

**WOMEN IN TECH IN THE MIDDLE EAST: EXPERIENCES AND POSSIBLE
SOLUTIONS TO THEIR CHALLENGES**

by

Rita Sharon Ikhuoria, B. A, M.Sc.

DISSERTATION

Presented to the Swiss School of Business and Management Geneva

In Partial Fulfillment

Of the Requirements

For the Degree

DOCTOR OF BUSINESS ADMINISTRATION

SWISS SCHOOL OF BUSINESS AND MANAGEMENT GENEVA

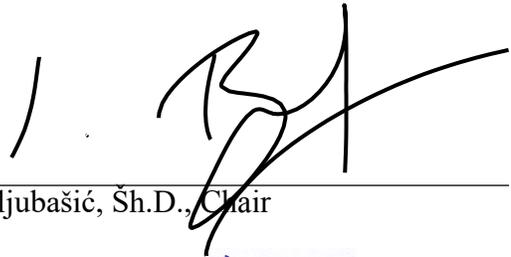
APRIL,2023

**WOMEN IN TECH IN THE MIDDLE EAST: EXPERIENCES AND POSSIBLE
SOLUTIONS TO THEIR CHALLENGES**

by

Rita Sharon Ikhuoria

APPROVED BY



Prof. Iva Buljubašić, Šh.D., Chair



Prof. Saša Petar, Ph.D., Committee Member



Prof. Josip Burušić, Ph:D., Mentor and Committee Member

RECEIVED/APPROVED BY:

<Associate Dean's Name, Degree>, Associate Dean

DEDICATION

I want to dedicate this work to Dr. Innocent Dim and Late Miss Cecilia Hüdepohl, who have been important parts of my life besides my immediate family.

I'd also like to thank the Ikhuoria and Kanoba families as a whole, especially my Parents, Mrs. Mary and Mr. Paul Ikhuoria. You can all do it to my siblings Brandy, John-Paul, James-Jones and Obehi!

Thank you for your unending love and support.

ACKNOWLEDGEMENTS

I want to acknowledge Dr. Josip Burusic, who has guided me throughout this research, and Thank you to the Swiss School of Business Management for making this academic journey possible for me. My gratitude also goes out to all participants of my interviews and the Creative organization in Yemen.

ABSTRACT

WOMEN IN TECH IN THE MIDDLE EAST: EXPERIENCES AND POSSIBLE SOLUTIONS TO THEIR CHALLENGES

By

Rita Sharon Ikhuoria

2022

Dissertation Chair:

Co-Chair:

This study aimed to assess women's challenges in tech in the Middle East and possible solutions to mitigating these challenges. First, an in-depth literature review using several academic databases was conducted to understudy the study's objectives. Thirteen In-depth Interviews were conducted among women who work in different technology industries in Yemen (8), Israel (4), and Iran (1). The first participant was identified through an internet search for women in the technology industry in Yemen, and then snowballing was used to recognize other participants. As disclosed by participants, the challenges facing women in tech included personal beliefs or opinions, family inclinations, societal norms, sociocultural and organizational structure and practices, the low value attached to education, perception of child care and women's role, and unfavorable work hours and difficulty getting managerial positions. Identified factors that facilitated the women's interest and choice of technology education and industry included that tech jobs came with a good salary, support from family, societal influence, and good academic performance in courses like mathematics. Participants and other related studies have pointed out some ways to deal with these problems. These include giving young women who want to work in

tech access to role models and grants and scholarships for tech education, making sure that the government and organisations have policies that help women do well in the field, raising awareness to change people's negative ideas about women in tech, and giving young women who want to work in tech social support. The success of women already in the tech industry will depend on a multi-pronged approach that addresses their challenges by implementing policies that will address the gender gap in tech holistically while tackling issues from the home to the society to the work settings. (Mukhwana et al., 2020). Approaches that remove barriers to women's success in technology at the individual, family, and social levels, as well as in the workplace, as well as policies that protect gender parity in technology in education and career prospects, are strongly recommended.

Keywords: Middle East, women, challenges, solutions, facilitators, Yemen

CONTENTS

DEDICATION.....	III
ACKNOWLEDGEMENTS	IV
ABSTRACT.....	V
CHAPTER I: INTRODUCTION	1
1.1 Introduction.....	1
1.2 Research Problem	2
1.3 Purpose of Research.....	4
1.4 Significance of Study.....	4
CHAPTER II: REVIEW OF LITERATURE.....	6
2.1 Theoretical Framework - IDTGIT	6
2.2 Concept of the Tech Industry.....	9
2.3 Tech Career Opportunities.....	10
2.4 The Tech Industry in the Middle East.....	11
2.5 The Tech Industry in Yemen	13
2.6 Women in the Tech Industry in the Middle East and the World at Large: An Overview.....	17
2.7. Challenges Facing Women in Tech in the Middle East: An Overview	28
CHAPTER III: METHODOLOGY	45
3.1 Overview of the Research Problem	45
3.2 Operationalization of Theoretical Constructs	47
3.3 Research Objectives and Questions	48
3.4 Research Design.....	49
3.5 Population and Sample	49
3.6 Participant Selection	50
3.7 Instrumentation	50
3.8 Data Collection Procedures.....	51
3.9 Data Analysis	52
3.10 Conclusion	53
CHAPTER IV: RESULTS.....	54
4.1 Characteristics of Participants.....	54
4.2 Research Question One.....	55
4.3 Research Question Two	60
4.4 Summary of Findings.....	64
CHAPTER V: RESULTS DISCUSSION	65
5.1 Results Discussion	65
5.2 Discussion of Research Question One	65

5.3 Discussion of Research Question Two	93
5.4. Research Design Limitations	106
CHAPTER VI: SUMMARY, CONSEQUENCES, AND RECOMMENDATIONS	108
6.1 Summary	108
6.3 Recommendations for Future Research	110
6.4 Conclusion	111
APPENDIX A INFORMED CONSENT	112
APPENDIX B INTERVIEW GUIDE	114
REFERENCES.....	117

LIST OF TABLES

Table I : Top Tech Positions for Females and Males.....	24
Table II: Professional Identity of Study Participants.....	54
Table III: Educational Attainment.....	55
Table IV: Location of Participants.....	55

LIST OF FIGURES

Figure I: Individual Differences Theory of Gender and Information Technology (IDTGIT)	8
Figure II: Women enrolment in Universities of some Middle Eastern Countries from 2016 to 2017	23

CHAPTER I: INTRODUCTION

1.1 Introduction

Globally, the tech industry is said to be male-dominated, as women are significantly underrepresented (Powell & Chang, 2016; Alghamdi, 2016; Kemppainen, 2019). Women's underrepresentation in tech is reflected in a statistic that shows that only 25% of all jobs in the digital industry are held by women (AdevaIT, 2018). For example, In the United States, where women currently make up over 47% of their labor force, less than 30% of the women are in the tech industry (Chang, 2022; Stephen, 2019). Similarly, in Australia, only 12.4% of female engineers and 20.7% of female computer software designers were recorded in her labor force in 2016 and 2017 (Australia Bureau of Statistics, 2017; Kaspura, 2017). Also interesting to note is that Japan and Singapore are rated first and second on the list of the Top 10 most technologically advanced countries, reporting that only 41% of women are involved in their tech industry (World Population Review Statistics, 2022).

In the Middle East, where women make up only about 35% of the workforce, there is an obvious under-representation of women in the tech sector, with Yemen lagging far behind (Stephen, 2019). Being a woman in the Middle East technology industry presents several hurdles, from education to careers (Islam, 2019). The best conditions for success are only sometimes present for women in technology. For instance, ICT Facts and Figures, 2016 report that 250 million more men than women browse the internet, presumably caused by unequal access to technology education and career opportunities across genders.

The Middle East is made up of the following countries: Algeria, Bahrain, Cyprus, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, Turkey, United Arab Emirates, and Yemen. Also in this area are Qatar, Saudi Arabia, and the United Arab Emirates, which are all on the Arabian Peninsula. It is known for having a lot of oil and keeping Islamic culture alive (Teach Mideast, 2019). More than

400 million people live in the area, which is almost 5% of the world's total population. It has more than 103 million people working for it in 22 different countries (Lord, 2016). In this particular population, the rate of women working could be as low as 25%, even though the average rate of women working in the workforce around the world is 50%. (The Bank of the World, 2019).

In the Middle East, there are many social, cultural, and political factors that make it hard for women to work in tech. Alserri et al. (2017) and Popescu et al. (2020) both say that the Middle Eastern IT industry is thought to be dominated by men because there aren't many well-known women in the field. Women in the Middle East think that the tech industry is geared toward men because of laws and gender norms that limit the types of jobs that women can do (Stephen, 2019). The difference in how many women work is expected to cause the region's economy to shrink by 27%. (El-Swais, 2016). The Middle East can make up for these losses by making it easier for women to get jobs.

While several Middle Eastern countries have improved the situation for women in technology, some countries still lag significantly behind as there still exists a significant gender gap in tech involvement in the country (Ilyas, 2021). Powell and Chang (2016) and Kempainen (2019) both found that giving women more opportunities to work in tech will not only help these women become more financially independent. But it will also help businesses and the economy of the country. Al Akayleh (2018) demonstrates how increasing the proportion of women in tech promotes economic progress through associated technological advancements. Given the advantages of women's involvement in the tech industry, seeking out and offering solutions to women's technological challenges is crucial, hence the need for this study.

1.2 Research Problem

Women are underrepresented in the Middle East's tech sector in computer education and tech professions. According to statistics, only roughly 35% of Middle Eastern tech entrepreneurs are women (Stephen, 2019). The underrepresentation of women in tech is a significant issue owing to the disadvantages that unequal gender representation brings to both businesses and the economy

at large. It contributes to the underperformance of businesses, as organizations cannot perform optimally in the face of gender imbalance (Naidoo, 2019). Consequently, this poor performance of businesses negatively impacts the nation's economy in general hence the need for gender parity in the tech industry.

Several factors prevent Middle Eastern women from entering the tech business, including the gender gap in access to technology (OECD, 2018). According to Alserri, Zin, and Wook, 2016 and Hanton, 2015, impediments to women entering the IT industry include gender stereotypes, expected societal roles, and the perception of male domination. When analyzing the obstacles for women in tech, Bella and Chandran (2019) and Popescu (2020) also bring out the difficulties in achieving an ideal work-life balance, which aligns with the characteristics of gender roles and cultural stereotypes prevalent in the Middle East.

