation in their circles about finding ways to encourage more women to participate in the field. As for a brief introduction about Alicia, she has a doctorate degree in the field and works in a senior research position at a security focused technological organization. Alicia is responsible for "generating ideas" for others to implement, she told me. Alicia lives in a European location for work, but hails from another country originally. At the time of this interview, Alicia was seated in her office and dressed in a formal attire. I was at home in Athens, Ga. The interview went on for approximately 1.5 hours without any technical difficulties. In the following sections, I discuss Alicia's experiences leading up to a career in cybersecurity, followed by the key career influential factors and career meaning-making. For a visual

representation of Alicia's career in cybersecurity refer to Figure 4.5.
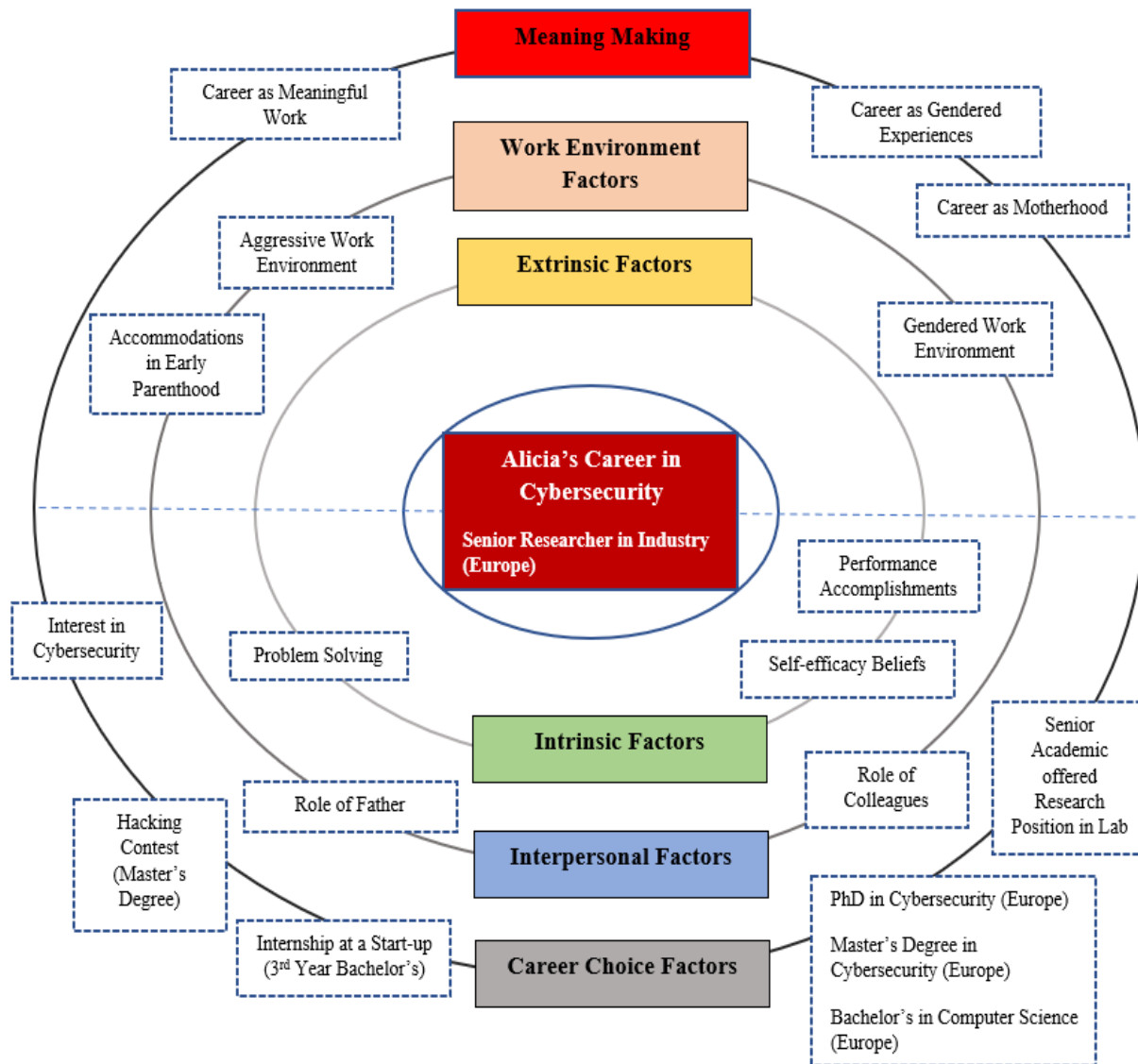
Figure 4.5

Visual Representation of Alicia's Cybersecurity Career

Alicia's Career Choice of Cybersecurity

Alicia received her bachelor's degree in computer science. It is core topics in computer science that she felt drawn, as Alicia said:

> *I was very interested in systems topics like operating systems, systems architecture, assembly language, basically low-level programming.*

In the third year of her university studies, Alicia got to read more about operating systems and the manner in which they function. These learning experiences inspired her to write her "own operating system." With her newfound enthusiasm, Alicia discussed the matter with a friend. Together they decided to work on this project, Alicia told me. It was during this time that Alicia and her friend came across a person who ran a start-up organization. Based on interest in the topic, Alicia now set new personal goals to get relevant work experience in developing something (Lent & Brown, 2013). The person from the start-up talked about his work in "implementing a security device" and offered both of them job opportunities. Alicia and her friend accepted the job offer as it "sounded pretty cool." This was also the time when she "started learning about security." At this time Alicia was still completing her undergraduate studies in the university. Alicia said:

> *We met with a person from a start-up at our university, and we discussed our plan. He was working on implementing a security device, kind of like a router. So, he said, "Look, if you can do a lot of operating system level programming, then we have a lot of work for you."*

Alicia worked at the start-up "for a year" and learned about security and its related issues. She found it "very interesting." However, Alicia had to leave the start-up as "he did not care about" them and did not pay for their "social security." As her experience with the start-up turned sour, Alicia chose to take the academic route. She revised her outcome expectations in saying that "industry is not so nice" (Lent & Brown, 2013). She then enrolled for a master's degree in cybersecurity. Alicia said:

> So, I discovered that and thought to myself, "Okay! industry is not so nice. I would better do something in academia." So, I started my masters, again in security and just by chance, when I was doing my masters, I met this well-known professor in the field. He offered me to be there in his lab for the remaining part of my studies and I went there. Then basically, I started working with him and I did my Ph.D. on the topic. And I always liked it, it was fun for me.

Alicia mentioned she met with a "well-known professor in the field" during this time and he "offered" her to move to his lab. This appears to be a contextual affordance which gave her the necessary support to explore a career in research (Lent & Brown, 2013). She gained research experiences in his lab all while completing her master's degree. She "liked it" and chose to stay even longer to get a Ph.D. in a cybersecurity related topic as well. Thus, setting a new personal goal towards her career choice (Lent & Brown, 2013). Alicia emphasized that the reason she "chose" to work in security was because she "liked it" and not "because someone introduced the topic to her." But she also admits that "there is a little bit of luck" involved because if she had

not met this professor, maybe she "would have never gone in this direction." Surprisingly, Alicia said:

> *You know, one of the things is that I was the only female person in the group always.*
> *Also, when I was in XYZ city [in the security focused lab], which was weird!*

Alicia shared her learning experiences gained through a "hacking contest" during her master's degree. There was so much enthusiasm in her voice during this part of the narration. I could sense her excitement. Alicia said:

> *We had this hacking contest type of a course. There 10 ten or 20 questions and the level*
> *of difficulty increased with every question. When you are able to solve a question and*
> *pass, you basically become something. For example, you start with a script kiddie and*
> *move onto become a master of something. They give you some title. So, if you are able to*
> *pass all of them, like 10 or 20 questions, I do not exactly remember, then you become the*
> *guru of security (smiles). It was like a game right; it was fun to do. And there were not*
> *really many, about 3-4 people who were able to pass this. And I was able to pass.*

Alicia shared she was the "only woman who was able to pass" the contest. But it had nothing to do with her gender and everything to do with her ability, she told me. It appears that by setting performance goals to do well in the challenge in turn, influenced her self-efficacy beliefs (Lent & Brown, 2013). Alicia found this to be a "fun" way of doing the course than "just doing exams," she said. I asked Alicia why she liked the hacking contest so much. To which she responded:

I do not know, the contest challenged me, and I always like being challenged. You know,

my father kind of raised me more like a tomboy rather than a girl, may be that also

helped.

Alicia spoke of her father several times during the interview. We laughed together at some of his anecdotes also. It seemed as though he had set her up well for the life circumstances. After finishing her higher studies, Alicia moved on to work at an organization in their research wing. During the time of this interview, Alicia was leading a group of 25 male engineers at her organization and was responsible for "generating new ideas" that "students and colleagues" could then implement. Later, in an email exchange Alicia shared she got promoted to be the head of her organization's research unit for the entire European Union and was also expecting her second child. I was thrilled; both for her expansion as a careerist Western woman and as a mother. There are many things about Alicia that I find inspiring, but it is her constant reflection between work and life that stuck with me (Lent & Fouad, 2011). For instance, when Alicia said:

In life there are ups and downs, always. You might fail, you might do bad, and anything

might happen to you. May be that day, I would quit this and say, "Okay, let us open a

little shop here and cook." I do not know. I like that. I enjoy that too!

In sum, Alicia shared the intersecting experiences through academic, internship, as well as work settings which is not often looked at in tandem in research (Smith & Gayles, 2018).

Alicia's Key Career Influential Factors

Intrinsic Factors

      Performance Accomplishments. Alicia shared she "had very good 5-6 years of career" and that she had been promoted "almost every year" during this time. I asked her for some indicators of success based on her own work experience. Alicia named a few such as producing scientific papers, making conference presentations, participating in program committees, and also doing successful technology transfers. To get promoted to a level where she is at, Alicia shared one also needs to do innovative work "that is different than what others are doing." Past performances are a major source of self-efficacy beliefs (Bandura, 1997; Lent & Brown, 2013). Alicia said:

> *If you are publishing enough numbers of papers per year, you are part of the program committees of well-known conferences, and you might have to have a technology transfer to a product in a company, this would be a plus. Also carrying presentations, you know being invited, being respected in the community. These kinds of things, basically.*

I asked Alicia to describe her process of working towards her career goals. Alicia shared she has moments of sleeplessness "every once in a while, maybe once in a month." It is during these moments when she feels deeply that "something is not going well." It could be because she has been a "bit lazy" at her work as other life events may have taken precedence. Alicia said:

> *This [self-criticism] kind of controls me. That night of sleeplessness and the bad thoughts and feeling that I cannot do anything, actually helps me to do things on time.*

This nervousness, Alicia emphasized, helps her to organize herself "better," put a "deadline" for projects and "prioritize" work. She tries to assess her progress from an outsider perspective, Alicia said. I was a little bewildered at first, but understood where she was coming from. Considering the demands on researchers to produce scientific papers and to be at the forefront of security developments, I could understand her position. Alicia shared she never thinks in herself as doing very good work and this "self-control" and "checking in" helps her to move forward. This truck me as somewhat upsetting because it indicates a lack of empathy towards the self and self-doubt about oneself (Brown, 2012). Alicia said:

> *In my case, I never think that I am doing something very good. And I think that this self-control and checking in to see how you work and criticize yourself helps me to produce things.*

Problem-Solving. Alicia said, "I like solving problems and that is probably one of the reasons why I became a computer scientist." An interest in solving problems led Alicia to make a relatable career choice decision (Lent & Brown, 2013). She traced her enthusiasm to solve problems back to her days in the university. Even in her first two years during the bachelor's studies, Alicia found her lab courses in programming to be very interesting. For instance, she talked about creating a linked list (data structure) using the C programming language. Alicia felt an urge to do her programs "fast and accurate and correct." She acknowledged that sometimes these problems were challenging, and needed more time. Nonetheless, "it was interesting," Alicia said. Similarly, during her master's program Alicia was intrigued by challenges in

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working with security programs. Alicia noted these problems "were more sophisticated" and shared:

> *You are trying to exploit the program and get control of a machine. You are fighting with the unknown, so you do not know what is happening. You are trying to understand. I mean, it is problem solving and it is interesting to me. To solve those problems, I was working night and day… Sleep was not important back then.*

Self-efficacy Beliefs. Alicia demonstrated very high self-efficacy beliefs in her skills. Also, in a manner that I thought would be encouraging to early career individuals. Alicia reminded me that we talked about this in our first meeting too. Alicia said:

> *I told you in our last meeting also, cybersecurity looks like such a big deal, such a difficult thing. I mean, "Oh God, hackers, and reverse engineering!" In reality, it is not so difficult, if you can learn it.*

Alicia substantiated the claim with her own example: "I knew nothing about security, but I was able to read around and do better than the other kids." If one is interested to learn, then they can learn cybersecurity, Alicia implied. She went even further to say that it is subjects like physics and designing new algorithms that are much harder. But programming is not that difficult, Alicia said. With enough work and attention to technical details, it is possible. Alicia said:

> *I mean, coming up with a new algorithm or physics, these things are harder, and you have to be smarter. You have to be able to see the bigger picture.*

Alicia insisted that she never had anyone tell her what she must do with her career, either during her education days or later. "I did it myself," Alicia told me. She shared she was "the most successful in her class" and now in her "life" because she carries a "mentality" that she is not doing enough. She believes that "self-criticism" has helped her in the long run. I thought to myself that maybe there is a sense of humility in saying that "you are never going to know a lot." Alicia said:

> *I was always the best student in the class, but I was not always confident that I could do it. I always thought that I did very bad in the exam, that I am going to fail, that I do not know anything. You know, I always have this mentality. But, probably, having this mentality, actually helps you grow, you study more, you try to learn more because you know that you are never going to know a lot. So, this is a very important thing.*

I also felt that to keep moving ahead and doing well, Alicia demonstrated no sense of complacency. Based on what Alicia shared, it appears that her self-efficacy beliefs keep modulating even with high performance achievements. I also wondered about the mental health effects of operating from a place of self-doubt and a lack of empathy towards the self (Brown, 2012).

Interpersonal Relationships

Role of Father. Alicia fondly talked about life lessons she learned from her father. She mentioned his influential role in her life (Lent & Brown, 2013). I listened with extreme curiosity as this meant something deeper than meeting the everyday parameters of her job. Alicia said:

If someone really influenced me in my life, that person would be my father. He taught us [Alicia and her siblings] that you will never know everything, you are never going to be the best. You will always have to keep learning, because you can never truly achieve something in your life. Actually, in reality we achieve things, like getting a paper accepted can be seen as a small achievement. But in the overall picture you will only have achieved something, but you will never truly achieve it.

Alicia described her father's teaching has had a huge impact on her life views. Even as a child Alicia held those beliefs very close to her, she told me. Almost in the same breath, Alicia narrated how she was always alone in her educational endeavors. She had to move to a different country for her studies and it was her "first time" doing so. With it came different challenges, even to "find a place to stay and sleep" was a hassle. But Alicia somehow "managed to survive." Throughout it all, it is this belief that kept her going to actualize her dreams. When Alicia mentioned "you will never truly achieve" anything, it seemed as though at one moment it seemed Alicia had earned some things in life and yet, in another moment it seemed like she had earned nothing at all. And that it is an on-going quest.

Role of Colleagues. Alicia described the role of her colleagues and friends with much admiration and positivity. She began the discussion by talking about coworkers within her own research lab. These are scholars with advanced degrees, Alicia said. They get together weekly or bi-weekly for meetings to have project related discussions. She then talked about her manager who is a "technical person" and can "understand" Alicia's ideas. They have brainstorming

sessions every couple of months. In addition, Alicia also has the opportunity to talk to professors who are situated locally.

Additionally, she feels included during networking events. During conference visits either to the U.S. or other parts of Europe, Alicia gets to "go out and have fun" over "drinks and dinner." She has a good experience with her colleagues. During these social events, Alicia's womanhood does not strike her as "odd" and she does not feel "weird." This is indicative of belongingness and social connection which enable her to feel a part of the cybersecurity community (Brown, 2012). Alicia said:

> *I do not know; I find it pretty friendly. And when I join these kinds of gatherings, I never feel like I am a woman, or that I am weird (laughs).*

Alicia paused momentarily to reflect and say that when a person has an advanced degree such as a Ph.D. and they "are smart" then it is likely that other people will respect them. They will not care whether "you are black, or yellow, or a woman, or have curly hair," Alicia said. Perhaps, she meant that the reductive measures of breaking people down into buckets do not happen in communities of people with advanced degrees. I neither denied nor acknowledged her statement. Rather listened with curiosity. Alicia also made a general statement about the difference in "views of life" within her work community versus family and everyday people in home countries, noting that:

> *We are really lucky to be in this kind of environment. This is not reflected in your real life. When you go back to your country, your family, you see that they have different*

views of life, completely different. I think we have a very different life and we should not

complain much.

Work Environment Factors

Gendered Work Environment. Alicia shared her experiences with gender

discrimination in the field. She said, "It would be a lie, if I say there is no discrimination." It

struck me that Alicia was being careful in choosing her words in this part of the discussion. But I

was not surprised because these are difficult topics for women to talk about. Alicia went on to

say that her organization tries their "best to decrease discrimination as much as possible."

Meaning the organization enacts rules so people are careful in their interactions and behaviors.

However, people still behave inappropriately "sometimes," "without really knowing." It is true

that people tend to have implicit biases as a result of being exposed to stereotypes and

preconceived notions about groups of people that shapes our attitudes towards them even at a

later age (Greenwald & Banaji, 1995; Greenwald & Krieger, 1995; Smith & Gayles, 2018).

Alicia said:

> *Although sometimes people do this thing without really knowing. They have a lot of*
>
> *prejudices and they may not even be aware of what they are doing themselves. A woman*
>
> *might face statements that are discriminatory, "Oh, this woman, whatever!"*

She shared more examples of bias, this time from within academia. Alicia often interacts

with faculty members and also with her husband being an academic, she is familiar with

discussions that evolve in the field. I was astonished by her description of discrimination that

women face going up for tenure. Alicia shared, "If you are a smart and a strong woman, then you

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are not considered normal. You are not someone who is capable to have a family and kids and everything." This is a hostile form of sexism and discriminatory behavior towards women who hold positions of power (Glick & Fiske 2001). She said:

> *Let us say, you are running for tenure track and you have to really work for the first five years. If you are a very competitive and a smart woman then they would say, "Oh she is a bitch!" Sorry, for the word! But that is what they would say. "She is this and that, may be homosexual." I mean, if you are a smart and strong woman, then you are not considered normal. You are not someone who is capable to have a family and kids and everything."*

Alicia shared another example of gender discrimination from one of her presentation experiences in an Eastern European country. This was a presentation that Alicia was making for her organization. She found that people were "harsh" and that they "have a culture that is different" from hers. This conference has a tradition of giving notes to presenters after their individual session. Alicia shared she "got hurt" from the note she received. Alicia described:

> *When I was talking at the conference, I said "you know" too many times. At the end of the talk, they make a little note and give it to the presenter. One guy wrote that comment for me, saying that I said "you know" too many times. I was upset at the time. I mean, I got hurt.*

That said, Alicia emphasized that the problem with discrimination is a problem that we experience ourselves and also do it to others. She suggested it is everywhere "in our culture, education, and the way we grow up." She gave her own example and said, "if there is a car doing

something weird in the traffic, then I would say, Oh, what is she doing!" This can be also be

considered as an example of implicit bias (Greenwald & Banaji, 1995). Alicia explained:

> *I do not want to blame only men, because they are doing so much discrimination.*
>
> *Honestly, we are all doing discrimination. Up until a couple of years, men did everything,*
>
> *and women stayed at home. This is changing now, so I do not want to blame the guys.*
>
> *This is something that we as a community have to think about.*

Aggressive Work Environment. Alicia pointed out two things as important, especially

for women. First, to not internalize "strong criticism" and rather take it constructively. She

shared people in the field tend to use "strong statements" which some people may have difficulty

coping up with. But Alicia considers herself to be a "strong person" and "does not care" about

the language people use. Alicia said:

> *Another thing that most people have issues with is that they cannot cope with strong*
>
> *criticism. People use really strong statements and some people might get hurt; they might*
>
> *take it personally…I am pretty strong about that and I do not care. I may briefly feel bad*
>
> *at that moment, but I would not keep thinking about it.*

She suggested that beginners in the field might suffer from "self-confidence issues" as they are

not experts yet, and they may also perceive cybersecurity as "a man dominated field." This is

again a reflection of the masculine cultures and a lack of sense of belongingness leading to a

gender gap in the field (Cheryan et al., 2017). As early career individuals women may think that

because they are not "experts" yet, they may not be "respected." Alicia emphasized this as an

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"important" factor to consider in the approach to increase women's participation in the field. Alicia said:

> *Women might have a bit of self-confidence issue. They may feel, "Oh, this is such a man dominated field! May be, I will have some challenges. They may not respect me because I am not an expert." This is another thing that I think might be important to consider.*

Alicia and I talked about conflict resolution at work and her approach to it. Alicia shared her conflicts with managers happen mostly with respect to project ideas. "I am a very positive person, in general," and tries "to get the good out of every situation" she told me. Alicia shared she had conflict with her managers, but was ultimately able to do what she wanted. If Alicia believed in a project and could put the point across in a manner that her managers "understood" and were "happy about", then she was able to go ahead with her plans. She also added that she has had "good managers" in the last "4-5 years."