Masud et al., 2019 extend perspectives on how women in technology may face barriers to technological advancement due to a lack of access to education. Masud et al., 2019, with a focus on the United Arab Emirates (UAE), use the personal experiences of Middle Eastern women to show how things like restrictive traditions and violence against women can make it hard for them to take tech courses and keep them from entering the tech field. Lasic (2018) and Monk (2021), who both look at the issue of Syrian refugees in Lebanon and Jordan to show how traditions and outside interference in the region's politics can stop women from getting an education, have similar points of view. Similarly, Alghamdi (2016) focuses on Saudi Arabia and demonstrates the country's underrepresentation of women in technology, notwithstanding high enrollment rates in technology-related subjects at the university level. This point of view gives a unique look at how, even though education is available in the Middle East, it may still be hard to get a chance in technology. The 2015 Global Gender Gap Report says that 13 of the 15 countries with the fewest women working are in the Middle East and North Africa (MENA).

More research needs to be done on women who work in technology in the Middle East. Studies on women in technology are now being done in the Middle East. These studies lament the fact that there hasn't been much research on this topic in the area (Alserri, Zin, & Wook, 2017;

Powell & Chang, 2016). Since the problems that women in tech face in the Middle East are kept secret, more research is needed. More research needs to be done on women in tech in the Middle East to figure out how to help these women (Powell & Chang, 2016). This study fills in a gap in the body of literature because there isn't enough data on this subject.

1.3 Purpose of Research

The goal of this study is to find out how women in the Middle East use technology so that we can understand the problems that this group faces. It investigated women's experiences working in the tech industry in the Middle East. It identified the issues women in tech experience in the Middle East, allowing for the discovery of some potential solutions to relieve the hurdles women in tech face in the region. A scholarly study has discovered that a need for studies on women in technology in the Middle East must be filled, and this study aims to fill these gaps. It will contribute to developing solutions for them by better understanding what prevents women in the region from achieving success in the tech sector. Improving the circumstances for women in technology by removing barriers to their education and jobs would surely result in increased corporate performance, which will contribute to more remarkable economic growth in the middle east. Improving circumstances for women in technology in this area will also increase female empowerment.

1.4 Significance of Study

Technological advancements will benefit people, businesses, and economies by addressing the underrepresentation of women in the industry (Islam, 2019). Making progress, therefore, requires understudying these impediments in tackling the underlying causes of gender disparity. It also justifies the study's search for workable answers to this problem found by the scant number of currently available studies.

Understanding the experiences of women in technology in the Middle East could help us learn more about the biggest problems they face, notably those related to education and gender stereotypes, which result in their under-representation in the area. Understanding their experiences

may help identify potential solutions to the problems posing barriers and expose the difficulties experienced by women in tech across the Middle East.

Some strategies have been implemented to lessen problems for women in tech, both for those in education and tech employment. However, these initiatives are sometimes not generally known because no study emphasizes them. To help women in tech in Middle Eastern countries find solutions to their problems and increase their chances, it is essential to draw attention to these strategies, which would likely lead to a rise in the number of women working in the sector and benefit technology companies.

The dissertation employed both primary and secondary data to identify issues faced by women in tech in the Middle East and potential solutions as it took a qualitative approach to explore the subject. The research results are expected to identify practical ways to combat difficulties women face in tech education and tech careers in the Middle East. The study will shed light on the issues that confront women in tech in the Middle East and suggest some methods in which they can be aided to overcome the obstacles impeding their careers.

The few available studies on the subject, as earlier mentioned, have pointed out that education-related constraints and gender stereotypes are the main obstacles for women in the computing and Middle Eastern industry for technology. The findings of this study point to several potential remedies that might be implemented to minimize the problem of women in Middle Eastern tech education and careers.

CHAPTER II: REVIEW OF LITERATURE

This chapter explores the concept of the tech sector, tech education, and tech careers in the world and the middle east by reviewing peer-reviewed articles; it also highlights some of the challenges facing women in the Middle East, especially gender stereotyping. The theoretical bases for this study are also clearly explained in this chapter.

2.1 Theoretical Framework - IDTGIT

The three theoretical viewpoints that are most frequently applied in gender, IT, and related studies are;

1. The Theory of Gender Essentialism
2. The Theory of Social Construction
3. The Theory of Individual Differences

(Trauth, 2013)

When research seeks to explore the differences across genders, essentialism, and social construction theory are the best fit. In contrast, when the objective is to study a particular gender only, then the individual differences theory becomes the best fit. It was vital to establish a theoretical framework that allowed the researcher to properly analyze the individual components that drive the phenomenon under study. This study aimed to understand the changes women in tech experience in the Middle East. Therefore, implementing the IDTGIT Framework is a positive step for this research.

To better understand women's participation in IT, the IDTGIT investigates gender differences associated to personal and environmental factors (Trauth & Quesenberry, 2007). According to Trauth et al. (2004), IDTGIT hypothesizes that three categories of individual differences are primarily related to gender and IT;

1. Personal Information
2. Influencing and shaping variables

3. Environmental Situation

Social, economic, and biological aspects, including age, ethnicity, occupation, and parental status, are considered personal data. Unique features and influences include personality traits, role models, life events, and work experiences are examples of shaping and influencing variables. Environmental context includes cultural norms and values, policies, and geography. (Trauth et al., 2004).

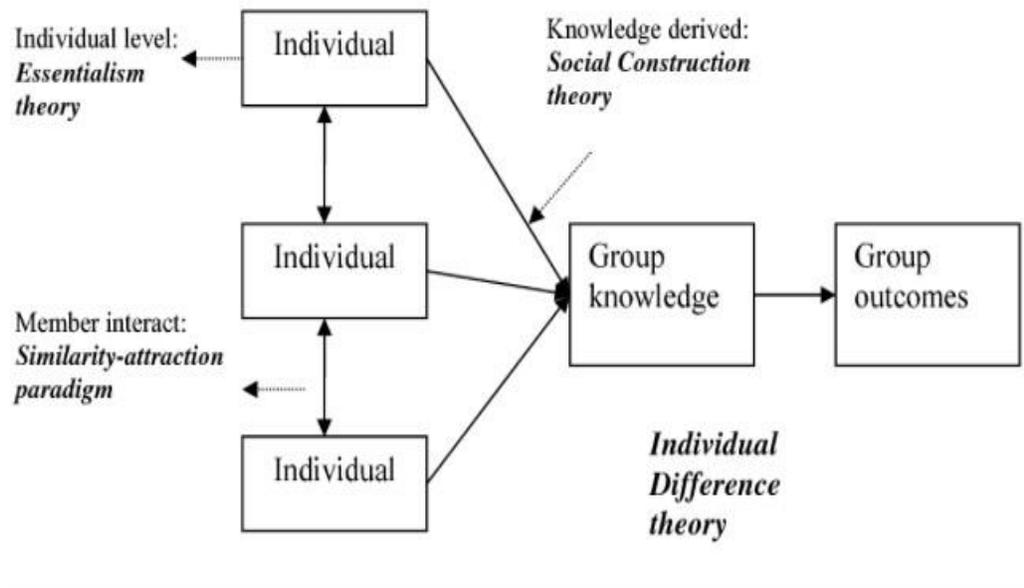
Since women's reactions to technology barriers vary across individuals, gender-based characteristics cannot be assessed at a group level. Thus, the theory points out that women face different influences that affect their disposition toward their participation in the IT profession (Trauth et al., 2004). The IDTGIT allows for the collection of qualitative data via in-depth interviews. It offers a different point of view on gender and IT as it allows one to examine the individual variations among women (Trauth & Quesenbery, 2007).

IDTGIT is able to provide creative intervention options because it is predicated on a profound understanding of the social and human variables that affect gender and IT (Trauth & Quesenberry, 2007). According to Trauth et al. (2016), IDTGIT was created to provide a clear reason for women who entered the IT Sector despite the barriers; and explain women's underrepresentation in the industry by identifying impacting factors.

The IDTGIT perspective treats gender at an individual level rather than a group level (Trauth, 2002). With this perspective, women can be assessed within a social context, and the relationship between their gender and the IT profession can also be determined (Trauth, 2013).

All three constructs of IDTGIT were adopted in the study to assess the challenges women face in tech and how they have been able to migrate their challenges, the shaping and influencing factors, and the environmental context in the Middle East surrounding their participation in tech. An In-Depth Interview Guide was developed using the theoretical constructs of the IDTGIT.

Figure I: Individual Differences Theory of Gender and Information Technology (IDTGIT)



(Source: Liu, 2010)

The Individual Differences Theory, apart from providing explanations for "how" and "why" individuals differ, also provides a platform for us to answer the questions of what similarities exist within and between groups (Thompson, 2008; Williams et al., 2008; Research base, 2020). The study's assessment of the individual experiences of women in tech in the Middle East is unique in that it allows for independent investigation of the research question (Yemen, Iran, and Israel) pertains to IDT constructions. Although the women belong to the same group as "Women in Tech Companies," Women in the study had varying perceptions as regards their experiences with educational attainment, gender stereotyping, and their career progression in the Tech industry, even though some of them were either working or had worked in the same Tech company. The individualistic perspective theoretical approach applied in exploring the challenges facing women in tech in the Middle East as it relates to gender stereotyping and education is intended to provide insight into group knowledge, experiences, and outcomes, allowing for a generalization of the findings.

2.2 Concept of the Tech Industry

Digital technologies are a broad range of technological tools, services, and applications that use varying hardware and software platforms (Rice, 2003). It has been demonstrated that using digital technology for learning, communication, and business—such as television, robotics, mobile phones, and personal computers—improves the effectiveness of these elements (Vuorikari et al., 2016; Motiwalla, 2007). Digital technologies are now widely acknowledged as a crucial factor in determining economic growth, national security, and global competitiveness. They accomplish this by enhancing access, reducing costs, and improving the quality of service delivery across national and international boundaries (Tulinayo et al., 2018). The digital economy greatly impacts the world's future and the well-being of society's citizens. It affects everything, including growth, the way resources are shared, and income (Makada et al., 2019). A "technology company" is a business that creates, makes, or sells electronic products (Globoledge,1994).

Although at varying rates throughout human history, the technology business has advanced significantly in the last hundred years. While much of the world's technology is developing quickly, certain nations are ahead of the curve, allowing their residents to benefit from cutting-edge advantages. (Hilmi,2021). Nevertheless, Loukil (2019) agreed that technological development depends heavily on technologies developed in advanced countries. According to the Technology and Innovation Report (2021), every wave of progress was accompanied by a rise in the disparities between nations' access to products, services, and public goods, including those related to education, health, ICT infrastructure, and electrification. Nevertheless, due to technological learning, imitation, and innovation, a few countries were eventually able to catch up.

Technology advancements have had a big impact on other businesses. For instance, technological innovation has made it feasible for medical advancements like the new virtual consulting room, which has changed the locations and processes of physical examination (Cristea,2020). The transportation and communication systems are also sectors in which Technology advancement has significantly influenced (Betz,2022). According to Raja and Nagasubramani (2021), the educational sector is another critical instance influenced by the

advancement of technology with virtual learning made possible. There is, therefore, no denying that the future of technology will continue to revolutionize our lives (Khan,2019). Wardynski (2020) concludes that Although technology can have drawbacks, it makes life easier. Humans will continually strive to create new technology and advance the ones we already have. Given our fundamental drive to improve our lives, technology allows us to do it reasonably.

2.3 Tech Career Opportunities

Tech Career Opportunities have ever-expanding needs and a wide variety of options. These opportunities are mainly categorized into two groups: "Hardware" and "Software" career opportunities (Malhotra,2012). The following few paragraphs below highlight some existing tech career opportunities in the world:

2.3.1 Software Developers

After analyzing user demands, software engineers design, produce, and alter universal computer applications software or specialized utility programs. They are the brains behind the programs that run computers. Some programs may focus on just one app or program, but others may create enormous networks or underpinning systems that power and activate other programs. Systems and application software developers are the two main categories of developers. The top technical skills sorted after in the world include Java®, Software engineering, JavaScript®, Python®, Microsoft®, Oracle, DevOps, and so on (Malvik,2020)

2.3.2 Web Developers

The development of websites is a component of this tech career opportunity. In addition to their primary task, which is to create a website that is both aesthetically pleasing and simple to navigate, many web developers are also responsible for the performance and capacity of the website.

In addition to this, they are accountable for creating and evaluating website code, which is often written in HTML, XML, or JavaScript, as well as the design of user interfaces and menus for navigation (Malvik,2020).

The job description of a Web Developer also includes

- By including multimedia content on a website
- Testing web applications
- Locating and resolving problems with performance and user experience
- Collaborating with stakeholders, designers, and developers

Data scientists are professionals responsible for gathering, evaluating, and interpreting large amounts of data. This career comprises people who have acquired technical skills to solve complex analytical problems and find ways that data can improve service delivery and quality of life. (Degrees and Careers, 2016)

2.3.3 Tech Engineers

A technology engineer is in charge of creating machinery meant to satisfy a customer's requirements. A tech Engineer creates software, hardware, and other specialized tools for a specific industry or field. Additionally, they produce technical documentation and give instructions on how to use the things designed (ZipRecruiter, 2012).

2.4 The Tech Industry in the Middle East

The digital revolution has been transforming the economies of the major Middle Eastern countries for a considerable time. The Middle East is on track to develop a robust digital economy. However, the talent and skill shortages in middle eastern nations may make this approach problematic, which indicates a decline in the demand for basic labor and physical and cognitive abilities. A significant section of the workforce is replacing them with digital literacy and competency requirements, and the need for computer skills is increasing. (Omar,2021). According to Menezes (2022), Middle Eastern governments are progressing in equipping and empowering the tech workforce. Some of these efforts include;

1. To make the UAE the world's top destination for coders and future innovators, the UAE government established a national initiative for programs (Menezes, 2022).

2. The Ministry of Communications and Information Technology (MCIT) in Saudi Arabia started the future skills programmes to help people get more in-depth training in digital fields (Menezes, 2022).

3. The Centennial 2071 plan that the UAE postulated aims at investing in the equipment of people with the knowledge and skills needed to address rapid changes (Menezes, 2022).

4. LinkedIn partnered with the UAE Government to provide a tech skills program for Emirati women (Menezes, 2022).

The expansion of the tech sector is highly prioritized in the national aspirations of nations in the region. As a result, several initiatives focused on tech have been launched (Nasir, 2021). According to Shirazi et al. (2009), the Middle East's technological development has successfully closed the digital divide and fostered economic independence in a region predisposed to political, social, and international strife. The relationship between technology and economic freedom is, however, increased and was constrained by national variations, such as the educational level of their inhabitants and institutional resistance to technology uptake.

Governments in the Middle East are getting ready to regulate new technologies, while tech companies are planning ways to increase their influence over the digital economy. Our expectations of the future are being challenged by technologies like artificial intelligence (AI), cloud computing, and others. The Middle East region's technological landscape is constantly evolving. Middle Eastern IT companies implement cutting-edge technology and develop innovative operational approaches (Nazli, 2003). The UAE has developed into the Middle East's center for communications and information technology, drawing IT experts from worldwide and making it a popular destination for expats (Lunt et al., 2006).

Digital technology is dramatically changing tech education and tech careers in the Middle East. With the development of technology and the Middle East's desire for innovation, the region is well-positioned for tech opportunities, and about half of the cities that are expected to become smart will be in the Middle East (Chebib, 2017). Like in other parts of the world, the Middle East

has a wide range of lifestyles and access to technology. Even though countries like Saudi Arabia and Kuwait have a lot of money, Islamic countries in the Middle East have to use foreign technologies to reach their goals (WGBH, 2002).

Data experts are in demand in the Middle East's public and private tech businesses due to technological advancements like machine learning. Data scientist was the fastest-growing role in the UAE in 2019, with a 46 % growth in demand, and by 2020, LinkedIn was responsible for an increase of 61 % in tech hires in the Middle East. Data engineers with technical expertise in statistical modeling and visualization are in high demand across industries. The study discovered that nations like the UAE, Saudi Arabia, Lebanon, Kuwait, and Qatar would succeed in the tech sector if given sufficient training in data science (Butcher, 2022).

2.5 The Tech Industry in Yemen

Yemen is one of the many Arab nations struggling with difficulties linked to technology acceptability. Yemen is a Middle Eastern nation located in the southwest corner of the Arabian Peninsula (Al-Tuhaifi, 2017). Yemen is now thought to lag behind the rest of the world regarding technological adoption, connectivity, and awareness (Al-Wazir & Zheng, 2014). According to Al-Tuhaifi, 2017, the Arabic world is considered one of the least technologically developed regions in the world, with Yemen not being an exception. The successful adoption of technologies in industries is dependent on technology characteristics and user characteristics which, in reality, these factors should be addressed by some companies in Yemen (Yaser et al., 2015). Technology in the form of computers was first introduced in Yemen in the 1970s. Since then, the number has increased to over 140,000, most categorized in the first entry computing level, and most are distributed in different government agencies (Mareai,2018).

Due to the advancement of technology, conserving the introduction and development of new technologies in tech education is vital. However, Yemen needs to catch up owing to the many challenges of introducing technology in education (Yaser, 2020). The Republic of Yemen is a less

developed country seeking to develop the tech education sector to sustain its development process (Yaser et al.,2015). Substantial changes and steps aimed at establishing tech education are being taken. Yemen has achieved tangible technological results, especially in developing policies and plans, adapting infrastructure components and electronic applications, and building human capacity (Ray,2018). Even as efforts are being made to promote tech education, gender disparity is an issue in Yemen.

It is encouraging to see initiatives like the government's plans for training civil servants and the online boot camp by Re-Coded Yemen, which could help increase technology education and adoption in Yemen. However, more needs to be done to guarantee full access to technology and the Internet in Yemen and to address the issues of poverty and illiteracy that prohibit young people from using technology. Investing in the technical infrastructure and setting up policies and priorities to ensure the transformation into a digital economy focusing on human capital development could be critical for Yemen's economic growth and development.

In 2017, the World Economic Forum's Global Gender Disparity Reports found that Yemen was 141st out of 144 countries in terms of the difference in education levels between men and women (Alaoudi,2021). The Yemeni government has made strides toward modernizing the nation's educational systems by implementing the most cutting-edge and efficient educational technology techniques. These efforts were made in recent years, keeping in mind that despite cloud computing being cost-effective, many academic institutions in Yemen have had difficulties implementing it. There are few scholarly studies to help them in their endeavors. (Alghushami et al.,2018).

There is an apparent political will by the Yemeni government toward investment in technology. Mahdi al-Mashat articulated this political determination, then the president of Yemen, in a speech he delivered in 2021. In the speech, he emphasized the relevance of scientific plans to progress science and technology to propel Yemen into industrialized nations. In the speech that was delivered in the President's stead at the opening of the Higher Authority for Science, Technology, and Innovation by Ahmed Ghaleb Al-Rahwi, a member of the Supreme Political

Council, it was mentioned that technology is a crucial component in the advancement of many nations around the world that have attained self-sufficiency and built a strong and coherent economy. This was mentioned in the speech that was given on his behalf by a member of the Supreme Political Council (Almarshahi,2021).

Regarding a tech career, Yemen is not exactly leading the top list (Alaoudi,2021). Since Arab nations have long relied on hydrocarbons, expanding access to technology might provide the groundwork for a brand-new economic future. As governments in the region implement economic diversification plans, the region's tech industry and its tech-savvy, frequently jobless youthful population have the potential to change the economy completely. (Langendorf, 2020)

E-government is the application of technology to enhance how citizens, staff members, businesses, and governmental organizations interact with the government. Achieving a high degree of preparation for e-government is being hailed as one of the top priorities for nations worldwide, particularly in developing nations. Although there are many obstacles, Yemen is one of the growing nations that aspire to improve the implementation and services of e-government. Al-Aghbari and colleagues (2014) Yemen made its first attempt at e-government in 2003, the same year its website was launched. However, the project failed because there needed to be a conducive environment for change (ESCWA, 2007).

Additionally, most current information systems need updated information and technical compatibility (NIC, 2005; Alrewi, 2007). The second attempt was in 2008; it started with a well-prepared plan and a clear vision. This kind of digital change could empower both present and future generations by offering them much-needed work opportunities and new avenues for civic engagement (Aleryani,2009).