As Alicia talked more, it became evident that her approach is more data driven. Alicia pointed out her success in the field in terms of "good publications and good outcomes" gives her credibility. It allows her managers to "respect" her opinions or project ideas. Alicia also prepares herself before negotiations such as a strong proposal with field research. Alicia said:

> *So, you know, I go up to them with a project idea and tell them that it is very interesting and there is nothing like it and it will be very important. Then you do a field study, you try to see if people are talking about it, what is included and what is not included.*

Alicia shared there are times when her ideas are not accepted by the managers. They may not find the ideas relevant to the organization or that it is "not the smartest" thing to do. In these

scenarios, you have to "accept that you are not always coming up with the best ideas." Alicia said:

> *And, as long as your manager comes up with a good reasoning as to why your project*
>
> *idea does not make sense you should be able to accept that decision.*

It appears that Alicia has developed an ability to both understand the work environment and knows how to navigate the space. She is not deterred by criticism and is able to thrive in her career (Buse et al., 2013). It is also apparent that Alicia has high self-efficacy beliefs because of her past performance accomplishments which helps her to continue on her path (Lent & Brown, 2013). However, she reflected on the nature of the environment to suggest how new female entrants to the field might find it difficult to cope up in the beginning (Buse et al., 2013).

Accommodations in Early Parenthood. Alicia and I discussed motherhood and how care work overlaps with her official work (Richardson, 2013). Alicia is a new mother and thus, was able to talk about her experiences more closely. She felt thankful for the support that she had received from her organization. Alicia shared she was working from home "when the kid was around 4 months old," but her managers understood her situation. She was not ready to give her baby to a nanny too early, Alicia said. From this perspective, Alicia found her managers "to be very supportive." These are contextual affordances that work as facilitating conditions that helped her to balance her personal and professional lives (Lent & Brown, 2013). Alicia said:

> *The company is very supportive. I was working when the kid was around 4 months old,*
>
> *but I was staying at home still. I did not want to give the baby to a nanny too early. They*
>
> *were like, "Okay, take your time!" It was understandable that I was taking more time*

than I would normally do for tasks. But I found a lot of support from the company.

Honestly, I cannot complain!

Alicia's Career Meaning-Making

Career as Meaningful Work. Alicia is motivated to work in the field because "there are so many things to do." She shared her experience from a recent conference visit. Alicia was in a stage where she "could not see" what she was going to work on next. But after some deliberation, Alicia was able to start a new project with her "intern" and "some more people" she met. They "brainstormed" an idea that Alicia came up with and all of a sudden, she was able to envision many new projects to do. Alicia pointed out it is not having something to do that scares her, noting that as long as there are projects to work on "it is good." Thus, making new meanings based on development in project ideas and alliances with other people (Lent & Fouad, 2011). An ability to create something worthwhile provides meaning to work (Frankl, 1963). Almost with a sense of relief, Alicia said:

> *I mean, I saw so many new possibilities for new projects. Things that I thought I could do. It is these possibilities that make me feel motivated. The fact that it is not finished, right? The bad thing is when you do not know what you have to do, until you find something that you want to do in the future. As long as you have that you feel motivated. And in my case, I always find something to work on.*

Alicia is an ambitious person. But she shared some of the uncertainty that comes with being in a position of power and influence. Alicia is in that stage of career where she is responsible for "producing ideas and giving them to students and colleagues" where they can take it forward and

implement. Alicia said, "it is hard to define who you are" and learn "your own contribution" to "be happy about." She expressed some relief in that she has "enough number of projects" to work on in the near future. But shared her uncertainty with respect to technology and that it changes so quickly. Bandura (1997) suggested that people have to develop an ability to cope up with uncertainties. Alicia reflects on the changing nature of technology and the struggles with keeping up, but she also demonstrates an ability to cope with it as she "always finds something to work on." Alicia said:

> *I mean, the technology is changing, it is so dynamic. And you can never establish some kind of knowledge that you can just fit yourself within it and be happy with it, no! You always have to increase this knowledge; you always have to do something to get better.*

Alicia talked about the uncertainties and challenges rooted in personal life as well. That sometimes unforeseen life events can set you back in your career. "You may not be able to improve yourself, and this may make you stay behind," Alicia said with a weariness in her voice. Again, reflecting on realities of life and relating it back to career.

Career as Gendered Experiences. Alicia has had experiences with prejudice; however, "it was not bad" Alicia shared. "I never got hurt from a man," she said. Also noting that it has everything to do with her character. Alicia suggested she is strong and can fight back if need be. Alicia said:

> *I have personally experienced prejudice, but it was not bad. I never got hurt from a man. But it is also my character: I am strong. I do not care, I can go and beat a guy, if necessary (laughs). But it is the prejudice that makes me feel uncomfortable and that is it.*

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I was curious to know how prejudice takes shape in her experience and asked her to share some examples. Alicia suggested prejudice is often subtle and is not overt that you can point a finger on it. She has never had an experience where somebody told her directly that she was "not good" at something or that she is not "eligible" to work on something. Alicia believes that women tend to "sense things more" and that her experience with subtle prejudice is not entirely a "creation of her mind." Alicia said:

> *Again, they might not even be saying something and then it is hard to judge and blame someone. Because the guy looked at me some way or his body behaved in some way, I do not know.*

Interestingly, Alicia shared the story of her recent visit to a Scandinavian country for work. Her voice was filled with hope and excitement, and I wanted to know more. Alicia shared the community "over there has gone to a different level where discrimination is minimal." Although Alicia felt apprehensive walking into the room with 30 – 40 "hacker, security types of guys," she did not feel uncomfortable at all. Alicia shared the nicest part of her visit was that they were "super comfortable making jokes," and not trying to be overly polite with her. In countries where there is too much discrimination, men tend to be "kinder" towards women, Alicia suggested. Later, in speaking with professors from that region, Alicia found out that they are doing a lot in this regard to reduce discrimination against women. Alicia said:

> *There were maybe 30-40 guys, they were all like lower level, hacker, security types of guys. I did not get that [feeling.] They were all perfectly fine, and I could not sense them thinking about me in a negative way. That was amazing! And the nicest part was—in*

places where there is typically discrimination, people would be kinder. I don't like that

either, you can curse in front of me but because I'm a woman I don't want you to stop

yourself and be a different person—I do not know they were super comfortable making

jokes and I felt good there. I felt amazing!

Through personal and critical reflection, Alicia sheds light on gender-based issues in the field of cybersecurity (Reed et al., 2017). Alicia admits that she has never been victimized in anyway. She has experienced subtle discrimination but has been able to stay strong and grow in her career.

Career as Motherhood. Alicia indicated her experiences with being a new mother as "pretty challenging." She mentioned not having exclusive time for just the two of them—Alicia and her spouse. I was not surprised to hear about the hardships that come with pregnancy; however, deferred my judgements until the end of her narration. During my interviews with Alicia, she always came across as a strong and ambitious woman who had met the typical metrics of success for a researcher and a contributor to the scientific community, all at a relatively young age. Alicia indicated she went into her pregnancy with a similar attitude:

Before having the kid when everyone said, "It is so difficult because you have to take

care of the kid." I said, "No! we can do everything." Then in the month that the baby was

born, my husband had 20 papers to review and everything was like a big mess (sighs).

Alicia and her husband hold very demanding jobs—he is an academic in the cybersecurity community. In speaking of challenges with parenthood, Alicia shared she and her husband split

the time to take care of the child. Thus, using social support from family members as a coping technique to meet home demands (Yang et al., 2020). As she said:

> *Sometimes, we have a hard time because we do not get to have this family time that three of us spend together. I take care of the child for 2-3 hours and then he takes care of the child for 2-3 hours. You know, this part is not nice, but that's life!*

Alicia pointed out her family, especially her father, is very supportive of her career. He comforts her in saying that a short period of slowdown in career "does not matter." However, there are also those moments where he encourages her to focus on her work and balance household and motherly duties as well. Alicia laughed and said, "I think he wants me to be very good at my work and also be a very good mother." She shared "he thinks I'm this superwoman and that I can do it all." There is an expectation that women have the capability to perform equally well in care responsibilities at home and accelerate in the workplace (Richardson, 1993). Longing with hope Alicia said it will be "easier" in time and everything will be "stable." However, she did not seem weary about having to juggle duties as a mother, a wife, and a career woman. Her account of experiences with motherhood is also reflective of the different phases in life and how we engage in meaning making depending on changing life roles for e.g., in experiencing love with another human being such as one's child (Frankl, 1963; Patton & McMahon, 2014).

Conclusion

Alicia has followed more of a linear career path in cybersecurity and works as a senior researcher in a large security-based technology company. She is based out of a European

location. Alicia started with a bachelor's degree in computer science and it was during her third year of college that she had a chance encounter with the founder of a security focused start-up. She accepted an internship at the company and got to explore security related work within computer science. This is when she developed an interest in security. After finishing her undergraduate degree and her internship, she enrolled in a master's program with a focus on cybersecurity. During this time, she met with a renowned professor who offered her an opportunity to work in his security-focused lab. Alicia joined his lab and completed her master's degree. She stayed the course and moved on to earn a doctoral degree soon after. Alicia pointed out she often found herself as the only woman in a class or in a lab, but gender never deterred her from working in the field.

Alicia mentioned several factors that helped her to continue working in a cybersecurity related career such as past performances, self-efficacy, and an interest in problem-solving. She loves being challenged and fits well with the nature of her work. Alicia did not mention any external payoffs that motivate her to work in the field. Rather, she spoke about her father's influential role throughout her life in supporting and encouraging her to do well. She discussed the challenges based on gender either through first-hand experience or by listening in to other people's stories. It appears that Alicia has learned to navigate the field in some ways, but it is also possible that a successful career resulting from publications, technology transfers, serving on committees and more, have provided her with the needed self-efficacy to navigate the field. She indicated her husband works as an academic in the security field too.

Based on this interview, it appears that Alicia makes meaning of her work experiences through meaningful work contributions, gendered experiences, and motherhood. At the time of this interview Alicia's family had grown and she was now a new mother. She reflected on some of the unexpected challenges that came with juggling occupational and care work. Throughout the interview, Alicia maintained a sense of humility in her work and the way she has navigated the field.

In the next section, I present the narrative account of Krista and related findings.

Narrative Account of Krista

Krista and I met online for the first time during this interview. It was a lovely afternoon over the spring break. The university was closed for its normal operations, and I was visiting my husband in Texas. So, I had some leisure time to prepare for the interview. Thankfully, the technology cooperated well, and we were able to start on time. Krista was dressed in a formal attire. There was a sense of poise to her. She had sent me a brief introduction earlier, so I had a rough picture of her work background. I knew that she had 20+ years of work experience spanning academia, industry, and the government. I was eager to hear more and learn her story closely. As the video chat started, we exchanged pleasantries and introductions before getting into the more formal conversation. For a visual representation of Krista's career in cybersecurity refer to Figure 4.6.

Krista's Career Choice of Cybersecurity

I asked Krista to tell me about herself and her background. Krista said she thinks of herself, primarily as a software engineer. She started her career as a programmer over 20 years
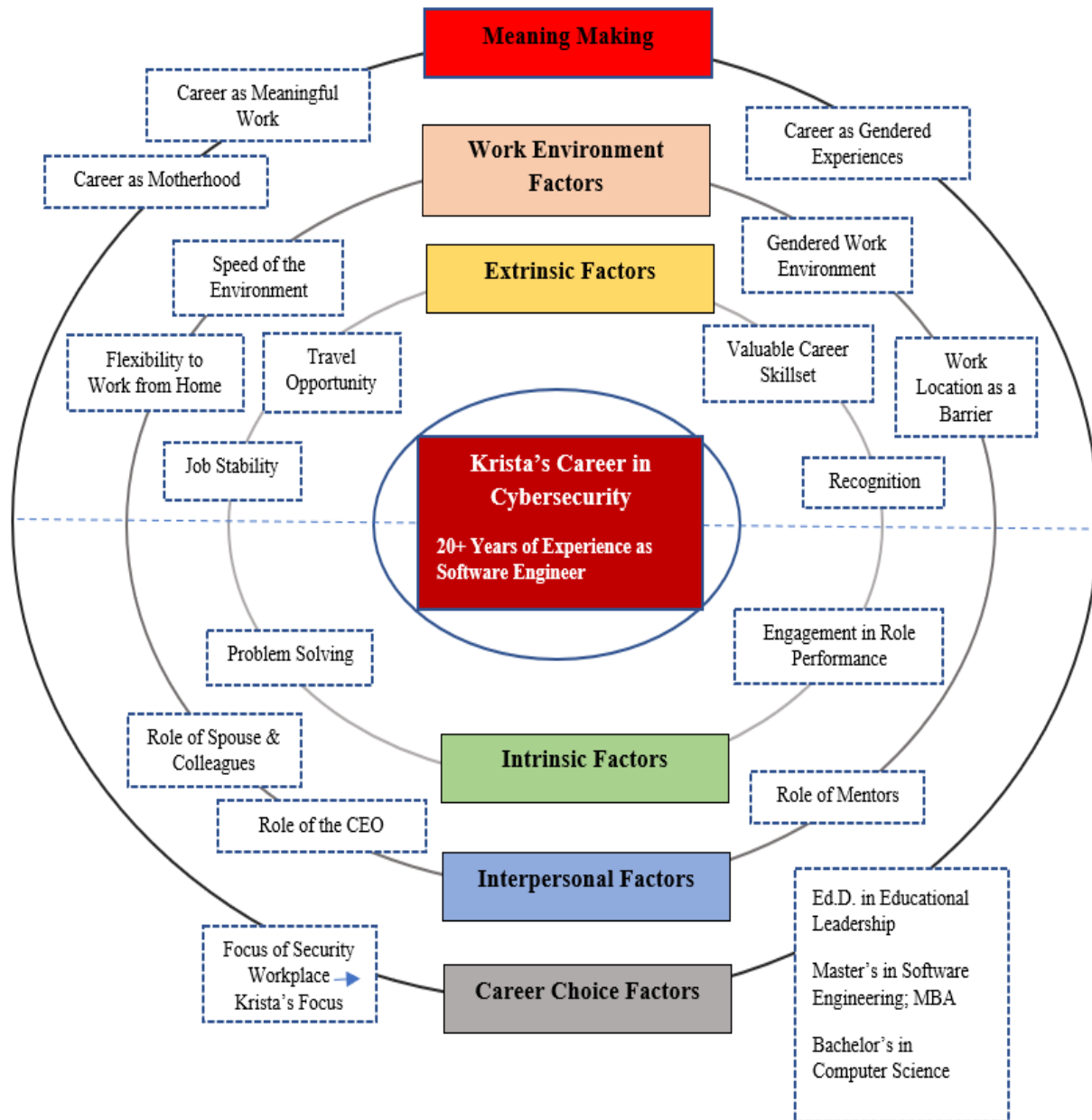
Figure 4.6

Visual Representation of Krista's Cybersecurity Career

ago and thus, has a vast range of work experience in the field. Krista told me she also has several

educational degrees to her credit—starting with a bachelor's degree in computer science, a

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master's degree in software engineering, an MBA, and, most recently, and most recently an EdD in educational leadership. As per Reed et al. (2017), women in cybersecurity have high educational qualifications and this is true in Krista's case. "I kind of accidentally ended up in the field because 15 years ago, we did not even think of it being cybersecurity," Krista told me. People simply went to work at a place where the focus was on network and system security. As she said:

> *I started in programming, and it evolved from there. Probably about 15 years ago, I went to work for a company whose focus was on the security of networks and systems, so that became my focus.*

Krista described she is transitioning in her career having recently earned a doctorate in educational leadership. She is "passionate" about exploring new career directions with her advanced degree, but aspires to "dabble" both in the field as well as academia for now. Krista shared she has some teaching experience in cybersecurity-related courses at a community college, and she would eventually like to move into a full-time faculty position. However, Krista is hesitant to move away from industry entirely at this moment, she told me. I wondered if it is because of her positive work experiences in the field, as she discussed at length later in the interview. Krista shared she had worked for so long in the industry that she was not ready to leave just yet. Additionally, Krista has "security clearance," which might be a challenge to earn again. Krista said:

> *If possible, my only goal would be to be able to go into academia and also keep a foot in the field, if it is consulting or part-time. So that is what I have come to terms within the past couple of weeks. I just feel like I am not ready to remove myself yet, totally…. It is a*

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tough decision, even though I am passionate about going a new direction, doing

something new. If I could find a way to dabble in both, that would be ideal for me!

Based on what Krista shared, it appears that her interest in continual learning and the

desire to contribute to both the field and academia, is reflective of a will to go above and beyond.

At the same time, it is also reflective of the effort that Krista takes in scaling up to meet the

demands of the job. This becomes more apparent later in the interview as the questions take a

more personal turn.

Krista's Key Career Influential Factors

Intrinsic factors

Problem-Solving. Krista explained problem-solving as the most exciting aspect of her

work. She gets "a sense of satisfaction" from translating customer needs into software

development. It is like "solving puzzles," she said. Krista and her team develop security focused

software solutions for clients with specific needs. She finds it encouraging when the product

meets customer expectations leaving the customer happy and Krista satisfied. While there are

unique challenges associated with every request, she thinks of them as "good" challenges. Krista

said:

I would definitely say problem-solving…Then when you solve their problem, and the

customer is happy, you definitely get a sense of satisfaction from that. It is a feelgood

moment. The challenge is good too. But I just think it is solving puzzles [that motivates

me].

It appears that Krista sees herself as self-efficacious in her ability to solve problems and

anticipates that solving problems will result in satisfaction both for her and her clients (Lent &

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Brown, 2013). This ability in turn leads to an enduring interest and maintenance of her career choice in cybersecurity.

Engagement in Role Performance. Krista described the extreme care she takes in goal setting and planning for her work every day. Krista diligently keeps an active and on-going list of tasks associated with her projects along with deadlines, she said. Krista told me she still has every notebook for the "last seven years" with details of activities for every single day. At this point, I was baffled but I wanted to hear more. This practice of writing everything down helps to have "visual" access to on-going tasks and gives her the ability to "think," Krista said. She turns a "new page" of her notebook every morning, writes down high-level priorities and outstanding tasks from the previous day, and then "mark tasks off" as the day goes by. Based on what Krista shared, it appears that it is an exercise in creating a repository of steps taken towards performance attainment (Lent & Brown, 2013). Effort taken towards goal-directed activities daily seems to be her approach to work. As Krista said:

> *I am a list-oriented person. I always have a bunch of task lists going or a project plan with a timeline attached to it. So, for me, that is something I have always done every morning— get up and look at that list and figure out what is still outstanding. I do a lot of it on the computer now…. I always kept a notebook out. I could go back over the past seven years, and I kept every single notebook because I still like to write things down and see it visually and write it down and think about it.*

Krista shared she "wore a lot of different hats" especially in the last project that she worked at. She had to perform several duties and "it was probably too much actually," Krista

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said. They had a small team of minimum four and maximum six people. She added that sometimes people thought "our team was a lot bigger than it was." They worked on a classified application, maintained a live environment, and supported users. However, even with all the added responsibilities and challenges "they made it work" and Krista thought "it was a great project."

Extrinsic Factors

Recognition & Valuable Skillset. It is only recently, that Krista has "realized" both the "value" and the "demand" of her skills. Considering that cybersecurity has gained a lot of attention and security is a concern for everyone, it is perhaps understandable ((ISC)², 2019). It appears that the demand for her skillset works as a positive reinforcer for her to continue working in the field (Lent & Brown, 2013). It is "something that builds" her up. As Krista said:

I have recently realized that these skills are in demand. So, it is motivating when people reach out to you, and they want you to come work for them because they feel like your skills are valuable, and they are in demand. So, I definitely have to say that it is something that builds you up and motivates you, and it is a good thing.

Travel Opportunity & Job Stability. Although Krista does not travel often, she indicated it is another perk of the industry. It is an excellent field for someone who likes to travel, Krista said. She even went on to give the example of her husband who has had the opportunity to "travel all over the world," as a result of his job in cybersecurity. Krista said:

Then also, if you are a person who likes to travel, there is much opportunity to travel. My husband does not mind the travel. So, he has traveled all over the world and just has the

opportunity to travel pretty much anywhere he wants to go. So, that is another great thing

about the field.

Additionally, Krista shared there is a sense of stability in the cybersecurity job market. There are new opportunities unfolding now and then. Having been in the field for so long, Krista is confident that job opportunities will continue to grow "for many years to come":

The upcoming opportunity, jobs that are available, and the prospects for the future look

perfect for people working in the field.

Availability of jobs can thus, help maintain the career choice in cybersecurity (Lent & Brown, 2013).

Interpersonal factors

Role of the CEO. Krista fondly shared the time during her initial years in the field. The environment was "new, exciting, innovative," Krista said. The then Chief Executive Officer of the firm Krista explained was the "mastermind" behind exciting projects. He was someone "on the forefront of things," Krista said. She shared he would go up to her and others with new and exciting project ideas. Sometimes they were left challenged and had to scale up, but that propelled her in the right direction. It was a "a huge factor," Krista said:

Then I would say some of the people that worked there. One of the main masterminds

behind it all who was the CEO at the time. He was just always coming up with really

interesting projects and was at the forefront of things, just ahead of the game. So, he was

definitely a factor because he would come to you with a project, "hey, I want you to do

this," something you have no idea how to do. But it was new, exciting, innovative! So,

that was a huge factor.