It is important to emphasize that Yemenis have unique chances to receive a technology education despite the difficulties the Middle East's tech sector faces, particularly in improving tech education. The Artificial Intelligence (AI) Expert Course offered by Unichrone in live online and in-person training formats exemplifies such a chance. The professional instructors share their perspectives on artificial intelligence with the participants, making difficult concepts and

procedures understandable. The AI Expert Course is offered in several Yemeni cities. Following the session, AI Expert Certification course participants can take tests to gauge their chances of passing the exam. By obtaining the certification, certified AI professionals can achieve their career goals and increase their salaries (Unichrone, 2022).

Online tech job prospects abound and may present opportunities for Yemenis (Rotaru & Pârgaru, 2012). Technology can give low-income nations access to high-income nations from a global trade standpoint (Terzi, 2011). By seizing these opportunities, Yemen might become economically prosperous. The adoption of technology is vital in the successful operations of Tech industries. One of the important aspects boosting employee productivity and the organizational performance of the tech sector is technology literacy. Political unrest harms Yemen's economy, employment rate, and labor productivity. By generating possibilities, jobs, and improvements in people's lives, technology can be a significant opportunity for growth and development in Yemen (Gunasekaran et al., 2002).

According to Al Rawabdeh et al. (2012), there are limitations to tech careers in Yemen due to factors such as poverty and illiteracy, which prevent many young people from accessing technology. However, to progress toward a digital and automated economy, investments in technical infrastructure, policies, and priorities are required to improve performance in the sector and transform into a digital economy with a skilled workforce.

However, Yemen has many ICT firms offering job opportunities for its people. As an illustration, consider Yemen Computer Company Ltd (YCC), the country's first tech business, founded in 1977. This cutting-edge organization, dedicated to integrating technology with business goals, has become one of Yemen's largest providers of IT services thanks to its stellar track record of customer satisfaction, productive alliances, inventiveness, and corporate responsibility. (YCC, 2022). Another illustration is the Yemen-Soft Company, which has significantly improved over the past 20 years and helped Yemen prosper economically. According to the Ministry of Trade and Industry's statistical report, the company generated 40.674 million YR in 1998 and 80.580 million YR in 2014. Nevertheless, while experiencing astronomical growth in the past time frame,

the company is currently dealing with several difficulties that impact its operations (Al-Halili, 2019).

Telecommunications is one of the sectors open to trade and investment in Yemen; however, numerous factors impede tech workers' high performance and satisfaction in Yemeni telecommunications companies. For instance, telecommunications companies in Yemen use management information systems to improve employee performance to gather, process, store, and retrieve information as needed (Alaoudi, 2021). However, some telecommunications workers aren't happy with how the system works, and others need to understand its benefits. The business should also provide greater system assistance to its personnel. Businesses must also offer enough training for using management information systems (Salem et al., 2010).

According to research, Yemen lags behind all its nearby Arab neighbors in using ICTs (Alaoudi,2021). Yemen ranked last on the Global Web Index 1 published in 2013 by the Web Foundation, which was unsurprising given that the country has a penetration rate of less than 14% for the Internet. However, despite having a poor telecommunications infrastructure and a shortage of personnel in the internet services sector, the country recently saw a significant increase in internet usage (Alaoudi,2021).

2.6 Women in the Tech Industry in the Middle East and the World at Large: An Overview

Even though the average number of women in the workforce around the world is about 50%, only 25% of women are working. (The Bank of the World, 2019). 1.25 percent of the people who work at Facebook (FB), 30% of the people who work at Apple (APPLE), and 30% of the people who work at Alphabet, which is the parent company of Google, are women (GOOGLE). As one's rank goes up, the number of women in that position goes down (Company diversity data, 2019; Camera, 2015). Only 34.4% of the people who work at the five biggest technology companies in the world are women. Amazon, Apple, Facebook, Google, and Microsoft are some of these companies (Daley, 2022). It has been found that more than half of the time, recruiting and

hiring methods for women in STEM fields are biased. Even though women only make up 7% of parliament seats in the Middle East, the average number of women serving in parliament around the world is 25%. (WEF, 2014).

In 2013, there were about 200 million more men than women who could use the internet. (Intel, 2013). Women use information and communication technologies much less often and less often than men do. (ITU, 2017). ICTs are used less often by women than by men. According to research from the International Telecommunications Union (ITU) in 2016, women used ICTs 16 percent less often than men in 2016 compared to 2013. (ITU, 2017). Experts say that giving women better access to ICTs can help them find resources and jobs that could help close the wage gap between men and women, improve access to education and health information, stop violence against women, and support women's leadership and empowerment (Brimacombe & Skuse, 2013; Weiss & Tarchinskaya, 2015). A 2016 World Bank study found that men are 7.6 times more likely than women to work in ICT and 2.7 times more likely to work in the global digital economy. Women in the Middle East have fewer rights when it comes to things like speaking their minds, choosing what to wear, making decisions, and going to school. Even though there are a lot of women in school and they are good at reading, the Middle East has the lowest rate of women working (24.6%), which is much lower than the global average of 47.8%. (Rima & Chiara, 2020). Many of these oppressive traditions come from regional cultural norms (Islam, 2019).

Even though religion has a big effect on the personal and professional lives of its followers (Tlaiss, 2013, 2014), social norms and traditions, especially for women, have a bigger effect on Middle Eastern societies as a whole. Women in the Middle East are sometimes willing to give up their dreams to do what society expects of them because they have to put their families first.

The World Bank says that almost all young women in the Middle East are currently in school, and more women than men go to colleges and universities (2019). In Middle Eastern colleges, women and men are equally represented in STEM (Science, Technology, Engineering, and Mathematics) fields, which means that almost half of STEM students are women. According to the most recent data from UNESCO and the World Bank, there was no big difference between

men and women in 2016 in the number of women who went into STEM fields or graduated from them. Engineering is the only field in which more men than women work (UNESCO Institute of Statistics 2019). Even though these are all good signs, women in the Middle East still have one of the lowest employment rates in the world. Considering how many Middle Eastern women are in STEM programmes and get degrees, it is clear that there is still a big gender gap in the workplace (UNESCO Institute of Statistics). The difference between how many women work and how many men work costs the region about 27% of its income (El-Swais, 2016).

In the Middle East, more women than men sign up for STEM classes, but it looks like the opposite is true when it comes to careers in STEM, especially research (Islam, 2019). An OECD study from 2018 says that the legal and social barriers that keep women in the Middle East from working cost the region about \$575 billion each year. The Arab world might be able to make up for these losses by changing its economic structure to make the private sector bigger, create more jobs, and make it easier for women to work and more socially acceptable for them to do so. The World Bank says that only 17% of women in the Middle East and North Africa work in jobs that are not related to farming, such as banking and engineering. The region also has the lowest number of women who own businesses anywhere in the world.

A Swiss non-profit called the World Economic Forum (2020) says that the Middle East is one of the places where men's and women's income gaps aren't too big. The survey found that Syria, Pakistan, Saudi Arabia, Yemen, and Iran have the biggest gaps between men and women when it comes to economic participation and opportunities for women. These countries have a gender gap of at least 65%. Even though there are more women than men in universities in the Middle East, the "demographic dividend" that drives economic growth is not as big as it could be.

Popescu (2020) and Alserri (2017) highlight that many girls find it challenging to name notable Middle Eastern women in tech. As a result, girls typically only have a few female role models to look up to or draw them into the industry. It has been demonstrated that role models are crucial in encouraging girls to pursue careers in technology (Alserri et al., 2017). Popescu (2020) claims that girls may only sometimes succeed in motivating one another to enroll in tech-related

courses. This lack of peer pressure is partly caused by females' perceptions of technology as a male-dominated area. Again, the under-representation of women in technology supports this viewpoint. Girls do not encourage one another to enroll in tech-related courses because they do not see examples of women who have succeeded in the field of technology and, in reality, see more men than women there (Popsescu, 2020).

Women are still frequently prevented from continuing careers in technology because of the expectation to be available at work and home, particularly in places like the Middle East, where women are still expected to perform domestic duties. According to Bella and Chandran (2019), the demands of family life and tech-related employment may consume a lot of energy and time, negatively impacting women in tech's ability to combine work and personal obligations. Even though they are highly prepared for their roles, they ultimately leave the field to prioritize caring for their family. Also, 98 percent of working women need to learn how to use technology in order to be competitive in these fields. People with some or a lot of training will need to change their jobs more and more to accommodate digital technologies and advanced analytics (ILOSTAT, 2018).

Organizations like the OECD (2018) say that getting low-tech education done is linked to things like the digital gender gap. Because of the digital divide between men and women, women and girls have lower levels of education than men. One thing that could be a cause of low educational attainment is political instability. Even though the world has made some recent efforts to reduce inequality between men and women, more needs to be done, especially in the Arab world, where women face many problems (Abalkhail & Allan, 2015).

In Saudi Arabia's schools, there are more young women than ever before studying science, technology, engineering, and math (Alghamdi, 2016). In the Kingdom of Saudi Arabia, 64% of all graduates in the field of information technology in 2017 were women. A study on underrepresented Emirati women in the information technology (IT) business of the United Arab Emirates found that young Emirati women often can't make decisions about their careers because of cultural and

family barriers. In the local information technology business, women are still often treated differently based on their gender and people have a lot of wrong ideas about them.

According to the United Nations, 34 and 57 % of Arab women hold degrees in STEM fields. Compared to either the United Kingdom (16%) or the United States (59%), there are significantly more female students studying computer science in Saudi Arabia (59%) than in either of those countries (14 %). The Middle East is performing significantly better than most other regions, notwithstanding the high percentage of women employed in STEM disciplines (UNESCO Science Report, 2015). Nearly all women in the Middle East and North Africa now go to school, and the number of women in college has now surpassed the number of men. Even though there have been many efforts to improve the situation, the number of working-age women is one of the lowest in the world (EL-SWAIS, 2015; Islam, 2019).

Ramady (2010) says that the organisations of Saudi Arabia naturally reflect the culture and society of the country. Men and women can't work together at work because of cultural norms and administrative rules. Organizations in Saudi Arabia often have big differences between men and women that are built into the system. For instance, women must still be regarded as capable of undertaking management responsibilities even when they make up more than half of the workers in the education sector. Due to their gender, they cannot occupy deanship (Alselaimi & Lord, 2012). Islamic law limits the areas of the economy where Saudi women are allowed to work, so they only make up about 20% of the workforce (Human Development Report, 2015).