Role of Mentors. Krista discussed the role that two of her mentors played in her career development. The first mentor is also the person who had hired her during early years of her career. Krista was in the job market then. She said, "he was like a dad," to her and others: someone who would "encourage" her to try new things, discover new directions, and also "build them up." Krista pointed out she still continues to be in contact with him. The second mentor is one of her most recent project managers. Although they no longer work on projects together, they continue to talk and be engaged in a mentor-mentee relationship, Krista told me. She indicated she seeks and finds guidance, feedback, and advice from him to date. However, Krista lamented not having such a mentor "a lot sooner" in her career. She did not realize the need for such mentorship until much later, Krista said:

> *Then I would say the last few years, my manager on a project I worked on became the mentor to me. We are still in contact even though we are not working together anymore. He is still that mentor for me. Even though my job transition, I talk to him a lot, and he gives me feedback, advice. So that is just something I wish I would have had a lot sooner. It is something that I think I did not realize until a lot later that it can be really helpful for support.*

Mentoring can play an important role in career development (Allen et al., 2006; Kram, 1985; Noe, 1988; Scandura, 1992). It appears that Krista has experienced some positive mentorship in career advancement through male mentors. Research shows that male mentors have a positive impact on women's career development (Ramaswami et al., 2010) and women

prefer to work with male mentors (Bevelander & Page, 2011). However, considering there are so few women in this field, it is difficult to say that with some certainty.

Role of Spouse and Colleagues. Krista explained the collective role of her spouse and colleagues in her career development. With her husband being in the same field and equipped with an advanced degree in information security, they "bounce ideas off each other." She also emphasized "being successful in the field has required networking." In that regard, she considers herself "lucky" to have great coworkers, including managers and colleagues, who not only supported each other during project time but kept the network going even years later. As I heard her speak, it struck me as extremely important to have a support network from people in your own field. Krista said she felt "welcome," and never "inferior" to them. Thus, leaving her with "positive work experience" and a sense of belonging in the workplace (Brown, 2012; Cheryan et al., 2017). I thought to myself that this must have been a key factor to her sustenance in the field apart from the hard work that she had put in, and it was. As Krista said:

> *I would say one of the best things that I have been thinking about a lot is just how lucky I have been to work at; I went to work at a small company where we had a really close-knit group of people, just really supported each other. And they became not just your coworkers, but your friends. And that has just been a great thing. A lot of us moved on to other companies together and helped one another out with networking... Even though I was the only woman on the team, I worked with great team members, and I never felt inferior to them. They were very welcoming to me, and so I had a positive experience in the field.*

Meaningful connections with people in the field helped create facilitating conditions for Krista to move ahead in her career (Lent & Brown, 2013). It creates a sense of belongingness in the field which creates positive affect and favorable career outcomes (Cheryan et al., 2017; Lent & Brown, 2013).

Work Environment Factors

Speed of the Environment. Krista talked at length about the role of her work environment in enabling her career growth. When she began working in the field—15 years ago, cybersecurity was not as popular as it is today, she said. People just went to work for an organization that had a "security focus." So, being in such a workplace amidst others driving "innovations" through "research and development" was profoundly inspiring to Krista. This also "encouraged" her to challenge herself and grow. Krista said:

> *So, I would say one of the factors that led me to the field was being in an environment where that [security] was the focus. Our whole mission was just security in systems and environments for the government. So, there was a lot of research and development projects going on and really innovative things. The speed of the environment where that was happening was really motivating.*

Lent and Brown (2013, p. 124) asserts that the environment plays a "potent role" in determining what a person gets to do, for how long, and the associated rewards they get. The environment is receptive to the merits and skills of an individual and makes a judgment about their abilities to meet the requirements of the occupation during the entire length of their career. It appears that Krista's abilities in conjunction with the nature of the environment moved her further along in the career choice of cybersecurity.

Flexibility to Work from Home. Krista pointed out one of the perks of working in the industry is the ability to work remotely. Krista shared she had the option to work from home both full-time and part-time for the last 10 and 15 years, respectively, "other than some travel onsite and off." This ability has afforded her a place in the workforce, allowing her to fulfill the role of a caregiver at home (Buse et al., 2013; Wang & Degol, 2017). Krista indicated it has always been a "priority" for her to maintain a home life balance.

Gendered Work Environment. To my dismay, Krista shared she was subject to gender stereotyping—a sociostructural barrier, on "a couple of" occasions in her career. I was surprised because she had spoken so positively about her career until that moment. I did not anticipate it at all. Krista shared it was the "most significant barrier" that she had experienced. Being the only woman on a team of male engineers led Krista to be a subject of implicit bias. Not by people on her team but by those who did not know her. People assumed that she worked in some type of administrative role such as an HR or a trainer thus, creating ill-informed judgment about her. Implicit bias resulting in preconceived judgements of underrepresented groups in the workplace is well documented in the research literature (Greenwald & Banaji, 1995; Greenwald & Krieger; 2006; Smith & Gayles, 2018) Krista said:

> *I think one of the most significant barriers that I ever experienced was just stereotyping. So, because I usually worked on a team that was mostly male engineers, and if we were all in a room together, other people would assume that you were not an engineer.*

Krista's experiences of gender stereotyping speak volumes about implicit connections people make about gender and occupation type and thus, is an example of bias. Research

suggests that gender-related stereotypes and biases create gender gap in STEM disciplines (Wang & Degol, 2017) and deter women from continuing to work and leave the field (Block et al., 2011). Such experiences can hurt one's sense of belongingness as it signals who should be in the field (Cheryan et al., 2009). Being gender stereotyped could also lead to shame, but people who are resilient are also people who believe in their worthiness (Brown, 2012). I asked Krista about the steps she took to overcome those circumstances and to essentially, face those situations.

Krista shared she corrected their assumptions by briefly introducing herself and mentioning her job role. Based on what Krista shared, it appears that there is an added layer of complexity where a female engineer has to promptly introduce themselves and perhaps, also prove their credibility to now deserve a seat at the table. Krista considered these experiences with gender stereotype to be "one of the biggest barriers" in her career. However, they did not deter her from staying in the field. Perhaps a combination of factors such as self-efficacy beliefs in field specific abilities, an interest, other favorable outcome expectations from her career, and support from other sources helped her to stay the course (Lent & Brown, 2013). Krista indicated she had great team members and managers, as she explained earlier; people who were supportive and treated her the same.

Location as a Barrier. Krista explained location could be a potential barrier for finding suitable work opportunities in cybersecurity. She said, "so, a very rural area where people do not move around a lot, jobs do not come upon a lot." When Krista and her family lived on the outskirts of a significant industrial location, it became increasingly difficult to find jobs, even

"local ones," Krista said. The limited opportunities for growth were another concern for both her and her husband. So, they moved close enough to the city to be able to find suitable work and commute regularly. Krista said:

> *Location can also be a factor that hinders somebody. So, for us, we were approximately two hours outside of XYZ metro area, so that is a hindrance whenever you are trying to be in the field: being on the outskirts.*

Krista's Career Meaning-Making

Career as Meaningful Work. I pressed Krista to share other factors that motivate her to work in the field. Krista described it is helpful when a project has a "mission" and a "purpose" that she can relate to. It then becomes "motivating," Krista told me. Perhaps motivation driven from a purpose-led activity helps to drive the necessary effort and meet the intended client needs.

> *I think a motivating thing is a mission, where you feel like you are working on something that matters and has a purpose. So, for us [Krista and her team], we felt that way about our project. So, that matters to me when you feel like you are doing something really important and that is motivating.*

As an example, Krista shared the experience she and her team had in their most recent project where everyone felt like they had a purpose. This project ran for seven years, Krista said. It is also her "most memorable" project. Krista was the lead software engineer on that project. She further described in the first couple of years, the project was "flying under the radar" until it gained "visibility." Krista took on the role of the Subject Matter Expert and that led her to present their product in front of high-level government officials, she said. The project gained momentum and her team started getting attention even from the management within their own

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organization. This experience was an "empowering moment" not only for her but also for her team, Krista emphasized.

Krista described how her team had struggled during those initial years when the project was not very well known. Their requests were not met by the management, because the project was considered "low priority" in the range of things. After the initial struggle, the product became known when it was in use by different groups of people. Her team then received more work requests for additional built-in features to be implemented and delivered. They were also able to offload some of the additional work onto other resources, a request that was previously not considered by the management. However, with more visibility came additional pressure. Nonetheless, it still brought a "sense of satisfaction" to her and her team-mates. Krista said:

> As I said, it was empowering for our team, and it was really good for the project. Of course, higher visibility means there is a little more stress level because a lot more people are coming at you…. But it felt like we were making a lot more progress, and the project was just more satisfying those last few years because we were, I do not know, just because it was growing, and the project was growing and just a sense of satisfaction with that.

Krista did not exhibit any self-doubt in her narration, which is a symbol of meaningful work as per Brown's (2012) wholehearted living "guideposts." Her account also resembles Frankl's (1963) idea of meaning making in life by creating something that seems like an achievement. Her attitude during this time is also important to consider because she along with her small team worked on bringing that project up for seven long years.

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Career as Gendered Experiences. Krista pointed out the experience with gender stereotype led her on a creative endeavor—a quest to find answers as to why she was the only woman or the only other woman in every team and in every job she held. This to me was interesting because rather than getting bitter about untasteful career experiences, Krista chose to find solutions. I was eagerly listening to understand her journey through this. Krista went on to give more examples. She shared there was a time when Krista worked on a team of "30 engineers" with only two females including her. On another project where she worked for seven years, there was only one other female engineer, Krista said. Her experiences with gender stereotype compounded the "question in her mind": why so few women? The quest resulted in Krista earning an Ed.D. in the field of Educational Leadership and pursuing the question that had lingered on for a long time. Krista said:

> But you wonder why there were not more [women]. So, the feeling it created in me was the question in my mind, "Why am I here, and why aren't other women here? Why are there so few women in this field?".… So that really became the basis, I guess, for my study that I did, just trying to figure out why there is not more women attracted to the field, and where is the breakdown?

Krista was resilient in standing firm in her career choice even amidst some of the stereotypical experiences (Brown, 2012). She was not deterred and rather used those learning experiences to guide her in earning an advanced degree. In its entirety, this account of Krista's experience is reminiscent of Margaret Atwood's writing as quoted in Brown (2018):

> When you are in the middle of a story, it is not a story at all, but only a confusion; a dark roaring, a blindness, a wreckage of shattered glass and splintered wood; like a house in

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a whirlwind, or else a boat crushed by the icebergs or swept over the rapids, and all

aboard are powerless to stop it. It is only afterwards that it becomes anything like a story

at all. When you are telling it, to yourself or to someone else. (p. 263)

Career as Motherhood. As a professional working woman and a mother, Krista had to

give equal importance to both her familial responsibilities and to work. As per Richardson

(1993) it is important to consider all types of work in understanding women's career

development including care work and occupational work. Krista indicated it has always been a

"priority" for her to maintain a home life balance. She found that a great benefit of being in the

field has been the ability to strike that balance. Krista pointed out she had the opportunity to

work from home both full-time and part-time for the last 10 and 15 years, respectively, "other

than some travel onsite and off." This ability has afforded her a place in the workforce, allowing

her to fulfill the role of a caregiver at home. Krista shared both she and her spouse hold

cybersecurity-related jobs and the flexibility to work from home has allowed them the parental

benefits to take care of their children. Most importantly, it has helped Krista advance in her

career while fulfilling responsibilities towards her family. On being asked if it was challenging to

be a remote working professional, Krista suggested keeping an active work schedule at home

helped to manage the two worlds well. For instance, having an office at home, a work desk,

dressing up for the day, and setting expectations for the children, have all helped in this regard.

Krista said:

I have found for me that you have to have an office [at home]. You have to have a place

that is set up that feels like work, that you are going to every morning and stick to a

schedule.

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As the primary caregiver to her family, Krista had to make specific work-related decisions. Cybersecurity as a field has its own demands, sometimes requiring people to work outside of "regular business hours," she said. As an example, Krista cited she held jobs where they expected her to work "weekend hours," "on holidays," and also "travel a lot." However, Krista found some of those demands challenging to cope and had to leave one of her jobs as it involved too much travel. This barrier led her to find a new job it did not create turnover intention from the field. Krista had to find an alternative way to accommodate care work and professional work by reducing overload such as denying involvement in excessive work activities to take care of responsibilities at home (Yang et al., 2020). An ability to do so has allowed her to continue to work in the field (Buse et al., 2013; Wang & Degol, 2017). As she said:

> *One of the reasons I left one of my jobs is because I felt that travel was becoming too much, and I just could not do it. I think that might be common to probably a lot of women…. I kind of had to give up my role because I needed to be home. So, for me, that ended up being sort of a barrier.*

Krista shared she has made both a general and a particular observation that women traditionally take on the roles of primary caregiver while men do the traveling. She has seen her husband's friends in similar situations, where the men travel for work and the women take care of the household. So, as work began to interfere with her family responsibilities, Krista had to find a suitable job. It appears that sometimes our immediate living environment cues us towards gender role socialization (Lent & Brown, 2013). Krista noted:

A lot of women seem to take on that role more than men do. The men will go do the

travel; the woman will stay home. I see that a lot with the guys my husband works with.

Conclusion

Krista's work lies within the intersection of software engineering and cybersecurity. She received a bachelor's degree in computer science and went on to work with an organization that had a focus on security. Although Krista did not anticipate working in cybersecurity, she accepted the focus of the organization as her focus as well. The work environment was so rich in research and innovation, that it inspired her to challenge herself. Notably, she also found support in the work environment to establish her career in this area. Along the way, Krista earned several other educational degrees – master's in software engineering, an MBA, and most recently, an EdD. Krista has 20+ years of experience in the field working as a software engineer. Krista mentioned she enjoys being in the field because she loves problem-solving. Working on client requests to create software solutions gives her the satisfaction which is compounded when the customers are happy with the solution. Krista is diligent and has worn many different hats in her role within teams.

When asked for factors that have helped her to continue in this career path, Krista mentioned the role of her colleagues, mentors, as well as her spouse who works in the security industry as well. Krista mentioned the support she received made her feel like she belonged in the field. She felt welcome. The networking also helped her navigate different work situations. Krista is motivated by the recognition she receives from valuable cybersecurity related career skills. She shared people reach out and offer job positions which is very encouraging. She also indicated she likes the stability that this career path provides. As Krista has made this career path

her own over changing life roles, she indicated the flexibility in striking a balance between her occupational work and care work. The option to work from home either part-time or full-time has enabled her to contribute to both worlds. This brings perspective to women's career as a professional and as a mother and caregiver.

Based on this interview, it appears that Krista derives meaning from her work experiences by doing meaningful work – in her individual contributions as well as through collaborative efforts. Krista also derives meaning from her own experiences with gender stereotype which led her to pursue a degree in educational leadership so she could pursue the question of low representation of women in the field. Krista's career path highlights the subjective elements of a career where not everything is about a vertical growth in the career ladder. Finally, meaning making for Krista also takes place as a result of her overlapping responsibilities of motherhood and professional work.

In the next section, I present the narrative account of Sherry and related findings.

Narrative Account of Sherry

Sherry and I exchanged emails before meeting online for the first time for this interview. I was a little nervous going into this meeting as I thought of her as a "brave pioneer woman" considering her 32 years of work experience and expertise in the field. However, soon my nervousness was put to rest by her sheer tenderness. Sherry and I got off to a really good start and I felt very comfortable talking with her. I briefly introduced myself, told her about my background and my passion for the project. I had already done some of it during our email exchange. Nonetheless, I felt obliged to do a self-introduction during our verbal exchange. Sherry and I had agreed to do a video chat, but for some reason we could not get her video to

work. We laughed it off and got straight into the interview without losing too much time. As promised, Sherry emailed me a picture of hers after the interview. In the preceding sections,
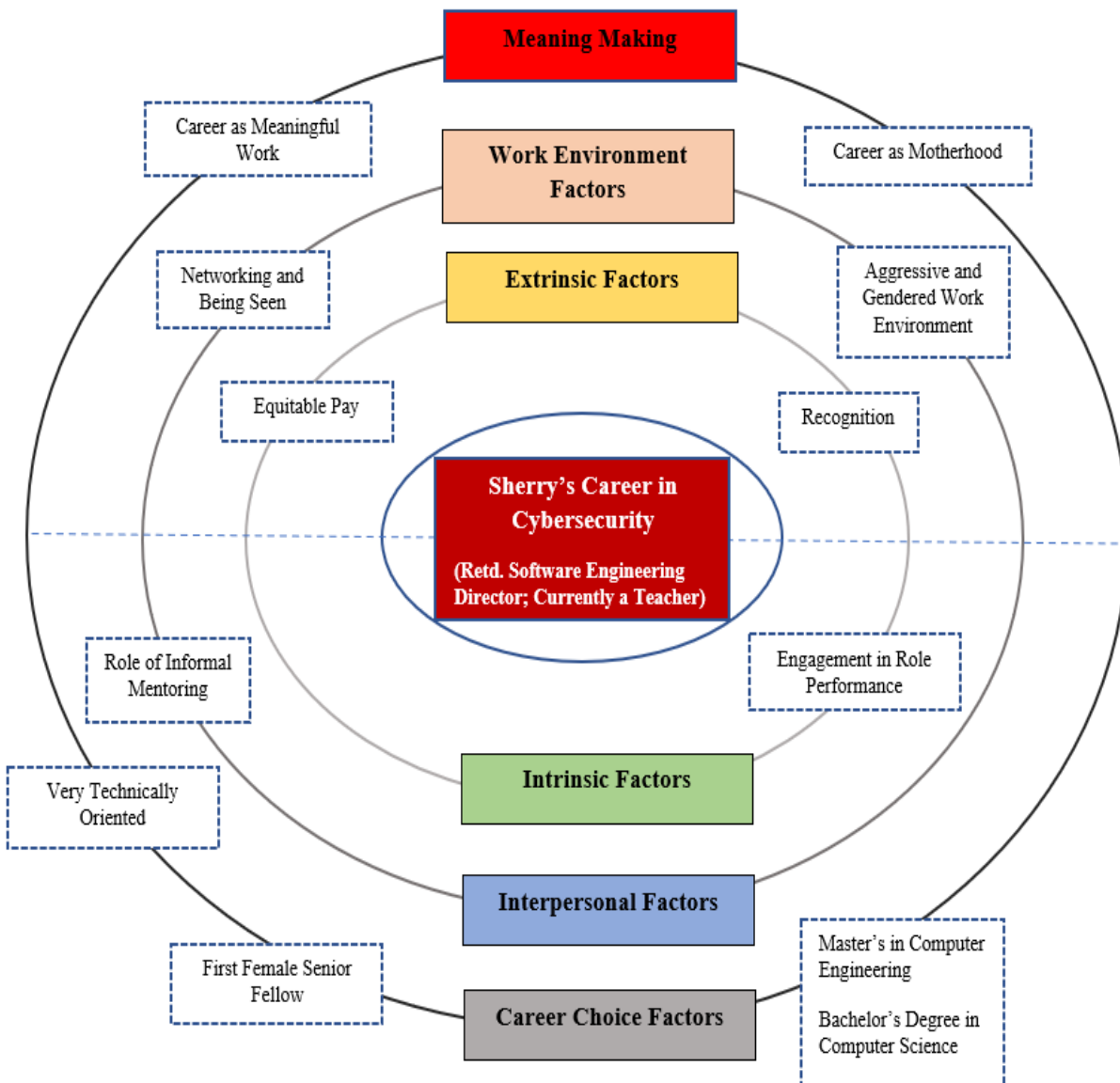
Figure 4.7

Visual Representation of Sherry's Cybersecurity Career

I present her narrative account in a manner that aligns with the research questions set for this study. For a visual representation of Sherry's career in cybersecurity refer to Figure 4.7.

Sherry's Career Choice of Cybersecurity

Sherry has just retired from a long and "successful career" of 32 years working in the security space with a large U.S. governmental contractor. She started her journey with a bachelor's degree in computer science and worked in the field for a few years before earning a master's degree in computer engineering. Sherry said:

> *I have a bachelor of science in computer science and a master's in computer*
> *engineering. I just retired a year ago from a very successful 32-year career working for a*
> *government contractor building defense articles.*

Sherry was very "technically oriented," she told me. At the beginning of her career, Sherry spent a couple of years with her first employer. However, she decided to move on when she felt she was not "challenged." At her next employment, Sherry felt deeply fulfilled, as she explains later in the interview. I was very eager to hear what had changed and what made her stay and sustain herself for so long. While at her second workplace, Sherry became the first female "senior fellow," she told me. In terms of career development, Sherry shared she wavered and "could not decide" on what she wanted to do. So, she tried different roles and job positions within the same organization and "all within the same field," Sherry told me. She indicated taking classes and necessary trainings to fill a gap in her skills for the required job or role as it appeared. Thus, engaging in goal attainment and skill development by selecting activities that kept her interest going and further influenced her self-efficacy and outcome expectation beliefs (Lent & Brown,

2013). Sherry retired as one of their engineering directors and held other positions as she climbed the career ladder. Sherry said:

Prior to that [director] role, I was a program manager overseeing multimillion-dollar programs of various technologies. Then I grew up, I was the first female senior fellow at ABC firm. So, I was very technically oriented but career, I could not decide what I wanted to be when I grew up. So, I kept trying, all within the same company and all basically within the same field. But I would try different types of roles within that company.