In some settings, women are expected to depend on men for everything they need and therefore do not need to pursue job education or career opportunities. For career women in all fields—the tech industry being an exception- societies of "women's place" and the reproductive stage of women frequently serve as justifications for travel and extra labor. According to studies, employing female employees is frequently discouraged by the distraction from family responsibilities that female applicants commonly name as a major barrier to hiring them (Braun & Turner, 2014).

The seven Middle Eastern countries of Egypt, Jordan, Kuwait, Lebanon, Oman, KSA, and the UAE are home to 78 million women and have a combined GDP of \$1.6 trillion (World Bank, 2018). These nations have about 40 million women who are unemployed or not in labor due to societal, physical, and familial barriers. Of the 13 million working women in these seven countries, 4.6 million work in professional and technical fields. By 2030, those positions are expected to grow by two to five times 11 million (MGI, 2019). The ratio of women to men in professional and technical jobs is lowest in the UAE (0.22), KSA (0.31), Oman (0.35), and Jordan (0.44), whereas Egypt (0.62) has an average ratio, and Lebanon (0.8) and Kuwait (0.93) have ratios that are comparable to those of the best-in-class nations (Rima & Chiara, 2020).

The digital age has made it much easier for women to start businesses online. This gives them access to new business opportunities, the freedom to schedule work around their personal lives, and the option to work from home and set their own hours. For instance, the emergence of social influencers, bloggers, and vloggers in the Middle East has been made possible by social media platforms, notably Snapchat, YouTube, and Instagram (Rima & Chiara, 2020). After the US, Australia, the UK, and Canada, the UAE ranked fifth in the number of freelancers it hired in 2015. However, connecting local freelancers to regional demand has considerably become more promising. For instance, women continue to be disproportionately underrepresented on the local freelance marketplace Nabesh, where only 24,000 of the platform's 120,000 freelancers are female (Rima & Chiara, 2020).

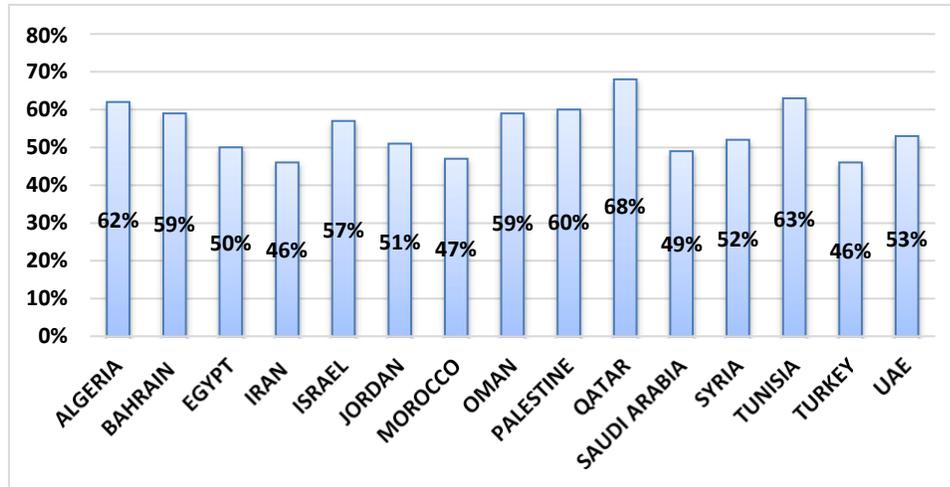
The gig/platform economy is an emerging trend in the technology industry that is rapidly growing and gaining popularity. Freelancer, a job site launched in 2000, has seen a total value of USD 3 billion, with 10.2 million jobs registered within six years of its inception (Freelancer, 2017). Online platforms could be a way for people in the informal or "shadow" economy to move into more formal jobs, especially for women in less developed countries. But it is important to have the right laws in place to make sure that these platforms offer real opportunities and don't just keep using exploitative methods (OECD, 2017b). Women in the digital economy usually work as professional freelancers. They offer services like data entry, administrative support, translation,

design, coding, legal advice, and business advice through online labour marketplaces like Upwork and Freelancer. These marketplaces connect clients with freelance workers around the world. It was projected that both websites would have 49 million users in 2016. (OECD, 2017).

For women, increased flexibility through platform work is desirable as women have control over their work life. Women may benefit significantly from digital platforms in both emerging and developed economies. These platforms enable more effective job searches and skill matches and expand the number of clients contacted globally without using conventional marketing techniques. Platforms also allow women to expand their skill sets by giving them access to and participation in various clients and projects. The integration of women into the workforce, which complements household income, and the opportunity for women to combine motherhood and a profession, which invariably boosts fertility increase, especially in aging societies, are additional benefits of the gig economy. Surprisingly, there is evidence that women have a lot of conscious and unconscious biases and preconceptions that can make it harder for them to use online platforms, even though the gig economy has many benefits (Rima & Chiara, 2020). It means that biases and discrimination against women who work in tech happen behind the scenes and online, and are therefore more about stereotypes than platforms.

In 2018, the World Bank did a study and found that when it came to learning outcomes, girls in the MENA region did better than boys. This shows that the biggest differences between boys and girls in school completion are in favour of girls (World Bank, 2019). In science, boys in Jordan and Saudi Arabia performed 29 points better than girls, followed by the United Arab Emirates (26 points), Lebanon, and Saudi Arabia (5 points). According to several studies and books, women continue to perform better than men across all fields at the university level (DiPrete & Buchmann, 2013).

Figure II: Women enrolment in Universities of some Middle Eastern Countries from 2016 to 2017



(Source: UNESCO Institute of Statistics, 2019)

Table I : Top Tech Positions for Females and Males

FEMALE	MALE
Project Manager	Software Engineer
Business Analyst	Systems Administrator
Other IT Roles	Project Manager
Q/A Tester	I T Management
Technical Recruiter	Applications Developer

(Source: Kawamoto, 2013)

2.6.1 Women in Tech in Israel

Israel has become known for its thriving tech sector, with Tel Aviv often referred to as the "Silicon Wadi." (The Guardian, 2017). Despite the sector's growth, there have been challenges for women in the industry, including a lack of representation and unequal pay (National Council for the Advancement of Women in Israel, 2018). However, there are also positive developments and prospects for women in tech in Israel. A problem for women in tech in Israel is that there aren't many women in the field. Only 24% of tech workers in Israel are women, according to a report by the Israel Innovation Authority (Israeli Innovation Authority, 2021). This is much lower than the number of women in the country's general workforce, which is around 46%. (National Council for

the Advancement of Women in Israel, 2018). People have said that this lack of representation is why there aren't enough role models and why there aren't as many chances for progress.

Unfair pay in computer employment is another issue that women in Israel must contend with. For instance, a study by Israel's National Council for the Advancement of Women revealed that women in the computer sector make 45% less money than men. The substantial pay disparity harms women's career opportunities and financial security. Despite these obstacles, women in technology in Israel have a bright future (Israeli Innovation Authority, 2019). To combat gender disparity in the tech sector, the Israeli government has taken action. For instance, a program to support women-led enterprises was introduced by the Israeli Innovation Authority in 2018 and provided financial and mentorship support to female entrepreneurs. The program has been successful with the backing of more than 100 female-led enterprises. Several organizations in Israel strive to help women in tech in addition to government measures. For instance, Women in Tech Israel is a group of tech professionals providing training, networking opportunities, and mentorship. The organization has over 2,000 members and has hosted events with major tech companies such as Microsoft and Google (Women in Tech Israel, n.d.). Another positive development is the growing awareness of gender inequality in the tech sector. More companies recognize the importance of diversity and inclusion, and there are increasing efforts to address gender bias in hiring and promotion practices. For example, Intel Israel has launched a program to promote women to senior management positions, and Microsoft Israel has implemented unconscious bias training for its employees (Calcalist, 2020; The Jerusalem Post, 2020).

In conclusion, women in tech in Israel face significant challenges, including underrepresentation and unequal pay. However, there are also positive prospects, with government initiatives, support from organizations, and growing awareness of the importance of diversity and inclusion. These efforts are crucial in creating a more equitable and diverse tech sector in Israel.

2.6.2 Women in tech in Yemen

Modern-day The kingdom of the Sabaeans, which later expanded into what is now Yemen, was one of the first civilizations in South Arabia. The Republic of Yemen has a low per capita

GDP and a population of approximately 28 million people that is predominantly Muslim. Yemen is a very young country that was initially divided between North Yemen and South Yemen until it was formally reunited in 1990. 2017 The World Fact Book from the CIA. Historically, Yemen has been the MENA country with the highest poverty level. They're one of the most catastrophic humanitarian disasters in all of recorded history is currently taking place (World Bank, 2019).

Women typically cover almost entirely and adhere to rigorous behavioral standards. Many of them are expected by societal conventions not to go out in public without a male family member. According to the World Economic Forum's most recent study on gender equality, Yemen ranks last in the world on the gender gap index (149/149), having only succeeded in narrowing less than 68% of its gender disparity. (WEF, 2018). As of 2016, there were 0.73% fewer girls than boys enrolled in public and private secondary schools (UNESCO, 2022).

Women in Yemen face significant challenges in accessing education and employment opportunities, making pursuing careers in the tech industry difficult. Particularly in the STEM subjects (science, technology, engineering, and math), which are essential for professions in technology, women in Yemen have restricted access to education (OCHA, 2021; UNESCO, 2021). Compared to other Middle Eastern countries, Yemen has the lowest enrollment rate for girls, and there is a substantial divide between boys and girls and between urban and rural areas. In Yemen, just 66% of girls will attend elementary school in 2022, and only 24% will attend secondary school. Yemen has not achieved gender parity in primary education, and as one advance in education, the gender disparity worsens (Al-Haidari, 2021; OCHA, 2021).

In Yemen, the respect of the family depends a lot on how the women act. As of 2020, 6.08 percent of women were working (UNESCO, 2022). Because of cultural and institutional norms, women in Yemeni countries continue to face more problems, such as a lack of women in STEM fields. The Global Gender Gap Report 2015 says that the Middle East has some of the lowest rates of women working. The 2015 Global Gender Gap Report says that the countries with the fewest working women are Yemen, Syria, Jordan, Iran, Morocco, Saudi Arabia, Algeria, Lebanon, Egypt, Oman, Tunisia, and Mauritania. Turkey comes in at number thirteen on the list. Family

commitments and practicing young marriage in rural communities are the main obstacles. In Yemen, early marriage is still a common practice in rural regions, and family obligations make it difficult for females to attend school and contribute to high dropout rates (Zakham & Juton, 2019).