Towards the end of her career, Sherry held the responsibility of more than 500 engineers, all with different capacities and backgrounds, she told me. Amongst other things the role also required Sherry to oversee the "training and career development" of these early career engineers. Sherry took a special interest in "mentoring" them, she said. Post retirement, Sherry decided she "was not done, yet." With some exploration, Sherry decided to transition to academia as an instructor. At the time of this interview, Sherry was teaching engineering and cyber programs to senior and graduate students at a large university in her area.

Sherry's Key Career Influential Factors

As Sherry and I talked more, she shared several important factors that had strong influence in her career trajectory. I present those factors in the sections below.

Intrinsic Factors

Engagement in Role Performance. As the interview unfolded, I was curious to know why Sherry stayed at one organization for only two years and at another for the rest of her career. Sherry shared her first job did "not challenge" her enough. So, she decided to move to another

organization where she found ample opportunities for growth. Sherry emphasized she kept "learning," propelled by "curiosity" to "try different job roles," and most importantly, taking on the "next challenge" whenever it appeared. Thus, a combination of new growth opportunities offered by the work environment as well as her own curiosity to learn and challenge herself created a good fit for Sherry to continue to work at the organization and remain in the field. Research suggests that finding new opportunities for growth and affective states of satisfaction and dissatisfaction resulting from those efforts help to shape career behaviors (Lent & Brown, 2013). Sherry said:

> *I worked for another company for two years before and I was not challenged. So, I left and then I joined XYZ organization. So, I stayed there for 32 years because they never stopped giving me great opportunities. I never ... okay it is not just they. I never stopped learning. I never stopped being curious. I never stopped wanting to take on the next challenge.*

Sherry had "no reason" to find a job elsewhere or look for another suitable workplace because the organization kept her engaged, offered relevant advancement and growth opportunities whenever she sought them. As Sherry said:

> *So, the diversity and the types of assignments of the roles that I had kept me engaged and happy, thriving, growing. I had no reason to leave!*

Moreover, if Sherry were interested in a job position or project and did not have the necessary skills, she would "take a class" and upgrade her skill to match the needs of the project. Sherry mentioned during the early years in her career – the first 18-20 years, she "prepared" herself for advancement opportunities. In fact, after gaining a bachelor's degree in computer

science Sherry did not think that she would need another degree. Sherry had "no intention of getting a master's degree," she told me. She thought the skills she had were going to be enough for her to "make the big bucks" and "have a great career." However, when she saw people around her with "skills and capabilities" that she lacked, she felt compelled to "get additional training." Apart from the continual "gap analysis" between current and future work aspirations, Sherry also kept her superiors informed about the direction she wanted to go. So when "there is an opportunity they have you in mind." This is an act of setting personal goals – setting intentions to engage in activities to produce favorable outcomes (Bandura, 1986). It also involves exercising agency to organize and direct behavior towards occupational pursuits (Lent & Brown, 2013). Sherry said:

> *But it is like you start seeing that everybody around you has skills and capabilities that you do not have, and it is like, "Oh well! I better go diversify; I better go get some additional training."*

By the time Sherry got to a leadership position, she had built both a "reputation" and a "network." Her reputation was one of "getting it done," she said. All of this came with the effort that she had put in.

Extrinsic Factors

Equitable Pay and Recognition. Sherry explained a couple of considerable factors that led her to stay for so long: an equitable pay and recognition. Sherry noted she was paid even more than some of her male counterparts. She expressed "feeling guilty" for the high pay that she received and brought it to the notice of her superiors. She even asked them to "stop giving raises," she told me. However, she kept receiving the raises and had to come to terms with it,

Sherry said. Most importantly, Sherry had to "learn" that she was getting paid because of the work that she had put in. Based on her personal experience, Sherry thinks women often do not value or appreciate the "contributions they are making" and that should change. People expect to receive favorable outcomes such as equitable pay when performing self-efficacious tasks where they feel competent (Lent & Brown, 2013). However, it appears that Sherry was not confident about outcomes such as raises and had to learn that she deserved the reward. Research shows that women underestimate their performance as compared to men on engineering tasks (Woodcock & Bairaktarova, 2015). She said:

> They kept giving me the raises and I had to learn that I was worth it. But that is another thing woman do… But I would say that is probably the number one reason I stayed so long is that I did not have to leave.

Apart from equitable pay, there were other factors related to recognition that motivated Sherry to continue her work in the field and in the organization. Sherry found that with time she had gained a reputation in the organization. In addition, her "domain experience," knowledge of "legacy" products, and the "network" of colleagues made her feel productive and valuable to the organization. As Sherry said:

> You know what, once you start building the network and you start building the domain experience and all of that legacy knowledge that you have, you start feeling very productive and very valuable.

The combination of values and favorable outcomes such as equitable pay influenced Sherry to not only stay in the field but also continue to work in the same organization for her entire career. SCCT suggests that people either develop such outcome expectations from either personally receiving those benefits or through vicarious learning (Lent & Brown, 2013). It appears that Sherry developed these expectations as she continued to work.

Interpersonal Relationships

Role of Informal Mentoring. Sherry described her mentoring experiences as positive noting that she had "great," but "informal mentors" during her career. She went further to say that "coaching" and mentorship are "absolutely vital" to career growth. I wondered what her mentors were like and who were they. To which Sherry explained they were people that she "respected," and went to for advice as she "struggled" in an assignment or sought guidance in moving up the career ladder. There were times when Sherry was put in job positions where she "felt uncomfortable," and so she had to reach out to someone who had the relevant experience or skill. Sherry indicated instead of being "daunted or intimidated by it," she reached out to her informal mentors. They were not her superiors, not people who would evaluate her performance, but others with whom there was a level of comfort to ask even "stupid questions," she said.

Sherry mentioned two specific mentors during the interview: first, the vice president of engineering; second, the vice president of a product line at their organization. The first mentor, a male, was someone who motivated her to "diversify her skills" so she could be more "versatile" as an engineer, Sherry said. The second mentor was a female, initially a peer but who "accelerated" to a leadership position. Sherry described her as a person that she could comfortably talk with about issues she was facing. She said:

But he [the vice president of engineering] would coach me that you need to diversify your

skills, you need to diversify your background, continue to grow your network so that you

become a more well-rounded, more versatile engineer... So, I had a few great mentors. I

had one female mentor who was actually my peer but then she accelerated. She ended up

becoming a vice president of one of our product lines. But because we were peers at one

point, I felt extremely comfortable talking to her.

Past research studies have shown that formal and informal mentoring play an important role in

career development (Allen et al., 2006; Kram, 1985; Noe, 1988; Scandura, 1992). While

mentoring can take place either in a formal or informal manner, studies have shown that informal

mentoring relationships lead to more favorable outcomes than formal mentoring relationships

(Chao et al., 1992; Eby et al., 2013).

Work Environment Factors

   Networking and Being Seen. Sherry emphasized the importance of networking and

being seen in the professional circles. She explained speaking up and asking questions helped her

in building a professional network. It helped her not only to stay in the field but also "feel

valuable," Sherry said. She pointed out people miss out when they hold themselves back and

hesitate to ask a question or let themselves be seen. For it is only by "being inquisitive" that

Sherry was able to "build a tremendous network." Sherry said:

People got to know me whether I worked with them or just because I asked questions.

Then one person would lead me to talk to another person and another person would talk

to another person. So, I had to overcome the fear of seeming or appearing to be inferior

or incompetent.

As we spoke more about the need to network, I learned that Sherry believed in being seen. I wondered what that meant for her and how might that translate for other women. Sherry shared being seen meant taking a seat at the table. She indicated how she always encouraged both men and women to do so. But insisted that it is especially important for women. Sherry suggested women should not "feel intimidated," they should not sit behind in the conference room, or "sit on the sidelines," rather women should be where the conversation is taking shape. They must "learn" and "contribute to the conversation." Sherry said:

One of the things that I always told people, and this is true for not just females but especially females, "take your place at the table." If you are in a conference room and you are in a meeting, make sure you sit at the table….Sit at that table, learn as much as you can, and feel comfortable being at that table and contributing to the conversation and the dialog that is going on.

Aggressive and Gendered Work Environment. During the early years of her career, Sherry worked in a male-dominated workplace. "There were not a lot of females," Sherry said. It is during this time, that Sherry learned "men work differently," that they are usually "blunt" in their conversations. So, working with male engineers meant learning how to "handle arrogance," Sherry said. But pointed out she had to teach herself not to take that behavior personally, and not to "internalize" it. For instance, if an engineering design had not worked and was a failure then it was not about her but the design, Sherry emphasized. She said many-a-times it seemed best to leave the conversation "at the table." Sherry described:

When you are dealing with engineers, arrogance gets in the way and I had to learn how to filter that out. If somebody, because of their arrogance or the title they had or the

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degree that they had, sometimes they did not play really well, they did not collaborate,

they were not team players, then you have to learn not to take that personally and not to

make it reflect back on you or your capability or what you are bringing to the table.

However, in certain severe instances, Sherry found herself crying. Later, she resolved not to do it as it made her feel "inferior" to her male colleagues. To my utter disbelief, Sherry said there were instances where someone called her names such as a "dragon lady" and a "bitch." I was baffled, but at the same time I had so much respect for her openness. I wanted to know how she handled those situations. Her mood both reflective and weary at this point. Sherry lamented and said she had to "learn to shrug it off," to "deal" with those experiences and not personalize any of it. It appears that Sherry was vulnerable as a woman working in this space, as instances of name calling, arrogance, and bad behavior took place (Brown, 2012). Sherry was resilient in going against career barriers and demonstrated courage to take on challenging work and grow in her career ladder (Brown, 2012; Khilji & Pumroy, 2019). She learned to navigate the workspace by adapting to the circumstances and working around the situations (Buse et al., 2013).

"Don't let the stereotypes get in the way," Sherry told me. She explained women should not solely blame their sex for getting passed over for "promotion" or missing out on an "opportunity," rather they should do a gap analysis to see if they lack a skillset. Sherry clarified it is possible that race or sex is "a factor" in these considerations, but skills must be considered too. Sherry said:

Personally, I hate this when women use their sex as an excuse: "Well, I did not get the

promotion because I am a woman. I did not get that opportunity because I am a woman."

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Sherry sighed and said there is also "reverse discrimination" in the field and shared her own experience. She told me she was given promotions into leadership positions as a result of her gender and that made her "mad too," because quite possibly they did not look at her as a candidate who also had "technical and leadership skills."

Attitude towards suffering also determines how we make meaning of our lives (Frankl, 1963). In Sherry's case it was by learning from every difficult situation and choosing for herself how she wanted to handle it. She found it best to ignore the negatives and focus positively on the work that led her to finally, have a "rewarding career."

Sherry's Career Meaning-Making

Career as Meaningful Work. Sherry and I began the interview with details about her new job experience with teaching at the university level, something that she had taken up post-retirement from an industry career. After a 32-year long career, Sherry decided to teach cybersecurity related courses to undergraduates and graduates at the university in her area. Sherry explained all through her career she received help from people in different ways and that during her retired years she wanted to "give back, by helping others." Sherry reiterated having "a great career," a "rewarding" one—filled with challenges and responsibilities, but also filled with "fun." So, Sherry felt a desire to continue to do more work, and this time for the benefit of others. This is evocative of the idea that work as an activity also links people to a larger social good (Richardson, 1993). As Sherry said:

I had a great career. It was very rewarding. I was responsible for a lot of different things and I took on a lot of challenges. So that was fun. So, when I retired, I decided that I was not done yet.

Teaching seemed like a meaningful option to Sherry. So, when she approached the university to revive their cybersecurity curriculum, they were "very excited." They accepted her offer and gave her the opportunity to teach. By the time of this interview, Sherry had taught three semesters at the university, she told me. We spoke at length about her input to the curriculum, attitudes and behaviors of students, her approach to teaching students, and more. Sherry also pointed out she teaches an engineering-based course to all seniors, in collaboration with industry partners.

We then changed directions and talked more about her experiences in the industry. Sherry fondly described her most memorable project experience where she and her team worked together as "a family." Through collaborative effort, they were able to bring a particular program in-house and their effort resulted in her entire team working very closely, Sherry told me. It was a new program at their organization, and they were competing against another large corporation. As the manager on the project, Sherry indicated she spent "75-80 hours a week" during that entire fiscal year. However, with the help of a "strong and capable team" they were able to come up with a solution that was "far superior" in comparison to the solution proposed by the competitor. They felt "exhausted," but ultimately, they were able to win the contract. Sherry said:

There were a lot of really tough times, extremely challenging times, times when we were exhausted. But then when we won the contract it was so extremely rewarding to know

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that all of the hard work, all of the relationship building that we had done not only within

our own team but within our customer community had paid off so that we were able to

bring this very strategic program into [my organization].

Sherry also pointed out this particular program is now in production and will be for the next "30-40 years." She thinks of the program as her "baby" and being part of the team that made this happen, it is her "favorite," Sherry told me. As Chen (2001) posits, life becomes meaningful when individuals strive to create and project meaning into their living experiences. For instance, by participating in creating a successful project that holds meaning for the entire organization.

Sherry also explained the importance of authentic connection to people throughout her entire career. She shared the virtue of treating every person on her team as a "human being" and with "respect and dignity," is part of her personal "success" story. Together they worked on some of the "hardest things" but there was always "humility" and "humor" in those meetings "whenever possible." This culture, Sherry told me, facilitated a work environment where people did not have to feel "threatened" to approach her for work.

As an engineering director, Sherry led close to 500 engineers. She was instrumental in "building the leadership team" and practicing a culture that was both "open and inviting" to the new hires, "especially to early career students." Sherry was curious to hear "new ideas" from these "early career" professionals so that the organization could learn new ways of doing business, she said. Sherry also helped the "early career individuals" meet people high up in the leadership. This way the leadership team could appreciate the "new generation" coming in with their unique capabilities. As Sherry said:

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I actually helped several of our early career individuals get exposure to many different vice presidents in the company and other senior leaders in the company so that they could start to appreciate this new generation that was coming in with tremendous capability and tremendous ways of doing things.

Sherry talked about leading with "humor" and "emotional intelligence" to make those connections with people as humane as possible. She suggested there is a tendency to "get so caught up in the stress" that we "forget to be human," that the person on the other end is a "person with feelings." So, Sherry practiced emotional intelligence at work, and briefly told me about her practice:

Being able to be perceptive on how other people are feeling and how other people are responding to what is going on whether it is you personally or the situation they are in so that you can adapt your style to make progress.

As part of her practice, Sherry had even given her team members the permission to let her know by just a show of hands if she was "getting too spun." She further shared if the team were working late hours or on weekends, holidays, she would bring them food and acknowledge their hard work. Shery said:

I may not have been able to contribute to the problem at hand, but I was there. They saw me. They knew that I was seeing how hard they were working. I acknowledged that. I tried to reward it… [That I] appreciate what you are doing and the sacrifice you are making right now.

Sherry shared another experience where she was asked to be the lead on a program "that was totally in the ditch." She believed she was given this new responsibility because of her

ability to connect with people. Sherry said there were several challenges in this project, such as people not working as a team, inability to meet budget estimates, and schedule deadlines. It was not a technology that Sherry was even familiar with, but her "teaming" skills and "emotional intelligence" helped them work towards the "same goals" and even make it "successful." Sherry said:

> *But the thing that I brought to bear was I believe my teaming and my emotional intelligence. I was able to bring these two factions that absolutely hated each other together to come from a team that started working towards the same goals. We started to work to make the program successful... It was the hardest assignment I ever had in my career.*

In Sherry's leadership style as well as in her attitude towards teaching young undergraduate students, she exhibits a caring relationship with those in her market work (Richardson, 2012; Blustein, 2019). She emphasizes her focus on being "approachable" and "nurturing" towards her coworkers then and her students now. This relational aspect is central to meaningful life and work experiences as it creates a sense of connection and belongingness with others (Blustein, 2019; Brown, 2012; Kahn, 1990).

Career as Motherhood. Sherry and I talked about her deeply personal story with motherhood. Sherry shared her experiences and pointed out how they overlapped with her career. Sherry said being successful at her career has required her to be "an overachiever" and "a workaholic to some degree." So, when it came time to make family decisions, she wanted children but had difficulty getting pregnant. However, with the help of In-Vitro Fertilization she

was blessed with two "beautiful daughters," twin girls, Sherry said. Her daughters are now grown-ups—one pursuing Engineering and the other Medicine. Sherry said:

> *So, because I am a workaholic and because I wanted a family and I had to work for my family granted, I had trouble getting pregnant. So, I ended up having IVF which is in-vitro fertilization and ended up with twins—two girls!*

I was curious to know how she managed her personal life and work life well. Sherry explained she "committed" herself to be a part of their lives and extended the same or even more care, time, and priority to her children. Sherry involved herself in their school activities right from elementary school to high school, she told me. Sherry volunteered at several of their school events such as organizing "fund-raisers" in elementary school, "school dances," and participating as a "troop leader in Girl Scout." Sherry indicated these efforts resulted in her not getting "much sleep," starting her day at 3:00 a.m. on most days. But doing a combination of those things "helped" her to maintain "somewhat of a balance" in both her personal and work life. Sherry shared it is only after her daughters got into high school that she was able to make time for herself again. She was finally able to go for "walks," and "exercise," and even began thinking and doing things for herself. It appears that Sherry persevered through her career and involved herself in her children's growing up years; thus, giving both care work and professional work the best, she could. This is the belief Richardson (1993; 2012a, b) enacted through her research that women's career development include work done within the occupational structure as well as outside the occupational structure and thus, should be given equal importance. An ability to Sherry said:

So, I did things to force myself to be committed to my family, to whatever it was they were doing. Whether they were in elementary school, middle school, or high school. I forced myself to be committed to those kinds of things.

Conclusion

Sherry has retired from a 32 year-long and rewarding career as a software engineering director in a firm that largely works with the U.S. government. Post retirement, Sherry now teaches at a university in her area. She considers it to be the best way to give back to the world. Sherry received a bachelor's degree in computer science and went to work as a software engineer after graduation. Her first employment did not bring her satisfaction and she chose to move on to a second employment where she spent the rest of her career. There she found ample growth opportunities, received an equitable pay and built a reputation along the years that motivated her to stay with the organization. She reflected on her career growth and shared she was able to develop and plan her career often through continual gap analysis. This helped her take related courses and grow in her expertise. After a few years into her career, Sherry also earned a master's degree. Sherry also took additional measures to grow in her career. For instance, she kept her superiors apprised of the directions she wanted to go. So, when opportunities opened up in terms of projects, they had her interests in mind.

Sherry took on many different roles during the vertical advancement in her career. She talked at length about some of her most memorable projects that gave her a sense of satisfaction. As a manager, Sherry shared she practiced emotional intelligence at work and valued the human relationships and people she worked with. She mentioned coming together as a family during some of these challenging project deliveries. Since no career is without its fair share of

hardships, Sherry shared some of the unique events with respect to a gendered and aggressive work environment. For instance, she shared her vulnerability in moments where an engineering design had failed or when projects were not coming together as expected or when people called her names. But Sherry also exhibited courage in overcoming those struggles to accomplish great things at work. She said she had learned to shrug it off – a sign of resilience. Sherry insisted that everyone, but mostly women must learn to take a seat at the table and participate in conversations.

It appears that Sherry makes meaning of her work experiences through meaningful work, in terms of projects and connections she built with others during those engagements. She also spoke about motherhood and how priorities changed due to family commitments. Sherry had to find a way to make both her occupational work and care work to shine. So, she committed herself to whatever her children were doing in there growing up years. She remained responsive to the changes that life and work demanded of her.

In Chapter 5, I present the results across all participants for the three research questions identified for this study.

CHAPTER 5

FINDINGS: CAREER NARRATIVES ACROSS WOMEN IN CYBERSECURITY

In this chapter, I present the findings across all participants to provide responses to the three research questions outlined for this study. The first research question explored participant descriptions of career choice making of cybersecurity, the second research question explored the key influential factors in their career paths, and the third research question explored how the participants make meaning of their work experiences as cybersecurity professionals. Findings related to each research question are presented in a sequential order beginning with the first research question. Participant descriptions are included to provide additional context. A visual depiction of the findings including themes and categories found in common across participants is also included for clarity (see Figure 5.1 below).

Research Question 1. How do women describe their career choice of cybersecurity?

Two major findings resulted from the data related to career choice: (1) a desire to research and study things, and (2) that participants very technically oriented. The first category refers to their earning of higher education degrees to fulfill work roles while the second category refers to a technical bent of mind with respect to problem solving. Additional information related to each key finding is described in the following paragraphs.

A Desire to Research and Study Things. A common finding that appeared across all participants is the desire to learn. This occurred in various ways: by pursuing higher education

degrees, taking up internship opportunities, and exploring job roles to gain the necessary

knowledge in career development. In spite of their individual differences in making a
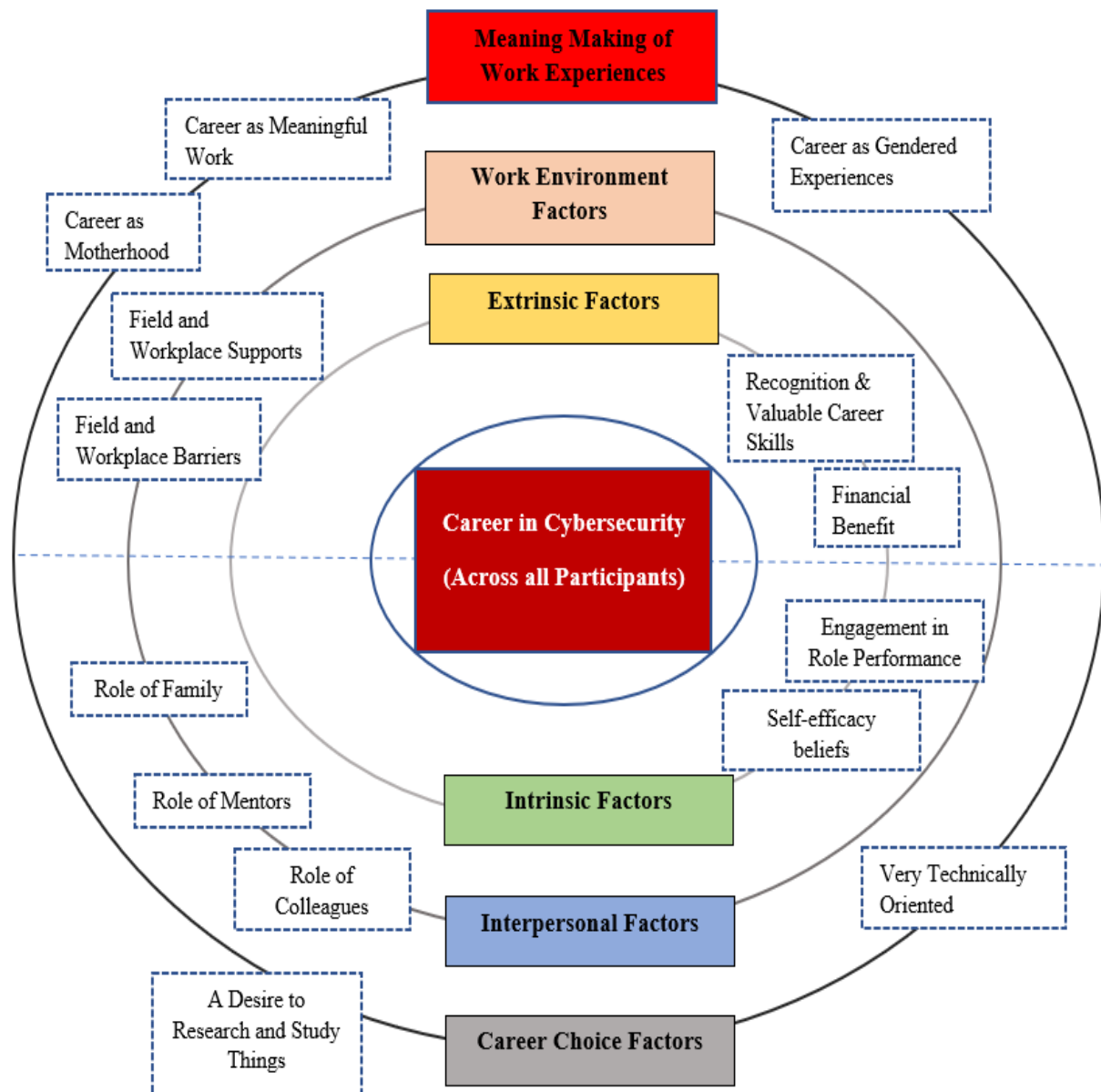
Figure 5.1

Themes and Categories Found in Common Across Participants.

cybersecurity related career choice, each of the participants set personal goals with respect to higher education degrees and job choices. Each participant has at least a master's degree in a computer science related field. While Angie, Alicia, Krista, and Sherry followed a career path all within the field of computer science and cybersecurity, Lisa and Mariah came to cybersecurity through other paths. Angie received a bachelor's degree in informatics, a master's degree in security, and a short-term work experience at a banking institution in the security domain before moving to doctoral and post-doctoral research work. It is during her time at the bank that Angie felt a desire to pursue further studies:

> *I wanted to try something that I am not familiar with, something that I am not taught yet, something that I had to study for. So, I went to get a Ph.D.*

Angie pursued a doctoral degree (Ph.D.), followed by post-doctoral scholarship on applied security.

Alicia received a bachelor's degree in computer science, and pursued an internship at a security focused start-up before moving onto a master's degree in security, followed by a doctoral degree (Ph.D.) in cybersecurity. At the time of this interview, she worked as a senior researcher in a leadership role, developing ideas and prototypes for implementation at a security focused technology company. Alicia indicated new research possibilities keep her motivated to work in the field.

Krista has the greatest number of degrees amongst all participants. She received a bachelor's degree in computer science, a master's degree in software engineering, an MBA, and most recently a professional doctorate (EdD) in educational leadership. She has over 20 years of

experience as a computer scientist and over 15 years of experience working in the realm of cybersecurity. Krista shared:

> *If you are a person that likes to learn and continue learning new things, there is no way you are ever going to get bored. So, for me, one of the motivators is there is always plenty of new stuff out there. If you are tired of what you are doing, there is always something else (in the field).*

Sherry shared a similar perspective to learning. She earned a bachelor's degree in computer science as well, and received a master's degree in computer engineering. Sherry said:

> *I never stopped learning. I never stopped being curious. I never stopped wanting to take on the next challenge… I would say I did that probably for the first 18 or 20 years of my career.*

Sherry has over 30 years of work experience in software engineering in building secured applications. After retirement, Sherry has associated herself with academia to teach cybersecurity and systems engineering related courses to undergraduates and graduates at the university level.

In contrast to Angie, Alicia, Krista, and Sherry, Lisa and Mariah came to cybersecurity through other pathways. Lisa received a bachelor's degree in zoology and horticulture, then moved on to a degree program in entomology, and worked as a "bug hunter in Mexico" for a while. She then returned to the U.S. and gained a master's degree in library and information sciences and an associate degree in computer and network engineering. She also interned at a law enforcement office before moving onto a security focused start-up in the finance domain. Lisa works as a security operations manager overseeing a team of security engineers. She shared "in

all the STEM fields, it's all about how things function" and that is why she does not think there was a "drastic change" in switching from zoology and entomology to cybersecurity:

> *I was literally a bug hunter for a while, but then, you start working with computers and you still get that underlying foundation of what is happening. It is just that desire to research and study things. So, "was that change really drastic?" Not really, because if you are curious and you like to know how things function, it is very much the same.*

Similar to Lisa, Mariah found her entry into cybersecurity through other paths.

Mariah received a bachelor's degree in psychology and served in the U.S. military for 4 years as an intelligence officer. She learned different kinds of intel including strategic and tactical intel. She was also deployed in the middle-east twice during her 4-year service in the military. Towards the end of her military career, she enrolled in a distance program for a master's degree in cybersecurity management. She also interned at a large technology company in a cybersecurity position. After completing her internship, Mariah got an opportunity to work as a program manager overseeing all cybersecurity project managers at another U.S. based technology company.

Reed et al. (2017) and (ISC)² (2019) both suggest that women in cybersecurity assert themselves with higher levels of education degrees and certifications compared to their male counterparts. In this study, all six female participants have earned higher education degree and at least a master's degree to forge their career path in cybersecurity. To follow a certain career path, it is necessary to set an intention to pursue the path by seeking relevant academic or job-related training (Lent & Brown, 2013). Subsequent attainment of degrees or gaining knowledge and

skills through these experiences lead to enactment of career goals and preparation for, and eventually entry into, a cybersecurity career (Fouad & Santana, 2017).

Availability of cybersecurity related jobs also made it possible for participants to take up a career in cybersecurity (Lent & Brown, 2013) even if they did not start on that path in their initial career trajectory. Interestingly, two of the more experienced women in the field who identify themselves as software engineers did not have security focused educational degrees. They went to work at organizations that had a focus on security and that became their focus as well. It appears that they were able to find a congruence in their computer science baccalaureate degrees and the job field broadly, in software development. The phrase "desire to research and study things," used as a label for this category, was used by Lisa in her narration.

Very Technically Oriented. The second common finding of a technical orientation and problem solving appeared across all participants. For instance, Angie found she was a "little bit better" in security courses and this confidence in accomplishing tasks led her to expect positive outcomes from engaging in future tasks in security related courses. This led to the development of interest and further goal setting for occupational interests. After completing a master's degree, she worked in the security domain at a financial institution and explored the "the applied side [of security], doing penetration testing, incident response, and malware testing." It is this interest that led her onto more complex coding in cloud-based systems.

Lisa shared she was always "interested in computer science" and studied it in high school for three years. Although Lisa did not pursue a bachelor's degree in computer science, she found her way back into it during a master's degree in library and information sciences. It is when "courses evolved into security and forensics" she became "really interested in cybersecurity."

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Similarly, Mariah also "had an interest in computers" growing up, but pursued an undergraduate degree in psychology. It is during her work experience in the military that she got to work on computers again. She also exhibited confidence in accomplishing tasks related to computer platforms. Mariah described:

> *I can understand software platforms and hardware platforms really quickly. Which is what I started doing in intel [in the U.S. military]. There is a lot of different platforms you have to learn and that is how I figured out that I was able to do it and also pass my tests pretty quickly and certify different things.*

Alicia also demonstrated very high technical orientation. Alicia shared she was "very interested in systems topics" during her undergraduate degree in computer science. So much so that she aspired to write her "own operating system." During her master's degree in security Alicia became very interested in a hacking contest. She shared:

> *So, we had a hacking contest type of course where you are trying to exploit the program and getting control of a machine and fighting with the unknown. You do not know what is happening and you are trying to understand. I mean, it is problem solving and it is interesting to me. I was working night and day to solve these problems.*

In the participant narratives, it was also exciting to see an evolution in the field of computer science and security. Krista shared she "accidentally ended up in the field." As of 15 years ago, security was not a fully developed area. Krista, as a software engineer, went to work at an organization with a security focus and that ended up being her focus as well. But throughout her career, Krista has had a particular flair in problem-solving. Krista described:

Especially, when it came to application development somebody would come to us and

say, "We have got this problem that we are trying to solve, or we need to figure out how

to track and report something." We would then come up with a way to do that and

implement it into the application.

Similarly, Sherry also shared she was "very technically oriented." However, career development for Sherry happened gradually in trying out different job roles within the realm of computer science and security. Sherry explained:

I was a program manager overseeing multimillion-dollar programs of various

technologies. I was the first female senior fellow at My Firm. So, I was very technically

oriented, but career I could not decide what I wanted to be when I grew up. So, I kept

trying, all within the same company and all basically within the same field.

Participants developed an interest in cybersecurity at some point in their careers either in an academic setting or through workplace experiences which led them to foster career relevant goals and actions related to this career choice (Lent & Brown, 2013). Subsequent performance attainment at work or in academic settings also helped in building their self-efficacy in the field (Lent & Brown, 2013). Interest, as per Social Cognitive Career Theory (SCCT), is considered to be a self-referent process dependent on a person's "existing outlook and arousal triggers, which create attendance to individually specific stimuli from objects or events. This psychological state is associated with positive affect and persistent arousal" (Lamb et al., 2018, p. 447). The participants in this study demonstrated the importance of performance attainment and their self-efficacy related to their performance. The phrase "very technically oriented," adapted as a label for this category, was used by Sherry in her narration.

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Research Question 2. What are the key factors or events that influence women's

career paths in cybersecurity?

The findings for this research question resulted in four main themes: intrinsic factors, extrinsic factors, interpersonal relationships, and workplace factors. Intrinsic factors refer to factors emanating from the self to engage in a cybersecurity career. Extrinsic factors refer to associated rewards and enactment of values. Interpersonal factors refer to the role of others in providing support. Finally, workplace factors refer to supports and barriers related to the field, academic and technical workplace. Details are presented below for each theme.

Intrinsic Factors

Two major intrinsic factors were identified in the data, including: self-efficacy beliefs and engagement in role performance. Each are described in more detail in the following sub-sections.

Self-efficacy beliefs. In terms of factors emanating from the self, participants demonstrated very high self-efficacy beliefs. Based on participant narratives, it appears that self-efficacy arises from many different sources such as performance accomplishments through projects and certifications, making meaningful contributions to the workplace and to the field, job specific skills, and an ability to resolve conflicts either to get a project idea across or negotiating for a raise. Other sources included actively building networks and being seen at work; balancing care work and professional work; support from friends, family, and mentors; finding new projects and assignments; vulnerability, courage, and resilience in adapting to male

dominated work environments and overcoming difficulties rooted in gender; and, in some cases, practicing mindfulness at work.

Mariah and Alicia demonstrated very high self-efficacy beliefs in their cybersecurity specific skills. Mariah mentioned she has an ability to "quickly learn platforms," both "software and hardware platforms." She also emerged as the best performer after year-one evaluations at her current workplace. In her current role as a cybersecurity program manager, Mariah is working on initiatives to "drive change" wherever she sees "inefficiencies," for example in "risk quantification" and "automation" for resource utilization. Alicia, who works in a senior research position in cybersecurity, shared she achieved her career goals on her own with "some luck" in the beginning in working under the guidance of a renowned professor and others in the lab. She insisted that cybersecurity is "not that difficult" to learn and that she was able to do it on her own:

> *I knew nothing about security, but I was able to read around and do better than the other*
> *kids.*

Angie, a post-doctoral scholar, considers her doctoral dissertation research as her "best work so far." Going through her doctoral journey has given Angie the confidence that she can "do anything," she said. Similarly, Lisa also pointed out the importance of attaining career related accomplishments. For example, Lisa takes the time to study for industry certifications as it "empowers" her to earn the associated credentials. She also shared she likes to communicate her accomplishments to her male coworkers.

In terms of conflict resolution and negotiations, participants shared unique yet, similar incidents as well. For example, Alicia shared she had experiences with conflict resolution for

implementation of project ideas. But she was able to go ahead and do what she believed in because of her stellar track record:

> *I am doing my job well. I have some good publications and good outcomes that you can easily quantify. So that is one of the reasons my managers respect my opinions.*

Lisa and Sherry highlighted the need to actively network and make yourself visible when at work and at conferences. "Take a seat at the table," Sherry said. "Do not be a wallflower," Lisa said.

Sherry shared she has had a "great" and a "rewarding career" where she took on a "lot of challenges" and "that was fun." She never had to leave her organization where she worked for 32 years as they never stopped giving her new assignments and opportunities. In addition, Sherry explained she was also able to manage time well between her family and work. It did not come easy as she had to compromise on her sleep a lot. Unfortunately, there were instances where Sherry was called names such as "the dragon lady" and a "bitch." However, Sherry shared she learned to "shrug it off" and not let "stereotypes get in the way."

As a cybersecurity professional and a mother, Krista was able to manage both work and home. She had the flexibility to work from home either part-time or full-time. Krista also mentioned the role of her colleagues, and mentors in finding support. Krista experienced stereotypes in the field, but dealt with it by writing a thesis on the problem of low representation of women in the field. Similarly, Lisa also shared her experiences with the gendered nature of cybersecurity work environment, but demonstrated confidence in handling nuanced situations. She shared subscribing to the Harvard Business Review to self-learn how to handle tricky work situations. Her self-efficacy beliefs also increased in successfully negotiating for technical training that she was initially denied.

Recent research has shown that women who stay in engineering fields demonstrate self-efficacy in three domains: engineering tasks, ability to navigate organizational culture, and ability to manage multiple life roles (Fouad et al., 2011). Similarly, Fouad et al. (2016) also found that women engineers who persistently demonstrate self-efficacy building from the same three domains mentioned above. Buse et al. (2013) found that engineers who persist told stories of successfully finding new assignments, solving challenging technical problems, maneuvering difficult situations, managing conflict with superior or coworkers. All of the participants in this study demonstrated persistent self-efficacy.

Engagement in Role Performance. Sherry emphasized she had a "great career" but she also "worked hard." Sherry shared a typical day at work varied depending on the job role. For instance, when she was "a designer developing a product" she would spend most of her time in the lab. Sherry described:

> *When you are in the lab, you just lose track of time because you are trying to make something work. More times than not it does not work and so you are trying to figure out why it does not work and figure out those challenges.*

Towards the end of her career, when Sherry moved on to leadership roles she was in "meetings all the time." She said, "it was never ending" and sometimes meetings would start at "6:30 in the morning and they would go until 7:30 at night." Sherry shared an example of a favorite project where she had to put in "75–80 hours a week" for an entire year. Similarly, Krista discussed the effort she and her team had to put in on their projects. She described she "wore a lot of different hats" and sometimes people thought their team "was a lot bigger than it was." She shared

performing both administrative as well as technical work as part of her job description. Her diligence and effort in everyday work was particularly interesting. As a "list-oriented person" Krista shared she prefers to write everything down and has a record of task lists for the last seven years.

Angie emphasized the role of effort that she takes in her post-doctoral research work as well. Angie said:

I try to get up early, because the more you stretch it, the more it goes later into the day.

She shared she keeps an ongoing list of tasks as well. It helps her to know that she has "not wasted the whole day doing nothing." As a research scholar working on advanced applied security, Angie discussed that certain tasks are more challenging than others and take more time to complete. Sometimes the chosen techniques and methods work and sometimes they do not. Then she has to "research extensively" and "try different approaches."

Lisa shared in her role as a vulnerability manager "every day is different" and that "you never know what fires you are going to put out." Lisa manages a range of events in her work day starting with "daily intel report," "checking on client accounts," "special projects," "special requests" from clients, "working with the C-levels, going over their presentations, checking their data," "back-end calls" with team-members and clients, "large scale security events" and is also "in-charge of press releases." Lisa also works on "recruitment" and personally visits conferences to hire people for her team.

Alicia shared, as a researcher and as someone in a leadership role at a security focused technological company, her work is very similar to that of "a professor." On a daily basis she is either working on "projects," "reading papers," "writing papers," "answering mails," doing "some coding," and "learning something." To pursue her ideas and projects, she goes and meets with "product groups in the company" and visits "conferences." Alicia shared her efforts have also been recognized as she has been "promoted almost every year" in the last "5–6 years." Mariah pointed out, as a program manager leading all cybersecurity project managers in her technology company, she spends "a lot of time in meetings," she also travels "a lot" as her team is spread "all over the country." She talked elaborately about her own initiatives with risk quantification and resource utilization and the rationale behind those projects. Mariah also shared she "workflows everything" and that helps her "visualize connections in a network" and "find dependencies" and "stakeholders." She indicated using a technological tool called "OmniGraffle like it is no one's business."

Participants demonstrate a strong engagement in their work and connection to their occupation. This is similar to the finding of "work engagement" in Buse et al. (2013), where majority of long tenured women engineers felt motivated and challenged by opportunities to work on new technologies and projects, sought opportunities and engaged in continuous learning opportunities. Buse et al. (2013) adapted the terminology from Kahn's (1990) research on personal engagement at work where people used varying degrees of their physical, cognitive, and emotional selves in work role performances. As per SCCT, individuals' beliefs in their abilities to successfully complete work tasks (i.e., self-efficacy) and beliefs about positive consequences

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resulting from performing those tasks (i.e., outcome expectations) determine the amount of effort they will expend in obtaining their desired goals (Lent & Brown, 1996; Turner et al., 2019). The data from the participants in this study illustrated the linkage between engagement and a connection to their profession.

Extrinsic Factors

Several extrinsic factors were identified in the data, including: financial benefit, recognition, and valuable career skills. Each are described in more detail in the following sub-sections.

Financial Benefit. The importance of financial benefit as a consequence of working in cybersecurity appeared across most participants. Mariah shared "definitely pay" is a great motivator for her to work in this field. Angie also indicated financial benefit as a motivating factor as it allows her to be independent and "do well" for herself. This way she does not have to rely on her parents for money, Angie said. Lisa also shared she appreciates the pay as well as stock options that her company offers to workers. "I have bills and a mortgage," Lisa said. Sherry talked about "equitable pay" and "raises" that she received for her "hard work." She shared it made her feel valued and thus, not ever needing to switch to another organization. The phrase "financial benefit" used as a label for this category was used by Angie in her narration.

Recognition & Valuable Skills. Angie shared her greatest motivation to work in the field is the recognition that women receive as scientists. She believes that when women become scientists it holds more value because "there are so few women" in the field. It also "carries more weight" because women have added responsibilities such as to "take care of their homes" as well as meet "other social pressures." Sherry also leaned toward recognition. She shared it is her

domain experience and a reputation of "getting it done" that brought her much recognition in the organization. She retired as a software engineering director. Krista and Lisa did not talk about recognition directly, but mentioned cybersecurity related skills are highly valued in the job market and that encourages them to work in the field. This acts as a positive reinforcement as Krista said, "people reach out to and they want you to come work for them." Lisa also indicated something similar and shared "it is comforting to be in a field where you know your skills are valued, and you know that you will always be able to find a job."

While there are commonalities there are also some notable differences across participants. For instance, Mariah discussed the combined value of "purpose and patriotism" as motivational factor in her continued work in cybersecurity. She shared it is hard to find purpose in organizations because "to whom does the work really matter?" However, from a patriotic point of view, security can be thought of "as the defense of the company" and that helps her to put things in perspective. Angie shared she finds it encouraging to work on "technological innovations." Lisa mentioned the "continuous learning opportunity" in the field as a motivating factor along with "working with really smart people" on "fascinating stuff."