According to a UNICEF report from 2014, 1.1 million children, or 21% of all children aged six to 14, are not in school. Of these, 69% are girls. Only 29% of public primary and secondary school teachers and 15.5% of higher education teachers are female. Additionally, more than two-thirds of females marry before the age of 18 to help families survive financially difficult times. Furthermore, 36% of first-graders will not finish the sixth grade (Schrandt, 2020). Yemeni women scientists are among the world's most resilient researchers because, despite the challenging circumstances, they are generally devoted to science and education. They also frequently work without pay in hazardous battle environments (Zakham & Juton, 2019). Social and cultural barriers also influence women's participation in tech. Yemeni society is conservative, and women often face social and cultural barriers to pursuing careers outside the home. Women in tech in Yemen may face discrimination and harassment and be discouraged from pursuing careers in male-dominated fields (Al-Haidari, 2021; OCHA, 2021).

Yemen is one of the world's poorest nations, and its tech sector is still in its infancy (OCHA, 2021; UNDP, 2020). The country lacks the infrastructure and resources to support a thriving tech industry, such as high-speed Internet and reliable power sources (Al-Haidari, 2021; UNDP, 2020). Political unrest and bloodshed have persisted in Yemen for a long time (Al-Haidari, 2021; UNDP, 2020). Businesses, even computer firms, find running efficiently in this unstable environment challenging. Due to Yemen's terrible economic situation, characterized by high unemployment and pervasive poverty, it is challenging for tech women to find financial support for their businesses (OCHA, 2021; UNDP, 2020). Government, industry, and civil society must work together to address these issues. It is important to work on giving women better access to education and training in STEM fields, promoting gender equality, giving Yemeni women more power, and helping the tech sector grow in the country. The international community can also provide funding

and support for initiatives promoting women's empowerment and economic development in Yemen.

2.7. Challenges Facing Women in Tech in the Middle East: An Overview

The socio-political, organizational, and personal obstacles that Middle Eastern women face are caused by patriarchal cultural gender roles and status, according to the International Journal of Business and Management (2015). These obstacles were the same throughout the Arab world but slightly varied between and within Arab nations due to gender ideology differences (AFESD, 2006). Few studies show that a woman's family background and support, her education, her drive to succeed, and her self-confidence all help her career (e.g., Wilkinson, 1996; Omair, 2008). Also, it seemed like women's ability to advance in the workplace was affected less by patriarchy than by their family backgrounds (Omair, 2008; Karam & Afiouni, 2013).

Omair (2010) says that the quality of a woman's social capital, which includes her relationships with her bosses, coworkers, relatives, and strategic sponsors, is one of the most important things that will determine how far she will go in her IT career. This finding fits with what has been found in the past. For example, more than 60% of Arab women leaders surveyed by DWE (2009) said that the support of their fathers or husbands helped them advance in their careers, and Omair (2010) found that women's social capital in (tech) careers was one of the most important things that helped them advance in their careers. This finding fits in with what we already knew. Nicolaou-Smokoviti said, "Women elites, more than men, need more structural and cultural resources to make up for the structural and cultural disadvantages that come with being a woman" (2004). The results back up what she said.

With the start of the "Arab Spring" uprisings, women are pushing back against conventional, conservative ideas and mindsets that mistrust women as change agents and tyrants. Some groups are uncomfortable and in conflict with tradition when women are connected with freedom in the wake of the upheavals in Egypt and Tunisia. A female protester from Egypt

informed Catherine Ashton, the top diplomat for the EU, during her visit to Tahrir Square, "When we said that Mubarak should go down, the guys were anxious for me to be present. But now that he's gone, they want me to go home." (From April 23, 2011, The Guardian). Surprisingly, some educated women strongly back laws that make it legal to limit women's rights in the name of "honour" and "obedience." A. Ikhlas (2015)

Even though there are more women than men working in the information and communication technology (ICT) sector around the world, senior management is often thought to be run by men (Tandon, 2012). Families in the Middle East and North Africa who are struggling financially are more likely to let their daughters stop going to school or taking online classes if they don't have access to the resources they need. Child marriage can be a lifeline for these families. The main reasons given in studies for why women do not purchase mobile phones in lower- and middle-income countries worldwide are affordability, literacy, and skills, "family does not approve," safety and security, affordability, and affordability. 2020 (Bhatti). Arab families who are more traditional can feel uneasy about letting their girls use phones due to exposure to strangers or potential internet harassment. Also, women could have to interact with men in stores to purchase their phones or top-up cards (Bhatti, 2020).

The demands of online learning and the gendered effects of COVID-19 are causing female students in the Gulf states to struggle. Many Gulf-Arab women find it unsettling to reveal their faces online and break cultural taboos. Female students have expressed concern about webcam monitoring during exams around the Arab world. While some educators believe this raises questions about academic honesty and responsibility, the problems are more complicated and have deeper cultural roots for some female pupils. Nevertheless, cultural conflicts in the area are related to women's education and affect how online education is implemented. Many Gulf-Arab women students are hesitant to pursue degrees online while balancing family obligations to prepare for a future that is now more uncertain than ever. Because when it comes to the emergency remote learning made necessary by the coronavirus outbreak, the digital gap is a problem, including systemic gender inequities as well as tech infrastructure and mobile devices (Hurley, 2020).

According to research, men typically speak more in meetings than women, and some women find it difficult to speak out. Women appearing online is socially and culturally taboo in some places. Some Gulf-Arab women, but not all, have a strong practice of avoiding facial presentation on camera or in photographic portraits in media outlets (Hurley, 2020).

According to data from the International Telecommunication Union, 48% of homes in Arab nations lack access to home internet (2019). Mobile phones are not a reliable substitute for broadband Internet. However, internet access on mobile phones may only sometimes be available or may need to be faster to support online learning. When internet speed is enough, hardware costs and cost of access become essential factors. Online learning frequently relies significantly on posting, downloading, and viewing files and movies, requiring broadband Internet piped into the home. (Faek and El-Galil, 2020).

Among other difficulties, females may encounter cultural restrictions in many nations that deter them from acquiring the skills required to work in the ICT industry. A "geek" or "nerd" culture has emerged in the tech industry in various regions of the world, which frequently draws more boys than girls. Since personal computers were initially marketed as toys for boys rather than girls when they first came to the United States, there was a dramatic decline in the number of women pursuing computer science (NPR, 2014). Further studies reveal that whereas girls often use technology to accomplish another goal, boys typically play with computers as naturally engaging toys or puzzles (AAUW, 2000). Girls are frequently underrepresented and less experienced in computer science elective classes.

Working in STEM occasionally includes long hours and complicated schedules frequently conflicting with family duties and arrangements. One explanation for female gender discrimination, according to Highghat (2013), is the belief that women are less physically and psychologically fit than men, that women are less dedicated to their families than men, and that paying for maternity leave costs money, even in the face of fierce competition in the tech sector. Haghghat, 2013, added that it is more difficult for women to find jobs and advance their careers in the computer business because of these biases and stereotypes, which are more pervasive there.

Women typically struggle more than males to balance work and life because they typically shoulder the majority of household duties (Eccles, 2009). The difficulty for women to find a balance is compounded by the lengthy workweeks typical of the technology sector. For instance, a program at several tech firms works extra hours to increase productivity and cut costs (Haghighat, 2013).

The disparity between the demand for workers with expertise in information and communications technology (ICT) and the number of job seekers who possess the necessary technical skills poses a risk to the ability of those nations to participate in the digital economy, which is an essential growth driver in the twenty-first century. This gap would be bridged if more women entered the information and communication technology workforce. However, at the moment, they need assistance to reap the full benefits of this burgeoning business. In the information and communications technology business, Middle Eastern women typically hold entry-level positions such as data entry, office and secretarial work, phone operations, and other tasks near the bottom of the supply chain (Melhem & Tandon, 2009). Another study that looked at global trends in information and communications technology found that 30% of operations technicians were women, but only 15% of managers and 11% of strategy and planning experts were women. This means that lower-level jobs in this field have become more "feminised" (Tandon, 2012).

Even though careers in information and communications technology (ICT) have the potential to offer flexible hours and the chance to work from home, which can help women balance the needs of work and family, very few organisations are setting up their work in this way to make roles more accessible to women. As the ICT sector grows, workers must also keep improving their skills because they need to know more about technology. According to a 2012 ITU study, this puts women "at a disadvantage given their many responsibilities in the workplace, at home, and in society, as well as the cultural bias that tends to favour investing in men's education over women's" (Tandon).

Women who work in ICT in the Middle East face another problem: they don't have any role models or mentors who are women. Role models can help young women and girls who want to work in fields where men are more common, like information and communications technology (ICT) and other fields. These role models can provide assistance and networks for employment access, as well as encouragement and advice throughout their careers. In numerous case studies, the need to have female role models in information and communications technology is emphasized, and specific examples of how to achieve this goal are provided (Powell and Chang2016). Role models are often looked up to by kids because they can show them how to use their STEM skills to change the world. This is why it's so important to have role models. More and more young people in the UAE want to work in science, technology, engineering, and math (STEM) (STEM). A survey done in December 2017 and published in a report by Emirates Global Aluminum, the largest industrial company in the United Arab Emirates (UAE) that isn't in the oil and gas industry, found that a more well-known role model and internship opportunities are needed to make this happen. (Islam, 2019).

There is no doubt that not many women work in STEM fields, even though these are some of the fastest-growing and best-paying jobs in the world. Most experts, business leaders, and lawmakers don't agree on what caused it. Some people say that because most computer science and engineering students are men, women may find these fields scary and have few chances to move up. Only a small number of women in the Middle East want to work in STEM fields, which is another thing that needs to be changed. No matter what the reason is, discrimination against women and the lack of women in STEM fields are problems that are deeply rooted in cultural beliefs about women's ability and interest in these fields of work. (Islam, 2019).

As gender diversity becomes more and more accepted and industries like oil and gas, waste management, fast-moving consumer products, and chemicals have a high demand for technology and innovation, there are many opportunities for women in the Middle East who want to work in STEM. Even though there are a lot of women who graduate with STEM (science, technology, engineering, and math) degrees, there is a big gender gap in the workplace (UNESCO, 2019).

More than two-thirds of respondents in a poll concerning people's beliefs in the region that the UN Women agency carried out and Promundo stated that a woman's primary responsibility should be to care for the home. The majority of the women considered this to be their most important responsibility. (2017) Feki et al. Another respondent clarified the challenges, stating, "Unfortunately, as my profession has developed, I have encountered fewer female role models. I've worked in finance, technology, and now at the intersection of those three fields " (Rahal, 2022). Women are marginalized, making it much harder to enter and stay in the workforce (UNESCO, 2017). Even though Islam lets women work outside the home, conservative groups in Saudi Arabia want to keep men and women from working together. This is done to keep Saudi women from being influenced by Western women, who have different ideas and goals than Saudi women. The women who were interviewed said that the only fields that were good for them were the ones that women have always been good at, like the public and business sectors.

On the other hand, there aren't many jobs for women in Saudi Arabia, and the ones that are there don't give women many chances to move up in their careers. 2017 (Al-Asfour). The Saudi women in this study had a hard time because they had to work outside the home and take care of their husbands, children, and other family members. In today's society, women are expected to take care of their homes and work, so the participants talk about how busy their lives are and how tired they are (Al-Asfour, 2017).

The Wahhabi school of thought perpetuates in Saudi society the gender stereotypes and traditional beliefs that restrict Arab women's professional advancement generally. The main religion the KSA acknowledges is Islam, and Sharia—the Arabic name for Islamic law—rules daily life. Although Islam considerably impacts followers' personal and professional lives (Tlaiss, 2013, 2014a), it is also important to consider how Saudis, particularly women, are affected by sociocultural traditions and values. To be more specific, Sharia law permits women to work in particular professions as well as participate in politics and the economy. But because Islamic teachings emphasise gender inequality and give men an advantage over women, Saudi women have one of the lowest rates of working in the area (Al-Asfour, 2017).

Another study on why there aren't enough Emirati women in the UAE's IT sector shows that cultural and family pressures keep many young Emirati women from making their own career choices, and that the region's IT sector is still dominated by negative gendered assumptions about women (Marzouqi & Forster, 2011). Bagchi-Se (2010) says that increasing the number of women in executive and administrative positions is important for achieving gender equality and meeting customer needs in the cybersecurity business. Kemp and Madsen's (2014) research on female managers in Oman led them to the conclusion that employment policies in the private sector of Oman need to be looked at again to help women get hired, stay in their jobs, and move up. The study they did on women who run businesses in Oman led them to this conclusion.

The main things that worried the participants were also their pregnancies and the births of their children. The Saudi women's birth rate has gone down from 3.39 percent in 2007 to 2.89 percent in 2014. However, the high birth rate in the KSA is still a worry. (2015) The Central Department of Statistics and Information says so. Even though childbearing is crucial in creating a family, some women put their plans on hold. Many interviewed women talk about having trouble performing their job duties during and after their pregnancies. Some businesses demand that women reapply after a year or so rather than making accommodations for them (Al-Asfour, 2017).

The demand for more mobility is a fundamental obstacle prohibiting Saudi women from participating in the economy. Saudi women who were questioned claimed that working outside the home made it difficult for them to travel. Women are not permitted to operate motor vehicles in the countries of Saudi Arabia, Egypt, Jordan, or Libya. As a direct consequence of this, women are compelled to rely on male taxi drivers, their spouses, their siblings, their sons, or other male relatives who live close by. (OECD, Suliman, Batha, and Al-Asfour, 2017; 2017). (2017).

When asked if Saudi women face gender bias or other types of discrimination at work, an interviewee said that Saudi men don't talk to Saudi women, but they talk to foreign women a lot more. This may be because of cultural norms. The interviewee was asked if Saudi women face discrimination at work because of their gender or other reasons (Al-Asfour, 2017). A female interviewee recalled some instances from early work when bias was evident. Initiating ideas and

improvement schemes are among them; if they came from another team member (a man, as you might assume), they would be accepted and appreciated (Rahal, 2022). Despite progress in allowing girls to attend school, these cultural restrictions discourage them from using their education. Even if they attended school, society would likely treat them poorly at employment because of their gender (Grande, 2018). Sociocultural and Islamic traditions and beliefs greatly impact organizations and the norms, beliefs, obligations, and regulatory pillars (Scott, 2014).

Because of the deeply rooted discrimination and cultural expectations in Yemen, women continue to have a substantially harder time breaking into STEM fields and are underrepresented overall (Zakham & Jatou, 2019). In today's society, women face more problems, such as patriarchal systems, cultural and religious gender norms, fewer chances to move up in their careers, cultural barriers that make it hard for women to be in management positions, being left out of informal networking, not having enough family support, and wanting equal opportunities. These challenges are listed in the following paragraphs (Tlaiss, 2014a, b).

According to a World Bank Group study (2019), households start using broadband internet when the cost is only 3 to 5 % of their monthly income. That is accurate for certain Arab nations but not for Djibouti, Syria, or Yemen, where the cost of broadband considerably exceeds 5% of an individual's income. The impoverished are most affected by this. According to research by the World Bank Group, the poorest 40% of Yemen's population would have to pay more than 51% of their income solely on mobile internet services (Gelvanovska et al., 2014). Women in IT face difficulties in these fields.

Saudi women face challenges in the workforce in many respects compared to those that affect women in other Arab nations, such as Yemen. Sexism, male coworkers' disrespect for women, a lack of informal networks, mentoring programs, and organizational assistance were identified as barriers that prevent women from advancing their careers, as stated by Binti et al. (2014). In Saudi Arabia, Muslim women have restricted access to professional development and training opportunities. 2017 (Al- Asfour).

The fact that many Yemeni women leaders, especially those in the middle and lower levels of management, would rather not challenge structures or address gender inequality in their workplaces or projects out of fear of upsetting their bosses or the system in general and hurting their chances of career growth was a fascinating discovery about Yemeni women leaders. If you look at the competition for dominance as a zero-sum game, this is not something that only women do (Ruthig et al., 2017).

Despite the wide range of differences, only about 25 % of women in Middle Eastern countries have paid jobs. Women's employment rates are significantly lower in countries and regions experiencing conflicts. According to certain studies on working women, the high rate of mothers who leave the workforce as professionals are partly due to the challenges of juggling work and family (Leber Herr & Wolfram, 2012).

According to research, women in the middle east (Yemen) face the most significant challenges because they interact with seniors the least, receive minor support from coworkers, and have the least number of positive role models in their lives. However, women exhibit greater pleasure than men as their tenure increases. 2020 (Assi and Marcati).

When it comes to beginning enterprises related to information and communication technologies, women in underdeveloped nations face more challenges than men because they typically do not have access to finance (Stanton, 2016). Most microloan programmes that help women become entrepreneurs focus on traditional women's activities, like handicrafts, rather than ICT-based industries. Women are also underrepresented in the structures that make decisions in the information and communications technology (ICT) industry. This is especially true in ministries, regulatory bodies, and corporate boards (Melhem & Tandon, 2009). Firms have been reluctant to train their workers in fragile and conflict-affected areas like Yemen, where political and economic unpredictability makes many types of investments even riskier (Blattman & Ralston, 2015).

According to Graham, 2016, the following summarises the barriers facing women in tech industries in the Middle East;

1. prejudices and unfavorable views among those who work in the industry
2. An increase in the length of working hours and a decrease in the degree of flexibility in working conditions 2. The absence of well-known women who could serve as role models in the industry.
3. The intimidation of working in a workplace where men predominate results in gendered work cultures and behaviors ultimately.
4. Negative feelings of seclusion among female employees in the industry
5. Negative assumptions of incompetency and hence discrimination and denial of opportunities

2.7.1 Challenges Facing Women in Tech in the Middle East: Gender Stereotyping

There are many ways to talk about gender in literature. Gender refers to the differences between men and women that are based on social norms (Ridgeway, 2011). Differences that already exist are made worse by cultural ideas about what roles women should play (Giuliano & Nunn, 2013). Wharton says that gender is a system of social practises that causes and keeps inequalities alive (2009). Gender impacts people's identities, behaviors, and relationships in various social circumstances (Wharton, 2009).

Associating different characteristics and behavior with particular genders often results in gender stereotyping (Dandapant & Sengupta, 2012). Gender stereotypes are specific attributes or characteristics that society considers fit for a particular gender (Ginge et al., 2007). According to Heilman, 2012, there are two categories of gender stereotypes, namely descriptive gender stereotypes and perspective gender stereotypes. The former states what women and men are like, and the latter states what women and men should be like (Heilman, 2012).

There are four components of gender stereotyping, as highlighted by Dandapant and Saguta, 2012. The components are traits, behavior, physical characteristics, and occupations, and they all interact with one another. Gender stereotyping negatively influences women's participation in the work environment as it is associated with discrimination (Duehr & Bono, 2006). This

discrimination can influence women's progress in their career paths and deter other women's involvement.

The Stereotyping associated with the tech industry within the Middle East causes female individuals to perceive the tech field as male-oriented. Alserri et al. (2017) and Popescu (2020) indicated how the tech industry is considered a male industry in the Middle East. This opinion is primarily the result of the absence of female role models in the Middle East and the global tech industry. This scarcity of female pioneers in tech has ultimately resulted in the overall underrepresentation of women in tech. Popescu (2020) and Alserri (2017) highlighted that many girls could not mention prominent women in tech in the Middle East. Girls, therefore, generally lack female role models to look up to and inspire them to join the field. Role models are essential in motivating girls to join tech-related fields (Alserri et al., 2017). Popescu (2020) also highlights how stereotyping associated with tech limits peer influence among girls to enter the field.

According to Popescu (2020), girls may often need help encouraging each other to pursue tech-related courses. This absence of peer influence is attributable primarily to girls associating the tech field with the male gender. Again, this perspective is reinforced by the underrepresentation of women in tech. Since girls fail to see women who have succeeded in the tech field and see more males in the industry than females, they do not motivate each other to pursue tech-related courses (Popescu, 2020). The gender biases associated with the tech industry, therefore, limit the interest in girls entering the field. Stereotyping in the tech industry, on the other hand, often culminate in curtailing the progression of women's careers in tech.