Positive outcomes, such as money or equitable pay, recognition from work, and earning valued skills appear to function as positive reinforcement for participants. Positive reinforcement, in turn, can contribute to the maintenance of their career choice of cybersecurity (Lent & Brown, 2013). The data from the participants in this study reinforces the effect of positive reinforcement.

Interpersonal Factors

Three interpersonal factors were identified in the data, including: role of mentors, role of colleagues, and role of family. Each are described in more detail in the following sub-sections.

Role of Mentors: Formal and Informal. Sherry discussed the role of "informal mentors," while Angie and Krista talked about the role of formal mentors in their careers. Studies have shown that informal mentoring relationships lead to more favorable outcomes than formal mentoring relationships (Chao et al., 1992; Eby et al., 2013). Angie explained the role of her formal mentors during doctoral degree program and their guidance in successfully completing her studies. She shared "they pointed me in the right direction" and "encouraged to make progress."

Similarly, Krista also mentioned the role that two of her mentors played in her career development. The first mentor "was like a dad" who encouraged her and her coworkers to try new things and discover new directions in the field. The second mentor is a more recent one—a manager with whom she worked on a project together. Although they no longer work on the same team, they have forged a mentor-mentee relationship. Krista lamented she did not find such a mentor sooner in her career. Research shows that male mentors have a positive impact on women's career development (Ramaswami et al., 2010) and there is some evidence that women prefer to work with male mentors (Bevelander & Page, 2011). Lisa pointed out she seeks a "strong female C-level mentor" but is not confident of finding one soon. She said:

> Finding a strong female C-level mentor, I think would be very valuable. I do not think I
> am going to find one of anytime soon. I see that as a challenge because it is always best
> to get words of wisdom from someone who has been in this longer than me.

Research shows that mentoring experiences make important contributions in career development (Allen et al., 2006; Kram, 1985; Noe, 1988; Scandura, 1992). Through mentoring experiences junior women get the opportunity to view senior women in the field as role models (Kelan, 2012). The participants in this study provided evidence that mentors played important roles for them, formally and informally.

Role of Colleagues. Angie shared she "connects" with her peers in her post-doctoral research work, and is able to seek help when she is stuck on a work-related problem for long. Mariah, Alicia, and Krista also talked about the role of colleagues in their work. Mariah mentioned she is "close friends" with one of her female colleagues. Together with their families they get dinner from time to time. Alicia mentioned the role her colleagues play both in project related discussions, and social gatherings especially, during conference visits. She mentioned she does not feel "weird" in their presence for being a woman working in cybersecurity. Similarly, Krista spoke very highly of her colleagues and their role in her career development. Krista described starting her career in a small firm, where she was able to forge bonds with other male coworkers who later grew to be her friends. She considers herself "lucky" to have worked with great people who supported each other and kept that relationship going even years later. She never felt "inferior" to them and always felt "welcome," Krista said.

Support from coworkers create both relational and socio-emotional support for focal individuals and reflect an expression of care towards them (Fouad et al., 2016). This could also lead to a sense of belongingness in the field which is found to be important for women in STEM careers (Cheryan et al., 2017; Good et al., 2012). In general, people seek a sense of belongingness and connection at the workplace (Brown, 2012), the absence of which could lead

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to an abandonment from STEM field to another field where they find a higher sense of belongingness (Good et al., 2012). As demonstrated in the data from this study, peer support played an important role for these participants in choosing to stay in cybersecurity positions.

Role of Family: Spouse, Parents, Grandparents. The participants in this study described the role of their families and their career choices. Lisa mentioned the role of her grandparents in providing her with the inspiration to go into STEM fields. She shared that both of her grandparents were involved in world war 2 and it is her grandfather in particular, who was very supportive of women going into the sciences and the teaching profession.

In a similar vein, Mariah, Krista, and Alicia discussed the supportive role of their parents and spouse. Mariah explained the role of her mother as instrumental in gaining an interest in computers. Her husband has work experience in the IT sector and thus, can relate to the work. Mariah finds guidance in her father with navigating managerial responsibilities, especially with people and their personalities. Krista mentioned her husband also works in cybersecurity and often "bounce ideas off each other." Alicia shared her father inspired her to follow a career path that she liked and provided her with continuous support, and sometimes criticism, but only so Alicia can remain focused at her work, she said.

The role the family members play in career choice was certainly described by the participants in this study. That said, Banerjee et al. (2018) have called for more qualitative studies to examine the role of parents in STEM career choices. Rozek et al. (2017) also suggest that parental involvement can help to promote STEM preparation and career pursuit as parents play a key role in shaping their student's motivational beliefs and educational outcomes in

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subject areas. Further exploration is needed to better understand the roles that family, particularly parents, may play in career decisions.

While there were commonalities across the majority of participants, there were also some notable differences in terms of the roles of family and friends. Most notably, Lisa expressed sadness in her alienation from friends as a result of her career choice of cybersecurity. Lisa shared not everybody can relate to the work she does. Nonetheless, she is "proud" to be associated with this field of work. Exploring the role that friend support plays is another area in need of additional research.

Work Environment Factors

Several work environment factors were identified in the data, including: field and workplace barriers and field and workplace supports. Each are described in more detail in the following sub-sections.

Field and Workplace Barriers. Participants expressed concerns with workplace barriers resulting in gendered and aggressive work and academic environments. Every participant mentioned different experiences and observations related to gender. Angie mentioned people are generally "more critical of women" than they are of men in the field. She also expressed her concern with gender representation in the field becoming another way of discriminating against women. These can either be considered as sexist behaviors or social undermining at the workplace (Fouad et al., 2016). Along similar lines, Lisa brought up her concerns with diversity efforts especially, with respect to conferences designed only for women. She fears that these

efforts could be "isolating women" when the focus should be on "integration" of men and women in the field.

Mariah raised concerns with biased evaluations hindering promotions in the workplace. Although she has not experienced it, isolation and limitation in socializing with male coworkers made her worried. Mariah shared her observation with respect to discrimination in hiring. She mentioned when men hire, they hire those who look like them. Additionally, "one of the biggest challenges" she sees was with men hiring women in managerial roles and not technical roles.

Alicia shared she has experienced more subtle discrimination in her career, but none so severe that she "got hurt from a man." Alicia works in the industry, but often talks with professors in academia and pointed out that when women go up for tenure, they are given names and called "a bitch" or a "homosexual." On a similar note, Sherry mentioned her experiences with being called names such as a "dragon lady" and "a bitch." Krista talked about her experiences with gender stereotype as the "biggest barrier" she experienced in her career.

Research suggests that women in academic and technical workplaces experience such sexist behaviors, isolation, biased evaluations, and non-supportive supervisors (Ayre et al., 2013; Catalyst, 2008; Fouad et al., 2011; Hewlett et al., 2008). These are micro-aggressions (Sue, 2010) which could lead to adverse effects on women's commitment to the workplace and to the profession (Fouad et al., 2016). SCCT model posits that negative influences in the form of micro-aggressions act as barriers to career choice behaviors (Lent et al., 2002).

Sherry, Lisa, Mariah, and Alicia talked about the nature of aggressive work environment. Sherry shared she had to learn not to internalize arrogant behavior and leave the conversation at the table. She shared men tend to get "high and mighty" and she had to learn how to navigate

those situations. Alicia shared there are often "strong criticisms" to work. She then added that new comers to the field might find it a bit unnerving and it could hurt their "self-confidence." But Alicia noted she is a strong person and does not easily get hurt. Mariah talked about the presence of bad management practices where instead of "building each other up," people demonstrate arrogance and "tear you down." She shared such practices hurt people and their "sense of confidence" which in turn effects their productivity. In worst scenarios, it may lead to turnover, which is a concern considering there are so few women cybersecurity professionals in the field. As a program manager herself, Mariah practices "mindfulness" at work and is careful in choosing her thoughts and words at the workplace.

These experiences as shared by participants can be considered micro-aggressive behaviors related to workplace hostility and social undermining by bosses and co-workers (Fouad et al., 2016). Workplace hostility can result either in incivility where individuals experience deviant behavior with ambiguous intent to harm them (Andersson & Pearson, 1999; Fouad et al., 2016). Vicarious experiences of mistreatment of other women is also considered an experience with workplace hostility (Miner-Rubino & Cortina, 2007). Social undermining by bosses or coworkers hinder an individual's ability to maintain positive interpersonal relationships, attain success at work, and maintain a good reputation (Duffy et al., 2002; Fouad et al., 2016). Finding ways to monitor and remove micro-aggressive behaviors in the workplace are necessary, particularly for underrepresented groups.

Field and Workplace Supports. Contextual supports from the work environment have significant influence in participant's career choices (Fouad et al., 2016). Krista discussed the "speed of the environment" and "flexibility to work from home" helped her move forward in her

career during different stages in her career and life roles. The "speed of the environment" inspired her to challenge, learn, and grow in domain experience. Thus, compelling learning experiences may have expanded her sense of technical capabilities leading to further building of self-efficacy, outcome expectations and interest in the field (Lent et al., 2013).

The "flexibility to work from home," enabled Krista to balance responsibilities at home and at work. Krista and Sherry both insisted that this is a great perk for those seeking employment to manage work and family responsibilities. Alicia mentioned the ability to work from home during "early parenthood" as a great perk. "The company is very supportive," Alicia said, when she decided to work from home when her first child was only 4 months old. They were also understanding when she took longer to deliver on some tasks, Alicia shared.

Research has shown that women who persist in engineering careers find support from inclusive work environments that allow them the ability to manage work-family roles and value their contributions (Singh et al., 2018). Mariah also indicated her organization is supportive of work-family culture, provide advancement opportunities, as well as training and development opportunities, which according to Fouad et al. (2016) are all indicators of workplace social support. Also, research shows that manager's support for employees' work-life roles resulted in greater commitment as well as lower turnover intentions (Allen, 2001; Hammer et al., 2009). For participants in this study, an inclusive work environment played a contributing role in their career decisions.

Research Question 3. How do women make meaning of their work experiences as cybersecurity professionals?

Three major findings resulted from the data related to meaning making of work experiences: (1) career as meaningful work, (2) career as gendered experiences, and (3) career as motherhood. The findings within each area are presented below.

Career as Meaningful Work. The significance of work came across very strongly across the participants. The meaning attached to their work appeared in the form of project work experiences either through collaborative effort or individual contribution, and also through authentic connections with coworkers, managers, and supervisors. Frankl (1963) postulated that meaning can be found by creating and doing something that seems like an accomplishment. For example, Angie is "fond" of her doctoral dissertation work as it is her "best work so far." She is also "glad" the research she had started in her previous lab, is now being taken on by another student. It is "interesting" to her that that could happen. Angie mentioned the highly collaborative nature of her academic work experiences and spoke fondly of her academic supervisors and peers. She also drew parallels between the importance of cybersecurity in everyday life and how being a part of that field seems relevant to her; thus, making meaning of her work and its role in the society.

Sherry shared she had a "rewarding career" which involved its own hardships in working on some challenging projects. But the challenges were also fun, she said. Together with her team they were able to see the desired results for some of their critical projects. The directed efforts led to success in project work and also positive team-building with everyone coming together as a "family," Sherry said. Similarly, Krista shared the trials and tribulations in her 7 yearlong

project and how it slowly gained prominence. She mentioned the hardships that came along the way, but in the end, it was "empowering" both for her and for her entire team to see the project finally, take off. Mostly, towards the end when their product became popular and started to be used by more people. Krista emphasized on the supportive role of her colleagues and managers in her career path.

Mariah shared a particular experience in mitigating a virus that had affected their entire organization. This was an important event for Mariah as she realized that what she does "really matters." She also appreciated people in different teams coming together and working collaboratively to resolve this critical issue in hand:

> *It was kind of like masterminding enough, and everyone was getting things done as quickly as possible, being as helpful as possible. Even if it is not in their job description, it is "hey, everyone needs to help right now, and that is totally fine!" ...Umm... so that was really empowering for me because I got to see results. Normally, when you are on the prevention side of it, you do not know what you have prevented... So, you know in moments like that it is really empowering because what I do really matters.*

Mariah then discussed her own initiatives at work where she is focused on meeting some of the inefficiencies with respect to resource utilization and "risk quantification." As Mariah described, she works collaboratively with her team on these initiatives. Interestingly, through one of these initiatives she is trying to reduce the workload of engineers through automation because she believes they need to find time for themselves. She briefly indicated practicing mindfulness at work, so she is aware of her behavior towards others and that of others towards her.

Lisa shared an ability to translate her love for learning directly to cybersecurity work—a field which is constantly evolving and changing. She indicated her interest in "actively calling customers" to resolve issues through her work in vulnerability management. She also emphasized her need to build human relationships at work both with clients and coworkers alike. As a manager, Lisa always checks-in on her team to see if they need to talk, take some time off, visit family, take care of personal issues and more. Similarly, Sherry also indicated the need for connection with coworkers and the value therein throughout her career and even later. Sherry shared her "teaming skills" and "emotional intelligence" got her to oversee projects that she did not even want. She treated people with "respect and dignity" and brought in "humor" during conversations. She indicated carrying a similar mentality in her teaching role now.

In all of these occurrences, we see participants make meaning of their work experiences and actions based on what has happened (Chen, 2001). There is also a social element to these subjective meaning making experiences where they mention the role of relationship with others in varying dimensions (Chen, 2001; Blustein, 2019). While there is an emphasis on their personal engagement, there is also a focus on relationships with others that create necessary frames to reflect on lived experiences. Connection with others helps to meet relatedness needs, to feel known and appreciated, as well as worthwhile in giving support as part of role performances (Kahn, 1990). Persistent women engineers describe their career experiences in terms of reciprocal engagement in providing support, advice and collaborating with others (Buse et al., 2013). Through meaningful task and role characteristics, and work interactions with others, people experience engagement at work which is an important indication of "daring greatly" in everyday life (Brown, 2012). Buse et al. (2013) found that long-tenured women engineers who

persisted in their occupation derived such engagement in work through a match of interest, novelty in work, and the opportunity to find continuous learning opportunity. The participants in this study provide further evidence that having meaningful and engaging work plays a role in career decisions.

Career as Gendered Experiences. The relationship between gender and work led to an expansive diversity of participant experiences. Since, these experiences are deeply felt and have guided further work practices of participants, they are considered as major life turning points (Richardson, 2012). Participants shared different experiences and concerns related to gender either in their academic, work, or personal environments. Incidents of sexism in the workplace, including academic and technical workplace, represented a wide array of manifestations such as workplace hostility, isolation, discrimination, sexual harassment, and marginalization across all participant narratives. For example, Sherry commented on her experiences with name calling such as "dragon lady" and "bitch." Sherry shared she learned to "shrug it off" and not internalize those exchanges. This showcases resilience to go against career barriers and rising above adversity (Brown, 2012; Khilji & Pumroy, 2019; Miller, 2004), and also courage to push back against such behaviors to climb the career ladder. Similar to Sherry, other participants discussed their experiences and grievances that reflect the aversive impact of gendered experiences in their work lives.

Angie shared her experience with overcoming traumatic sexual mistreatment by her advisor, during master's degree, and how she overcame that with the help from a female lab mate, who was her senior. Incidents with sexual harassment in science and engineering fields are reported by over 50% of women (Hewlett et al., 2014; Smith & Gayles, 2018). Based on that life

experience, Angie indicated she is now willing to help any women who would seek her counsel in this regard – a sign of solidarity or sisterhood behavior by virtue of gender identity (O'Neil et al., 2018):

> *First of all, I did not know what to do, because you see, it was a situation where I had no agency and no power. If something were to go wrong, then I was the one that would be screwed. Because maybe I would not graduate or be graded poorly in my thesis and I did not want that to happen. But, on the other hand, I was feeling bad as to, you know, what to say, what to do.*

On a separate yet similar note, Angie raised an important concern about expectations from being a career woman. She shared women now have to be "recognized at work," have a "family and raise children," be "a good wife," a "good mom," and "a good cook." This is reflected in Richardson's (1993) work on the need for women to now be competent in their occupational role as well as their role as care givers.

Lisa shared her experience with sexual mistreatment in high school that changed her course from computer science to pre-med. According to SCCT, learning experiences gathered through specific gender-based experiences can deter women from continuing on a STEM related career path (Lent & Brown, 2013). She also talked about her experiences with gender discrimination in being denied technical training. She demonstrated vulnerability, courage, and resilience in going back to her superiors and negotiating without confrontations to get her due diligence (Brown, 2012; Khilji & Pumroy, 2019). Another participant, Alicia talked about her experiences with subtle prejudice in the field and reflected at length about the problems with discrimination. Her voice was cheery when she talked at length about the welcome relief from

discrimination during her recent official visit to a Scandinavian country. She shared, "I could not sense them thinking about me in a negative way. That was amazing!"

Krista pointed out her "biggest barrier" with gender stereotype led her on a quest to study the particular problem of low female representation in the field and to write a thesis on it. She did not let gendered experiences deter her and instead she found a way to channel that energy into a study. Krista was resilient and continued to work in the field (Brown, 2012). Although Mariah did not report any direct experience with sexism, she mentioned she has worked in male dominated fields all throughout her career including military and cybersecurity. So, she is always "mindful" of her behavior at the workplace such as to negotiate for salary, and not over apologize at the workplace. She indicated that she is "boisterous enough" to speak up when she feels the need for it. Thus, showcasing resilience to either negotiate or defy rules to establish her own (Khilji & Pumroy, 2019).

The vulnerability that women experience in the workplace is apparent in all the vignettes shared above. It also creates an understanding of the tightly interconnected nature of gender and work (Blustein, 2019). It appears that courage and resilience are the tools that women use to create inner strength and continue to thrive (Brown, 2012). It also appears that navigating such incidents create learning experiences that further build their self-efficacy in working in this field (Foley & Lytle, 2015; Lent & Brown, 2013). The women in this study have developed an ability to critically reflect on such inequities of the workplace and in their own ways engage in action to challenge such oppressive practices.

Career as Motherhood. Lived experiences of women exhibit that caring and working experiences are intertwined and not far from each other. Participants with children discussed the

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overlapping nature of their professional work and personal care work of loved ones. Sherry shared her journey with motherhood and the balance she struck between office work and parenting. At first the challenge for Sherry, was in getting pregnant. She had to go through in-vitro fertilization to conceive her children – twin daughters; an important turning point in her life (Richardson, 2012):

> *So, because I am a workaholic and because I wanted a family, I had to work for my family. I had trouble getting pregnant. So, I ended up having IVF which is in-vitro fertilization and ended up with twins—two girls!*

Sherry indicated making conscious efforts to be a part of her children's lives by participating in and organizing school events. All the while also going above and beyond at her work. This required Sherry to compromise on her sleep and exercise, she said. However, after her children grew up, Sherry was able to find time for herself again.

As a new mother, Alicia mentioned her "challenges" with motherhood trying to take care of the child, managing household chores, and doing her professional work. Alicia shared her husband, an academic in the field of cybersecurity, holds a demanding job too. But they take turns to take care of their child. Thus, Alicia is using social support from her spouse as a coping technique to meet parenting demands at home (Yang et al., 2020). This is also a promising finding to see that men are also doing caregiving work. Alicia indicated she remains optimistic that parenting demands which seemed "pretty challenging" in the beginning will stabilize over time. She also indicated her work team and managers were extremely supportive during this time. Mariah, also a new mother hinted at some of the benefits that her organization offers to

working parents such as maternity and paternity support, flexibility in logging into work, taking time off when needed and more.

Another participant, Krista shared her journey with motherhood alongside her professional work. Her approach to work was different from Alicia and Sherry. Krista chose to work remotely either part-time or full-time to find a balance between professional work and care work. Krista's husband also works in the security industry and thus, the flexibility to work at a distance helped Krista meet their parenting needs. Krista shared she sometimes found the demands of her job difficult to cope with and had to leave one of her jobs because they required her to "travel a lot," work on "weekends" and "on holidays." As the primary caregiver to her family, Krista found these demands particularly challenging and denied involvement in such excessive work activities to attend to family responsibilities (Yang et al., 2020). Krista also found the flexibility to work from home, either full time or part time, which allowed her to manage both work and family (Buse et al., 2013; Wang & Degol, 2017). With rigorous planning around work and care schedules, Krista has been able to manage the two worlds.

Examining the relationships between caring and work helped participants reflect on their experiences. It also creates an understanding of the role of workplaces in creating the layer of support for accommodating parenting needs and care work. This is useful because past research has shown that women are highly likely to leave computer science occupations once they have children (Ginther & Rosenbloom, 2015) or due to a lack of part-time work availability (Kahn & Ginther, 2015). Career theorists such as Blustein (2019) and Richardson (1993; 2012) have emphasized the importance of work done within the occupational structure and in the personal space. The participants' stories from this study help to further our understanding of the role of

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care work and professional work and the importance of both in the construction of lived

experiences.

CHAPTER 6

CONCLUSIONS

Summary and Overall Interpretation of Findings

The purpose of this qualitative narrative study was to explore the life and work experiences of women working in the area of cybersecurity, leading to an understanding of cybersecurity as a career choice for women. To derive an understanding of the experiences as described in the research questions and arrive at conclusions, I interviewed women with work experience in the field of cybersecurity. Overall, 6 participant interviews were selected for this narrative study: Lisa, Mariah, Angie, Alicia, Krista, and Sherry, where Lisa has the least number of years of experience in the field and Sherry has the most. Participants work either in academia, industry, the government, or in a combination of these areas, and are each located in a different geographic location. Analysis of participant interviews, both individually and as a group, led to the results of this study.

This chapter presents an overall interpretation of the findings in relation to the literature on women in cybersecurity and in STEM professions, as well as the theoretical framework created for this study, which includes social cognitive career theory, feminist standpoint theory, Wholehearted living, and meaning making of work experiences. Using a qualitative narrative research study design, and both interpretive and critical lens enabled me to identify several factors which contributed to the advancement of the women's career journey. The chapter also

includes a discussion of the limitations of the study, areas for future research, and a brief summary. The narrative inquiry in this study focused on the following research questions:

1. How do women describe their career choice of cybersecurity?

2. What are the key factors or events that influenced their career paths in cybersecurity?

3. How do women make meaning of their work experiences as cybersecurity professionals?

A thorough exploration resulted in the following themes for each research question: (1) career choice factors: a desire to research and study things, and being very technically oriented, (2) key career influential factors: intrinsic factors, extrinsic factors, interpersonal factors, and work environment factors, (3) meaning making of work experiences: career as meaningful work, career as motherhood, and career as gendered experiences. Together, all of these factors create an understanding of women's career development in cybersecurity. The interpretation of the findings are presented by integrating results across participants.

Overall Interpretation of the Findings

While each participant has chosen to work in the field of cybersecurity, their paths leading up to cybersecurity and experiences working in the field vary. I discuss the findings with respect to each research question below.

RQ1. How do women describe their career choice of cybersecurity? Findings of the study resulted in a major theme of career choice factors and two major categories: a desire to research and study things and being very technically oriented. The first category broadly, refers to participants' attainment of knowledge through higher education degrees, internship opportunities, and other learning opportunities within their job roles to pursue a career in

cybersecurity. Each of the participants has at least a master's degree in a related field. Angie and Alicia, both have doctoral degrees in cybersecurity and are employed in research positions – Angie in academia and Alicia in the industry. Krista has several advanced degrees such as a master's in software engineering, an MBA and most recently, an EdD in educational leadership. Sherry has a master's degree in computer engineering. Both Krista and Sherry got into the field with a bachelor's degree in computer science and got their advanced degrees later in their career path. Mariah has a master's degree in cybersecurity management and Lisa has a master's degree in library and information sciences which she earned alongside an associate's degree in network and security engineering. Mariah and Lisa have earned their bachelor's degree in psychology and zoology, respectively. Before beginning their fulltime employment in cybersecurity, they also gained relative work experience through internships. For all of the participants, a rich and thorough understanding of the field was important, although the path to which they got to that understanding differed. Finding ways to support women as they are developing their understanding of cybersecurity is one implication from this study.

The second category refers to participants' technical orientation and alignment to the nature of cybersecurity work. For instance, Angie discussed her interest in working on the applied side of security and thus, working on advanced coding in cloud security. Lisa mentioned she was always interested in computer science, as early as high school. Although she pursued other STEM fields for a while, she came back to learning computer science concepts during her master's degree in library sciences. She found herself drawn to security and forensics during this time and decided to follow that path. Mariah indicated it is during her time in the military she realized she has an ability to understand computer platforms such as hardware and software very

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quickly. Again, indicating an orientation towards the technical realm. Alicia shared she was interested to write her own operating system during the third year of bachelor's degree. Then during her master's degree, Alicia participated in a hacking contest and performed the best to reach the highest level. She was very enthusiastic about the problem solving it involved. Sherry explained her inclination towards technical work and cited she was the first female senior fellow at her organization, where she worked for 32 years. Similarly, Krista also shared her interest in problem solving, which is why she continues to work in this field of cybersecurity. The technical orientation that these women shared also provides evidence that supporting women as they are developing an understanding of cybersecurity is an implication from this study.

As noted in Fouad et al. (2016), "engineering jobs demand extensive educational skills and continual training" (p. 90), and it is true as per the findings in this study. Although not all participants in this study have computer science degrees, they have cybersecurity related higher education degrees and earned certifications. Thus, participants have acquired the knowledge and skills necessary to work in these environments. It is also important to note that participants shared their abilities to work in this space positively which matters as self-referent thought determines the relationship between knowledge and action (Bandura, 1982; Buse et al., 2013).

The findings in this study do not support prior research that suggests soft skills and business acumen take priority over technical expertise (Bagchi-Sen et al., 2010) and rather somewhat aligns with the findings of McGee (2018) that suggest women in information technology occupations need a combination of technical skills, soft skills, and business acumen. All participants emphasized the need for technical skills to work in these varied roles including technical/operational roles, academic roles, and later in advancement to executive roles. The

need to have good communication skills and confidence were also identified as necessary for being in the field. Participants in this study did not specifically talk about the need for business acumen. Additionally, the findings in this study support prior research by Buse et al. (2013) that persistent women in engineering careers describe their attributes, values as well as work experiences in terms of problem solving, working with clients, taking a seat at the table, and so on. These are similar characteristics that participants in this study demonstrated as well.

RQ2. What are the key factors or events that influenced their career paths in cybersecurity? Findings suggest that participants found the following factors to be influential in their career path: intrinsic and extrinsic factors, interpersonal factors, and work environment factors. The categories within each of these broad themes resulted in some common findings and notable differences across participants.

In terms of intrinsic factors emanating from the self to engage in a cybersecurity career, the findings resulted in two categories: (1) self-efficacy beliefs, and (2) engagement in role performance. Participants' self-efficacy beliefs arose from their ability to execute their responsibilities at work, navigate the workplace including its many barriers, and balance their life roles at home and at work. These sources of self-efficacy beliefs are also found in past research by Buse et al. (2013) and Fouad et al. (2011). Participants demonstrated an engagement in their role performance by describing the efforts they take in their varied tasks on a day-to-day basis, take on different roles and responsibilities, work on challenging projects, continue to seek learning opportunities, and so on. The use of engagement is based on Kahn's (1990) research on personal engagement at work where people used varying degrees of their physical, cognitive, and emotional selves in work role performances. In engaging in such work, Browns' (2012) research

on courage and vulnerabilities come alive as it highlights participants engaging with their vulnerabilities in their research roles or industry roles in leading projects.

In terms of extrinsic factors, associated rewards and enactment of values, the findings resulted in two broad categories: (1) financial benefit, and (2) recognition and valuable career skills. While Angie, Mariah, and Lisa mentioned money as a motivating factor, Sherry shared that equitable pay was one of the reasons why she chose to stay with her employer for long term. Recognition from work and the value of cybersecurity related career skills in the job market also seemed important to participants. Except Alicia, all other participants mentioned the role of an extrinsic influential factor in their career paths in cybersecurity.

In terms of interpersonal factors (i.e., role of others), the findings resulted in three significant categories: (1) role of mentors, both formal and informal, (2) role of colleagues, and (3) role of familial relationships such as those of spouse, parents, and/or grandparents. In their research, Fouad and Singh (2011) recommended offering mentorship opportunities for women in STEM careers. The findings in this study suggest the importance of mentorship, both formal and informal, in cybersecurity careers. Additionally, coworker/peer support was identified as an important criterion for participants in career progression. Past research also indicates that coworker support has a significant effect on persistence of women in engineering careers (Fouad et al., 2016). Interpersonal support from others at the workplace is also important to create a sense of belongingness in the field (Cheryan et al., 2017). The absence of belongingness and connection leads to suffering in people (Brown, 2012). Participants also mentioned the support of parents/grandparents and spouses. Further research is required to understand the significance of early and ongoing support from family members.

In terms of occupational and workplace factors, the findings resulted in two categories: (1) field and workplace barriers, and (2) field and workplace supports. In terms of barriers, participants mentioned several experiences related to gendered and aggressive work environments. Participants discussed their experiences in the field with implicit bias, sexist behaviors, social undermining, isolation, exclusion from networking opportunities, name calling, and other microaggressions. Research suggests that unfortunately, these experiences are far too common amongst women in engineering and other STEM-related careers (Amon, 2017; Powell & Sang, 2015; Rhoton, 2011; Smith & Gayles, 2018; Wynn & Correll, 2017). The power dynamics in the field needs to be called into question, and academic and technical workplaces alike need to create better environments where there are less barriers and more support.

In terms of workplace supports, participants spoke positively about some of the support received from the work environment in motivating and challenging them to propel their careers, through advancement opportunities, training and development opportunities, networking programs for women in leadership roles, flexibility to work from home, and a greater understanding of managers in meeting life roles at work and home. Past research suggests that these are examples of workplace social supports that indicate to employees that their well-being is valued by their employer (Fouad et al., 2016; Kossek et al., 2011). As per SCCT, contextual factors such as supports from workplace are positively related to career choice behavior (Lent et al., 2002). There is a positive relationship between employee's perceived organizational support and intentions to stay and commit to work (Eisenberg et al., 2016; Fouad et al., 2016; Shore & Wayne, 1993). Employees who experience better training and development demonstrate positive job attitudes, persistence, and loyalty (Fouad et al., 2016; Wayne et al., 1997). Studies have also

shown that workplace practices resulting in supportive work and family roles by managers lead to commitment to the workplace and lower turnover intentions (Allen, 2001; Fouad et al., 2016; Hammer et al., 2009). Finding ways to provide more support so that women recognize that the organization is aware of the challenges is an important implication for this study.

RQ3. How do women make meaning of their work experiences as cybersecurity professionals? The present study sought to understand women's lived experiences in cybersecurity careers and the meaning they associate with varied work experiences. Findings of this study resulted in a major theme of meaning making of work and relationships and three categories: (1) career as meaningful work, (2) career as gendered experiences, and (3) career as motherhood. Together the findings bring forth the importance of work, barriers that women experience as a result of their gender, and the overlapping nature of professional work and personal care work.

In terms of career as meaningful work, participants' narration evoked a strong significance of work, irrespective of the duration of their work experience. They found a way to connect to their work, the workplace, and engage in ways that felt worthwhile. Participants reflected on the success and hardships involved in various projects and day to day operations. While they spoke of their individual achievements, they also talked about the synergies resulting from collaborative effort in projects. This finding aligns with past research in that professional work has been shown to play a central role in people's lives (Blustein, 2019; Frankl, 1963). Other studies have found that women who persist in engineering careers find work engagement through motivating and challenging opportunities and reciprocal engagement via collaboration or in providing counsel, advice and support (Buse et al., 2013), and occupational commitment to

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engineering careers because it has a "personal meaning" to them (Fouad et al., 2016). Connection with others gives our lives purpose and meaning (Brown, 2012). Thus, it is not surprising that participants make meaning of their professional careers in conjunction with those they work with. Continuing to find ways to help women see the importance of their work and work in collaboration with others has implications for how women may enter as well as stay in the field.

In terms of career as gendered experiences, this study provides specific anecdotal experiences encountered by participants in school or workplace settings. While there is a growing body of literature on such experiences of women in academia as well as the industry (Fouad et al., 2016; McGee, 2018; Smith & Gayles, 2018), the novelty of the present study is in that it looks at gender dynamics at different points in women's lives ranging from high school all the way up to the workplace. The use of a feminist lens helped to study the influence of gender in meaning making and critically reflect on the prevalence of male privilege. The findings in this study and in the context of cybersecurity are similar to other gender studies in that it showcases workplace hostility, isolation, discrimination, sexual harassment, and marginalization that women experience in their workplace (Armstrong & Riemenschneider, 2014; Buse et al., 2013; Catalyst, 2019a; Fouad et al., 2016; Hewlett et al., 2008; McGee, 2018; Reed at al., 2017; Roldan et al., 2004; Schneider et al., 2013).

The findings of this study provide evidence that women remain vulnerable and yet, exhibit courage and resilient behavior to sometimes push back against the workplace barriers and create their own path (Brown, 2012). For example, Lisa found a way to negotiate for funds to undergo technical training when she was denied training at first. Mariah asked for a raise even

when it was against organizational policy to do so for year-old employees. Angie found a way to address the sexual harassment from her academic supervisor during master's studies. In other instances, Krista faced implicit bias, Sherry experienced name calling, and Alicia experienced subtle gender discrimination. The data from this study indicate that women exhibit very high resilience and continue to thrive at the workplace. Other studies have indicated that women who persist in these workplaces demonstrate resilience (Khilji & Pumroy, 2019) or showcase adaptability to male dominated work cultures (Buse et al., 2013; Fouad et al., 2016; Fouad & Singh, 2011). In spite of the many micro-aggressions that women face in such careers, some of them remain persistent and continue to contribute to the STEM workplace (Amon, 2017; Buse et al., 2013; Fouad et al., 2016; Hewlett et al., 2008; McPherson, 2017; Neumann et al., 2016; Powell & Sang, 2015; Smith & Gayles, 2018).

Finally, in terms of career as motherhood, experiences of care work was found to be equally important in women's lives. To make room for work and home responsibilities, participants demonstrated different coping techniques. For example, sacrificing sleep to give time to work and family, giving up jobs that require more time than they can afford to, sharing care work with their spouse, and seeking support from the workplace to find flexible ways to accommodate both worlds. As enacted in the works of Blustein (2019) and Richardson (2012), care work in the family holds equal priority and it is apparent in the case of this study participants. Similar to Fouad et al. (2016), participants in this study reported favorably about their managers and provisions of their organizations towards work-life obligations. In addition, this study also found that married women with children seek the flexibility to work from home either part-time or full-time in continuing to work and balance multiple life roles. This finding is

important because past research has shown that women left computer science occupations when they had children or could not find an ability to work part-time (Ginther & Rosenbloom, 2015; Kahn & Ginther, 2015). Finding ways to support women in their often-complex life situations is an important implication from this study.

<div align="center">**Implications for Theory and Research**</div>

Chapter 2 included a theoretical framework including three major theories: social cognitive career theory (SCCT), feminist standpoint theory (FST), and the theory of Wholehearted living. The results of this study indicate that the unification of these three theories created a robust lens to examine the lived experiences of women's career development in cybersecurity. SCCT created an understanding of women's development of career interests, self-efficacy beliefs, outcome expectations, and contextual supports and barriers. FST helped to provide further evidence of power dynamics, bias, and micro-aggressive behaviors in cybersecurity. The theory of Wholehearted living created an understanding of the vulnerability that women experience, and the courage and resilience they exhibit to address concerns of their work lives and thrive at the workplace. The findings and implications in relation to each of these theories are discussed in the following sections.

Social Cognitive Career Theory

Social Cognitive Career Theory (SCCT) as a vocational theory helps to identify the complex manner in which people, their behavior, and the environment in which they socialize mutually influence each other (Lent & Brown, 2013; Lent et al., 1994; 2000). SCCT helped me in this study to understand how women develop their career interest, make a career choice, and maintain their career behavior in cybersecurity. For example, the results from this study

identified the career choice factors of the participants as related to a desire to increase knowledge and skills through continual training and development, as well as an interest in complex problem solving. Together these factors helped the participants to align their interests to their chosen career paths. The three interrelated variables of SCCT namely, self-efficacy, outcome expectations, and personal goal setting, were all identified as important considerations to the participants in this study (Lent & Brown, 2013). In addition, it became clear that participants exercise agency over their career choice behavior and make decisions accordingly.

Self-efficacy beliefs were found to be derived not only on the basis of expertise in the career but also through other aspects of their jobs such as their ability to overcome workplace barriers, manage multiple life roles, and also support received from others as found in past research (Buse et al., 2013; Fouad et al., 2011, Fouad et al., 2016). In addition, participants identified other factors that motivate them to work in this space such as economic value of the job, recognition in the workplace or in the field, working on advanced technologies, and so on. Thus, hinting at outcome expectations from engaging in cybersecurity careers (Lent et al., 1994; 2000). SCCT also helped to bring the focus on individual and collective contextual supports and barriers (Lent et al., 2000). The role of mentors, family members, coworkers and managers were all identified as social supports that participants found to be very helpful, or indicated as challenges when they did not have access to such supports.

Participants also mentioned the role of other workplace supports such as advancement opportunities, equitable pay, training and development opportunities, and flexibility to work from home (Buse et al., 2013). Provisions to manage professional work and personal care work were also favorably spoken of (Bluestein, 2019; Richardson, 2012). In terms of barriers,

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participants collectively spoke about their experiences with micro-aggressive behaviors which take shape in many different forms in this field (Fouad et al., 2016). The findings in this study are consistent with the SCCT theory; thus, confirming it as a key element in the theoretical framework.

Feminist Standpoint Theory

Based on women's patterns of experience in the cybersecurity community, Feminist Standpoint Theory (FST) helped to better understand the sexist academic and workplace practices as a system of oppression. Considering standpoints are based on "critical, conscious reflection on the ways in which power structures and resulting social locations influences knowledge production" (Intemann, 2010, p. 785). Using this lens led to an understanding of the issues women – a minority in this field – experience as part of their careers. FST made possible to examine more thoroughly the circumstances that create barriers and adversely affect their place in the field. Although participants in this study have unique life and career experiences, there is an underlying similarity with their concerns about the field including implicit bias, sexism, sexual harassment, micro-aggressive behaviors such as social undermining of women in the field, workplace hostility and incivility (Fouad et al., 2016; Smith & Gayles, 2018).

The study found that considering there is no structured way to resolve these issues, women themselves find ways to maneuver such challenges and develop different coping mechanisms. It appears that women differ in how they respond to and cope with such behaviors. It was interesting to see how women drew upon their personal experiences as well as bystander experiences and gave equal weightage to both. It is clear that women in cybersecurity workplaces, academic and technical, want things to be different but there is a helplessness as to

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how to proceed. Is it more of a cybersecurity/engineering career specific issue or is it a wider

societal problem that need solutioning at a larger scale? This is something that we all need to

think about and care for more deeply than at a surface level. The lens that FST brings can help

scholars and practitioners think about best practices and strategies for addressing these issues.

Wholehearted Living

The theory of Wholehearted living helped to focus on how women resolve the issues that

arise in their daily lives (Brown, 2012). These issues could be either because of the nature of

their work in research or in the industry, or broadly because of the issues women experience

because of their gender. Based on the findings of this study, it appears that women are vulnerable

and yet, demonstrate courage and resilience in getting back up after facing a challenge and

persisting in the workplace. They experience "uncertainty, risk, and emotional exposure"

(Brown, 2012, p. 34) not only because of their gender and how they navigate their careers, but

also the challenges inherent in the nature of their work in cybersecurity.

The findings in this study suggest that even though women experience extreme

difficulties they practice Wholeheartedness by extending support, having tough conversations at

work, and finding connections with their co-workers. They let themselves be seen and in spite of

challenges they continue to engage at the workplace by putting in the needed effort, working on

collaborative projects, and thrive. Past research such as Buse et al. (2013) found that women who

persist in engineering careers demonstrate adaptability to the workplace culture. But using the

lens of Wholehearted living this study shows that women in these professions are actually

vulnerable, and it is through resilience and courage that they are able to resolve their problems

and furthermore, stay engaged in a meaningful way. Resilience is a core component of

Wholehearted living (Brown, 2012) and broadly, resilience research shows that resilient people are resourceful, self-reliant, have high self-efficacy beliefs, seek help when they are stuck, demonstrate an ability to cope with circumstances, and are also connected to other people (Brown, 2010; Jackson et al., 2007; Polk, 1997; Tugade & Fredrickson, 2004). Resilient women are able to overcome barriers rooted in gender (Khilji & Pumroy, 2019) and rise above adversity (Miller, 2004). Continuing to explore this role of resilience and Wholehearted living for women in STEM related fields may provide additional insights that will enable more women to stay in their chosen career.

Implications for Practice

The results from this study broaden our understanding of the field and direct our attention to efforts needed to recruit and retain women in cybersecurity in the following ways: (1) supporting women who enter the field of cybersecurity through other career paths, (2) creating informational videos with women in varied cybersecurity career roles, in different stages, might help to create an informed perspective of the field, (3) providing and encouraging internship opportunities should by educational institutions, (4) creating opportunities for mentorship, both formal and informal, (5) building awareness of bias and micro-aggressive behaviors to create safe and supportive workplaces, (6) providing flexibility to work from home and allow multiple life roles to flourish, (7) creating conferences and other forums where both men and women congregate and learn from each other, and (8) offering free travel and accommodation to female

early academics for increased conference participation. Each of these implications for practice are described in detail below.

The findings from this study suggest that women in other fields, when interested, can also take up cybersecurity careers. Those with a technical orientation and an interest in problem solving can align their backgrounds to match careers in cybersecurity. One challenge may be that women are not aware of how they might enter the field. One implication for practice is a need to create informational videos with women currently working in different capacities within cybersecurity careers such as project managers, program managers as well as women cybersecurity engineers in the field to demonstrate what they do and to share stories of how they have navigated their careers. It may also help dispel some of the misconceptions around what constitutes working in the field of cybersecurity. For instance, participants in this study have a mix of different backgrounds and also different type of work responsibilities and profiles; highlighting these differences can create a better understanding of working in this field.

The videos can also provide information about the perks of the field. Cybersecurity careers often offer high salaries, recognition, continual learning opportunity, travel opportunities, and stability of jobs. Women who are in the positions can weigh in on the perks to take up suitable careers in the field. Finally, the videos should emphasize that self-efficacy is malleable in nature and that development of knowledge and skills happen in time with related experiences. The findings from this study suggest that organizations pay for technical training and allow time off for skill development. Thus, women can take advantage of these opportunities to work towards their career development and gain skills necessary for their job roles.

Two factors seem worth considering for future work: internship and mentorship opportunities. First, participants in this study mentioned taking up internships to get relevant work experience. Educational institutions should encourage students to take advantage of internships and, likewise, organizations with cybersecurity related careers should create such opportunities and allow women to explore the nature of this work. This experience may help women who are new to the field set expectations and learn from those who have worked longer in the field. It is important to note that recent research indicates that young women experience implicit bias, sexism, and sexual harassment in the workplace through internship experiences (Smith & Gayles, 2018). Since, internships are formative experiences, companies hiring interns should make sure that interns work with supportive men and women in a bias free environment. Interns should also be given enough time to develop their credibility and skills during this period.

Participants mentioned the role of effective mentorship as important in career development, in both academic and technical workplaces, throughout their careers. While some mentioned the role of formal mentorship, others mentioned the role of informal mentorship. Based on participant data it appears that women who found better mentorship later in their careers wished they had received it earlier. Women indicated mentorship received both from men and women as helpful in charting their career journeys. This finding aligns with past research on the value of mentorship, in general (Allen et al., 2006; Kram, 1985; Noe, 1988; Scandura, 1992). Finding ways to create mentoring opportunities is an important implication for education and organizations.

Women found the flexibility to work from home very helpful in taking care of both professional work and care work. More organizations should make this possible for women to

work remote either part-time or fulltime. Participants found it helpful when managers were understanding of their need to manage multiple life roles. Progressive workplace policies that accommodate for the changing life roles of women (and men) should be prioritized at workplaces. With the advancement in technological tools and availability of broadband, working remote has become even more possible today. As one participant said, care work should be given equal priority as they are entrusted with raising the future generation. Recent and past research indicates that employees who experience supportive work-family cultures stay longer in their careers and demonstrate higher organizational commitment (Eisenberger et al., 1986; Fouad et al., 2016; Shore & Wayne, 1993).

The findings in this study indicate the urgency to pay attention and rid academic and technical workplaces of implicit bias, sexist behaviors, and micro-aggressions resulting in social undermining of women, workplace incivility and hostility. The findings are appalling as to the range in which these behaviors take shape and inflict women in the workplace. While there is an emphasis to recruit and retain more women in cybersecurity, equal emphasis should be paid to the well-being of women in these careers. The focus should be on creating more inclusive and supportive environments so people of all genders and backgrounds can feel safe to create, innovate, and care for others with whom they work.

Surveys to assess the climate of the workplace, in both academia and technical workplace should be encouraged. More awareness should be built on implicit bias and how each one of us has their blind spots (Banaji & Greenwald, 2013). Programs must be created to spread awareness of how women (and men) can handle situations of workplace hostility and harassment. Similarly, for witnesses of such experiences, there should be directions and actions they can take towards

helping those in need. There should be messaging about the availability of these resources that women (and men) can take advantage of. Also, people should be encouraged not to hesitate or shy away from making use of such resources. Academic and technical workplaces, alike, should take accountability measures for people who perpetuate such behaviors. Additionally, while the U.S. federal law prohibits sex discrimination in employment (as per U.S. Equal Employment Opportunity Commission), participant data suggests that there is still work that remains to be done. Finding ways to reinforce and strengthen anti-discrimination and anti-harassment policies is an important and vital implication for practice.

Since one of the concerns raised in the study was with how conferences and technical workshops aimed only at women can be creating isolating experiences, this study suggests that more thought should go into creating forums that are welcoming and inclusive. As the current focus is to create cybersecurity as a more inclusive and diversified area of work, conferences should perhaps aim at both men and women to congregate and exchange knowledge together. Another suggestion that came from a participant is to offer travel and accommodations free for female academics, especially doctoral and post-doctoral researchers. This will provide them encouragement to participate in conferences. Additionally, conferences can plan to hold one-day workshops for women. Participant data suggests that this creates an awareness of other women who are employed in different positions in this field and making contributions.

Limitations and Recommendations for Future Research

Despite the strengths and contributions of this study, there are certain limitations that need to be acknowledged. Additionally, the findings from this study indicate potential new

directions for research and exploration. A combination of the limitations and recommendations for future research are indicated in the following sections.

By nature of this study design, the sample size is small and that is an intentional choice and delimitation of the study. A limitation of the study is that it is limited to women in different career stages and roles in academia, industry, and the government. Studying an evenly distributed sample of early and senior academic scholars, and women in early and middle technical/operational positions, and senior executive roles would lead to a more cohesive understanding of the research context for each group. Expanding the sample size and narrowing down the focus to women at similar stage in their careers will create a nuanced understanding of entry and persistence conditions. In addition, future research should include women across other ethnicities such as African American women, Asian American women, Latinx women, and immigrants with different nationalities, and look at entry conditions and other considerations of each of these groups.

A further understanding of the required technical skills, soft skills, and business acumen and the attainment of these skills in different career stages should be some additional considerations. Since this study includes the lived experiences of two women who transitioned to cybersecurity from other backgrounds, a larger study to explore the lived experiences of women who have transitioned would lead to an understanding of their rationale, preparation measures taken, as well as contextual supports and barriers.

A limitation of this research is that the nature of interviewing varied amongst participants. While I conducted all the interviews for the current study online, I had interviewed two of the participants in-person once before. I met with both Alicia and Angie, at a

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cybersecurity conference. I conducted a single interview with others when I met them online for the first time. Considering all the participants in the study are neither personally nor professionally known, perhaps additional interviews would have led to more trust building and elicited even richer stories. Future research should use the phenomenological approach to interviewing recommended by Seidman (2013). In this widely popular approach, Seidman (2013) suggests the use of a three-interview series: (1) the first interview to understand the life history of the person in relation to the topic of interest, (2) the second interview to concentrate on the details of lived experiences, and (3) the third interview for participants to reflect on the meaning of their experience and how everything has resulted in their current situation. This study focuses on all three elements within the 1–2 interviews, which has its limitations.

In terms of other future research recommendations, a similar study with women of color in different stages of their cybersecurity careers across academia, industry, and the government might be explored. Additionally, as participants touched upon their internship experiences, future research might also investigate the nature and importance of internships as well as the support and barriers resulting from these experiences for women in cybersecurity careers. Since some participants mentioned the importance of support they have received from peers, mentors, colleagues, networks within organizations, and others did not, perhaps conducting a larger study to compare the two groups of women would be helpful to gain further insight into different support systems. Research could also look at how women build these support systems and the challenges therein. This is similar to the recommendation made by Smith and Gayles (2018) about support systems of women in early STEM careers.

Conclusion

This study investigated the lived experiences of women in cybersecurity with work experiences in different areas and positions within academic, industry, and the government. The intent of the study was to understand their career choice of cybersecurity, influential factors in their career path, and their meaning making of these experiences. Using a narrative research study design, this study aimed at deeply understanding the career paths of a few women in greater detail. While the focus of the study is not to generalize the findings, investigation of different factors and their intersection with gender leads to important results in the context of women and their careers in cybersecurity. The study includes a combination of women with experiences based in the U.S. and Europe.

The study design allowed to bring out the personal narratives of participants in Chapter 4, emphasizing the unique nature of life experiences of individual women. Then by comparing and contrasting the personal narratives of participants, I arrived at the commonalities found across participant narratives in Chapter 5. Since participants in this study have different backgrounds and are at different points in their career, they brought different perspectives that enriched the study. When looked closely, readers will find that even within identical themes and categories, participant descriptions differ.

Overall, guided by each research question, the study led to the finding of its various themes and categories. In terms of career choice factors, women mentioned their attainment of knowledge and skills through higher education degrees and trainings, as well as alluded their career choice to having a technical bent of mind. In terms of influential factors, participants discussed intrinsic and extrinsic factors, interpersonal relationships, and work environment

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related supports and barriers. In terms of meaning making of work experiences, participants focused on the significance of work in their lives which was also often spoken in relation to connection with others in the workplace, as well as gendered experiences in the workplace, and changing life roles and expectations with motherhood. The research concludes by recommending cybersecurity organizations to create more informative videos with women about their careers and career paths, both conventional and unconventional, workplaces to create very supportive work environments, and supervisors/managers to have higher understanding and appreciation for multiple life roles.

Broadly, researchers have argued that increasing women's participation in STEM careers will benefit not only women but the industry and the society. Further, women will gain from participating in high paying jobs as well as rewarding careers with many opportunities, industry will benefit from skilled technical workers, and society will broadly benefit from the participation of women's diversified talent and perspectives (Buse et al., 2013; Margolis et al., 1999, 2000). The larger benefits just described are the underlying assumptions of this study, leading to a rise in recruitment and sustenance of more women in cybersecurity careers. We need more talented and dedicated people in the area of cybersecurity, especially now. The urgency in cybersecurity during the time of COVID-19 has necessitated an increase in participation of more skilled people, including women, to address the ever-increasing threats to our security as individuals and as a society. Finding ways to encourage women and other underrepresented groups to enter the cybersecurity field is important; finding ways to support them so that they stay is critical. My hope is that the stories of the participants shared, and the results of this study, will help inform strategies for doing so.

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Appendix A

Table A1

Gender Diversity of Speakers at Hacking and Security Conferences

N (%)

Conference Name	Speaker	Conference Year						Total
		2012	2013	2014	2015	2016	2017	
Black Hat USA	Male	120(98)	227(97)	169(98)	185(92)	171(92)	209(92)	**1081(95)**
	Female	3 (2)	7 (3)	3 (2)	17 (8)	14 (8)	18 (8)	**62 (5)**
DEFCON	Male	194(92)	174(92)	166(89)	188(93)	153(89)	148(81)	**1023(90)**
	Female	17 (8)	15 (8)	21(11)	14 (7)	18(11)	35(19)	**120(10)**
USENIX	Male	47(92)	51(98)	69(92)	68(88)	73(87)	77(85)	**385(90)**
	Female	4 (8)	1 (2)	6 (8)	9(12)	11(13)	14(15)	**45(10)**
Total	Male	361(94)	452(95)	404(93)	441(92)	397(90)	434(87)	**2489(92)**
	Female	**24 (6)**	**23 (5)**	**30 (7)**	**40 (8)**	**43(10)**	**67(13)**	**227 (8)**

Appendix B

Advertisement

Hi Y'all,

I'm a doctoral student at the University of Georgia, studying why women come to cybersecurity and decide to stay in the field. Dr. Kang Li, the Director of Georgia Institute for Cybersecurity and Privacy, is my co-advisor. I'm conducting the study in the spirit of addressing the issue with gender diversity in the field.

In the process, I'm looking for women working in the field across academia, research and the industry at different points in their career. As a participant, you will be asked to participate in 1-2 interviews for an hour or so, over a video conferencing service like Google Hangout or Skype. The interviews will be audio recorded. As for the interview, the questions are pretty benign, meaning that nothing in the interview process should in any way affect the institution you work for. If you're interested, I can discuss more about this in person. I've attached the recruitment letter here, so you can get more information on the study.

I'm definitely looking forward to hearing from you.

Feel free to send me an email!

See you at the conference!

Regards,
Swagata

Swagata Das
PhD Student
Learning, Design, &Technology
University of Georgia

Appendix C

University of Georgia Consent Form

Why Do Women Come to and Stay in Cybersecurity Careers?

Researcher's Statement
We are asking you to take part in a few research activities related to "*Why Do Women Come to and Stay in Cybersecurity Careers"* Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. This form is designed to give you the information about the study so you can decide whether to be in the study or not. Please take the time to read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information. When all your questions have been answered, you can decide if you want to be in the study or not. This process is called "informed consent." A copy of this form will be given to you.

Principal Investigator: Ikseon Choi
                                              Learning, Design, and Technology Program
                                              ichoi@uga.edu

Purpose of the Study
The overarching goal of the study is to examine why women pursue a career in cybersecurity.

The purpose of this research is to understand what factors both enhance and hinder the experience of working as a cybersecurity professional, specifically for a woman. The research is designed to understand these experiences in detail, to find better ways to encourage and support and sustain more women to apply to this field. The research will also guide to create educational contexts at the undergraduate level of studies to see what skills are required to take a job in cybersecurity and promote an awareness of what the job entails.

Study Procedures

If you agree to participate, you may:
- Be asked to participate in 1-2 interviews: at top cybersecurity conferences held in the US and/or via video conferencing tool like Skype or Google Hangout, when not at a conference. You will be contacted to participate in the interviews face-to-face or via email, in which the interviews will take place in a location and at a time convenient for you. Each interview session is expected to take about 45-60 mins.

Risks and discomforts
We do not anticipate any risks to you from participating in the research activities.

Benefits
There are no direct benefits to you by participating in this research. The data collected from you in the research activities has the potential to benefit more women coming into this field. The data collected will be used to identify experiences that promote and hinder the career development of women in cybersecurity and improve instruction in security in higher education.

Audio and/or Video Recording
Interviews will be conducted by using audio recordings, when face-to-face, at cybersecurity conferences and video recordings when interviews are conducted outside of conferences. By voluntarily agreeing to take part in the research activities of this project, we are asking for your consent for researchers to review the audio and/or video recordings and transcribe some of them to use as data for research purposes.

Audio and/or Video Recording
As indicated above you will be asked to participate in 1-2 interviews. If you agree to be interviewed at that point, we will ask to audio and/or video-record the interview. Please provide initials below if you agree to have your interview audio and/or video recorded or not. You may still participate in the research interview even if you are not willing to have the interview recorded. The audio and/or video recordings will be destroyed after they have been transcribed and analyzed.

_____I am willing to have the interview recorded.

_____I do not want to have the interview recorded.

Privacy/Confidentiality
The interview audio and/or video recordings and its transcriptions that will be used as data for research will be stored in Microsoft Word and Excel. Dropbox.com with password-protected access will be used to store and access this data. Since Internet communications are insecure, there is a limit to the confidentiality that can be guaranteed due to the technology. To protect your identity and to maintain confidentiality during research, personal identifiers in the data will be replaced with randomly assigned research numbers before being stored in DropBox.

The project's research records may be reviewed by departments at the University of Georgia responsible for regulatory and research oversight. Researchers will not release identifiable results of the study to anyone other than individuals working on the project without your written consent unless required by law.

Taking part is voluntary
Your involvement in the research activities is voluntary and you may choose not to participate in the research activities or to stop at any time without penalty or loss of benefits to which you are otherwise entitled.

If you have questions
The main researcher conducting this study is Dr. Ikseon Choi, professor in the Department of Career and Information Studies at the University of Georgia and Swagata Das, PhD student in the Department of Career and Information Studies at the University of Georgia. Please ask any questions you have now. If you have questions later, you may contact Dr. Choi at ichoi@uga.edu or at 706.583.0794, or Swagata Das at swagata.das@uga.edu or at 706.394.7010. If you have any questions or concerns regarding your rights as a research participant in this study, you may contact the Institutional Review Board (IRB) Chairperson at 706.542.3199 or irb@uga.edu.

Research Subject's Consent to Participate in Research:
To voluntarily agree to take part in this study, you must sign on the line below. Your signature below indicates that you have read or had read to you this entire consent form and have had all of your questions answered.

_____   _____   _____
Name of Researcher   Signature   Date

_____   _____   _____
Name of Participant   Signature   Date

Please sign both copies, keep one and return one to the researcher.

Appendix D

Cybersecurity Professional Recruitment Letter

Dear Participant:

I would like to ask for your participation in a research project entitled *"Why Do Women Come to and Stay in Cybersecurity."* The purpose of the research is to understand why women pursue a career in cybersecurity.

This research aims to understand what factors both enhance and hinder the experience of working as a cybersecurity professional, specifically for a woman. The research is designed to understand these experiences in detail, to find better ways to encourage, support and sustain more women in this field.

It would be of great help if I get an opportunity to hear of the experiences that you have gathered in your journey as a cybersecurity professional working in the industry, academia or the government. The participation in this research is solely to bring more gender diversity by understanding the factors that help or inhibit the growth of technical abilities, career progression and interest in the field.

Your participation will involve participating in 1-2 interviews to share your experiences. Each interview will be administered either in person at a cybersecurity conference or using a video conferencing tool like Skype or Google Hangout at a time convenient for you. Each interview is expected to take about 45-60 minutes. We do not anticipate any risks to you from participating in the research activities. There are no direct benefits to you by participating in this research. The data collected from you in the research study has the potential to benefit instruction in higher education in general because the data will be used to understand how to create instructional contexts that promote an awareness of what the job entails and prepares them in some of their technical development.

If you would like additional information about this study, please feel free to contact Dr. Ikseon Choi at (706) 583-0794 or send an e-mail to ichoi@uga.edu, or Swagata Das at (706) 394-7010 or send an e-mail to swagata.das@uga.edu.

Thank you for your consideration!

Ikseon Choi and Swagata Das

Appendix E

Interview Protocol

Following the interview guide approach, the topics to be covered will be specified as an outline form. Below is a draft of the **first interview categories and questions** that will be used as an interview protocol to guide research.

Script

Hello. I would first like to thank you for taking your time to participate in this research and joining me in the interview. I am currently a Ph.D. student in the Learning, Design, and Technology program. Your willingness to participate in the study is greatly appreciated.

My research interest lies in exploring the factors that enhance the hinder the career growth of women in the field of cybersecurity. To better explore this line of research, I would like to hear your experiences in the field in order to understand some of the steps that have helped you to choose this career and prosper, and also understand the experiences you feel were not as helpful, but with effort can be improved, in terms of your career growth in this field.

This interview is expected to take about 45-60 minutes. I would like to audio or video-record our conversation to transcribe our conversation and to accurately analyze the themes found in the research. During the interview, I will also be taking notes for personal use to better lead the interview process. All the notes and recording files from this interview will be kept private and your identity will be protected. Here are two consent forms for you to read and sign; one copy is for you to keep and one copy is for me to keep (wait for interviewee to read through the consent form and sign). Before we begin, do you have any questions for me?

Interview guide

1. Tell me about yourself.

2. Please tell me how you came to this profession.

3. You've been in this field for X years now. Describe a typical day at work for you as a cybersecurity professional.

4. Tell me a recent memorable event from work.

5. Tell me what motivates you to continue working in this field?

6. Describe the work culture in terms of your relationships with other male and female colleagues and seniors. How do you feel about these relationships?

7. What are some challenges that you face in your job on a day to day basis?

8. Would you please describe your experience as a woman in this field?

9. Describe any barriers you have experienced as a woman in this field?

    1. What did these experiences mean to you?

10. How do you perceive this field in general?

11. Describe the growth opportunities that you foresee for yourself.

    1. How do you find support to move up in the career ladder?

12. Describe how life outside of work influences your current practice?

    1. Role of family?

    2. Role of friends?

    3. Role of peers?

13. Tell me a story about how life outside of work influences your current practice. (either 12 or 13)

14. Is there anything I haven't asked that is relevant to your work experience? Anything you would like to add?

15. Do you know of a female colleague or a friend who left this profession? In your opinion, why did she leave?

Appendix F

Participant Profile and Interview Transcription

Table F1

Interview Transcription Data

S. No.	Participant Alias	Time (in mins)	Length of Transcription (in pages)
1	**Alicia**	**91**	**23**
2	**Angie**	**43**	**15**
3	**Lisa**	**92**	**34**
4	**Mariah**	**63**	**23**
5	Pauline	64	23
6	Malia	90	23
7	**Sherry**	**60**	**17**
8	Dina	87	27
9	Justine	50	13
10	Meryl	56	15
11	**Krista**	**69**	**20**
12	Jenna	64	23

Participant Profile and Interview Transcription

Table F2

Participant Profile

S. No.	Participant Alias	Job Role	Stage in Career
1	**Alicia**	**Senior Researcher at a technology company**	**Mid**
2	**Angie**	**Post-doctoral student in cybersecurity**	**Early**
3	**Lisa**	**Project Manager in Vulnerability Management**	**Early**
4	**Mariah**	**Program Manager at a technology company**	**Early**
5	Pauline	Physical Security Expert	Mid
6	Malia	Assistant Professor in cybersecurity	Mid
7	**Sherry**	**Retd. Software Engineering Director, currently teaching cybersecurity**	**Late**
8	Dina	Lead System Engineer, Security Engineer & Project Manager at a security company	Late
9	Justine	Software Engineer, transitioning into cybersecurity	Early
10	Meryl	Program Manager at a government agency	Late
11	**Krista**	**Software engineer with a focus on security**	**Late**
12	Jenna	Network Security Specialist	Early

Note: Participant names in bold were selected for the study

Appendix G

IRB Approval

UNIVERSITY OF GEORGIA

Tucker Hall, Room 212
310 E. Campus Rd.
Athens, Georgia 30602
TEL 706-542-3199 | FAX 706-542-5638
IRB@uga.edu
http://research.uga.edu/hso/irb/

Office of Research
Institutional Review Board

EXEMPT DETERMINATION

January 29, 2018

Dear Ikseon Choi:

On 1/29/2018, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title of Study:	Why Do Women Come to and Stay in Cybersecurity?
Investigator:	Ikseon Choi
Co-Investigator:	Swagata Das
IRB ID:	STUDY00005641
Funding:	None
Review Category:	Exempt 2

The IRB approved the protocol from 1/29/2018 to 1/28/2023. This determination only covers Phase 1 of the study. Phase 2 should be submitted as a modification or a separate study.

Please close this study when it is complete.

In conducting this study, you are required to follow the requirements listed in the Investigator Manual (HRP-103).

Sincerely,

Kate Pavich, IRB Analyst
Human Subjects Office, University of Georgia