Gender bias in the tech industry essentially appears as sexism (Hanton, 2015). Sexism often creates an unfavorable work environment for women in tech in the Middle East, which limits their growth. The underrepresentation of women in technology is examined from this angle by Hanton (2015), who also emphasizes how sexism in the sector prevents women from feeling at home. The poor treatment of women in the industry and the sexist attitudes of males who often dominate higher levels of the field appear hostile to women (Hanton, 2015). This results in women abandoning their careers in pursuit of alternative ventures. Unfortunately, research reveals that the

sexism in the sector combines with the widespread gender prejudice in Middle Eastern society to provide even more unfavorable working conditions for women in tech.

Women are frequently prevented from continuing careers in technology because of the demand to be available at work and home, particularly in the Middle East. Bella and Chandran (2019) called attention to the fact that the demands from jobs in the tech field and the demands of raising a family may take up a significant amount of energy and time, which may subsequently affect women's work-life balance in tech. Therefore, the view that women should remain at home and focus on raising the family puts pressure on women in tech. They leave the field to focus on caring for their families, even when highly qualified for their positions. Gender stereotyping, according to the Gender Equality Law Center, is the overgeneralization of a certain group's traits and traits depending on gender.

No matter how far back in time women have been involved in technology, from Hedy Lamarr, a co-inventor of the frequency-hopping radio signaling device that served as the forerunner to WiFi and GPS, to Ada Lovelace, the first person to write an algorithm for a machine to perform mathematical computations, and Grace Hopper, the Esteemed Computer Scientist, Mary Wilkes who designed the system for one of the personal computers, and the list continues, the level of involvement of women in tech is still very much a far cry.

While stereotyping is a significant factor presenting challenges to women in tech in the Middle East, they benefit from a separate issue that inhibits women from gaining entry into tech in the form of low education attainment. The problem of poor educational attainment levels as a barrier for women in tech in the Middle East is highlighted by studies such as Masud et al. (2019) and Lasic (2018). Masud et al. (2019) attribute low education attainment to a lack of training opportunities from situations arising from restrictive traditions. The gender digital divide, on the other hand, is cited by organizations like the OECD (2018) as a contributing factor to low-tech education attainment. Female educational attainment is poor due to the gender digital divide, which denies women and girls equal opportunities to learn computer skills and information. Low education attainment may result from factors such as political instability.

Political instability arising from civil unrest affects all individuals regardless of gender. Nevertheless, events causing political instability tend to have more disproportionate implications on female individuals. Lasic (2018) and Monk (2021) focus on how instances of political instability bring about education inequalities to limit women from entering the tech field. The authors show how times of political instability coincide with greater violence against women to cause low education attainment. Women are thus disproportionately deprived of education opportunities in instances of political instability. Corroborative evidence on the benefit of high education attainment levels for women in tech in the Middle East is presented by Alghamdi (2016). This author shows that with education, it is possible to expand opportunities for women in tech. They focus on Saudi Arabia and show the immense benefits education provision has on women in tech in the Middle East.

The female gender in the Middle East region is considered to be caregivers and mainly support and raises a family. Even though female gender biases still prevail in other parts, the issues are more pronounced in the Middle East. Women are restricted by culture and religion (Islam) from any role that brings them to the fore. By this background, they are molded right from infancy, within the family setting, by what they see in society, and up to the classroom. Individuals can form their perceptions and understandings of what is happening through their networks. (Nadia Al-Sakkaf, "Yemen's Women and The Quest for Change") The flight captain is always of the male gender, and the flight attendant is always expected to be female, and so on. A doctor is always a man, and a nurse is always a woman. (Yemen's Women and The Quest for Change – Nadia Al-Sakkaf).

When you look closely at reports by (Sonja, 2013), you can see that women do just as well as men at different levels of education in many subjects, including tech-related ones, if they are given the chance to participate. But since this isn't true, their lack of tech skills also leaves a huge hole in the economy. These things also affect how girls think, act, figure out who they are, and make choices. Using ICTs to give women more power in developing economies. In this situation,

the teacher's sex is what decides if she stays or not. It ends up deciding on a major because it has contact with the other sex, which is against cultural and religious norms.

Cultural norms are regulations and moral guidelines which specify acceptable gestures in a particular society. Norms in some societies affect how females perceive tech, which is what has created a gap between the male and female gender in tech in the Middle East, although this varies from one country to another (Sonja, 2013). According to Sonja, 2013, girls in Middle East countries scored better than boys in science comprehension by 8%.

Women shouldn't have affairs outside of the home because they have to live and work alone because of strict cultures and traditions that say women are physically and emotionally weak and need to be protected and controlled for their safety and to keep the family's honour (Heinze, 2016). But because of the ongoing conflict in Yemen, "the lack of men and male protection has led to a significant increase in the domestic workload of women," who are now also the main providers for their families. Many women have also taken on the roles of first responders and humanitarian workers, helping to ease the suffering of their communities. Center for Applied Research in Partnership with the Orient, Women's Role in Peace and Security in Yemen, by Marie-Christine Heinze (CARPO).

According to Khamis et al. research 's from 2011, women in Yemen have been successful political leaders since the country's earliest days, even when doing so put their health and the honor of their families in jeopardy. Alongside the male demonstrators, hundreds of thousands of Arab women took to the streets across the region, including in some of the region's most traditional and conservative nations, such as Yemen and Bahrain, to call for an end to dictatorship and brutality as well as to demand dignity and freedom (Khamis, 2011; Radsch 2011, 2012).

Although the female gender under-representation in tech is a worldwide challenge, according to a study by Women in Tech, only 19 % of females are in tech careers. At the same time, the United Arab Emirates has recently picked up and seriously put measures in place to boost women's involvement. This is true despite though the United Arab Emirates and other Middle Eastern nations have the same traditions that restrict women and promote gender stereotypes in

the name of religion. According to an October 2018 Middle East Exchange Magazine, women in the middle east have moved up to 35% involvement in tech which is less male-dominant than 19% females in tech worldwide. The women feel that "The digital world seems more meritocratic and allows them more freedom and flexibility than regular office jobs.

Complete lack of or, in some cases, low educational attainment of the girl-child due to restriction from culture and religion or civil unrest, lack of female role models, intimidation and sexism, social interaction between males and females at the workplace, discrepancies in pay structure and lack of funding for the female tech startups add to the many barriers facing women in the Middle East countries and causing their under-representation in the tech industry.

2.7.2 Challenges Facing Women in Tech in the Middle East: Educational Attainment

Approximately 11% of graduate students in Yemen are female, with 60,000 men studying there compared to 15,000 women (Darem, 2014). While a computer science or engineering degree is required for most professional-level ICT jobs, the proportion of women graduating in these subjects is declining globally (Powell & Chang, 2016).

Only a tiny minority of Middle Eastern countries have been able to create systems that offer Middle Eastern women quality technical education. Most of the region's countries need to give women in technology the requisite education (Masud et al., 2018). Due to restricted traditions and inadequate infrastructure that prevents access to training institutions, women in the Middle East frequently need more training options (Lasic, 2018; Masud et al., 2019). Education disparities among women are greatly exacerbated in countries like Syria and Lebanon by political instability brought on by civil upheaval (Lasic, 2018; Monk, 2021). According to Tlaiss (2013), these societal and cultural norms about what women should and should not do impede women's growth.

With 68% of all students enrolled in institutions across a few Middle Eastern nations during SY 2016–2017, Qatar has the most significant percentage of female students. With 63%, Tunisia came in second, only 1% ahead of Algeria's 62 %. Palestine, Oman, Bahrain, Israel, United Arab Emirates, Syria, Jordan, Egypt, Saudi Arabia, Morocco, Iran, and Turkey are the following countries in line (UNESCO Institute of Statistics, 2019).

In Yemen, there are strict gender roles and a lot of pressure on young girls to get married and have kids. Consequently, some females may choose to leave school (Mehraas et al., 2017). Yemen's weak economy harms women. Most families, who earn an average of \$2,500 annually, meticulously plan the money they might spend on their children's education (Darem, 2014). As a result, women have little possibility of receiving technical training. Women have a very difficult time enrolling in universities in Yemen since there is no assistance for girls in primary and secondary institutions. Schools in Yemen need more teachers to teach many females because Yemeni households sometimes forbid men from teaching their daughters. These girls may go to college and eventually return home to become teachers (Darem, 2014).

Even though more women are graduating from colleges in major cities with high degrees in STEM, some limitations in the Yemeni and Arabic cultures impede these women from pursuing research-focused employment once they earn their degrees (Zakham & Jatou, 2019). Prejudice, gender-based violence, and stereotyping are significant concerns that must be addressed (UNFPA, 2017).

Education in Yemen still suffers due to the horrific civil conflict, but female pupils bear the brunt of the lost chances (Sharaf, 2019). "The university is far away, and the road is dangerous." Therefore, my father concluded that I did not need to attend college and that high school was sufficient (Sharaf, 2019). A young Yemeni woman replied, "Due to the ongoing war and the worsening security situation in some governorates, including kidnappings, murders, and attacks on education by forces on both sides of the conflict, families are discouraged from sending their daughters to schools or universities, even if they are very smart. Instead, they want to protect their girls, so they marry them off when they are young. The low female participation rates in education are attributed to factors such as the paucity of girls' schools in rural areas, family economy, and social standards " (Sharaf, 2019).

The average Yemeni girl marries before age 18, and 45 % of them do so before age 15. According to a 2016 UNICEF survey, this is the case. Girls who marry young are less likely to finish their education and are more vulnerable to physical abuse and domestic violence (Sharaf,

2019). Due to the shelling's devastation of the economic infrastructure, the reduction in household income, and the termination of wage payments, millions of families are forced to cease sending their daughters to schools and colleges to protect them and lower the expense of their education. According to a lecturer in Yemen, female students are typically prohibited from joining WhatsApp groups and other communication platforms occasionally used in online education. The majority do not own smartphones because of customs and traditions, says a Yemen-based lecturer interviewed by Faek and El-Galil (2020). This is a challenge for women in tech in Yemen as these are necessities for education and career growth. The attempt to move university instruction online during the coronavirus pandemic has exacerbated access disparities in the Arab world, making it more transparent which students have a high-speed internet connection and which do not—especially for students in Yemen embroiled in civil war. Refugees, poor children, those living in rural regions, and girls from socially conservative families—groups who frequently have limited access to education—now have less access, if any access at all (Faek & El-Galil, 2020).

Another big problem for young women's education, especially if they are interested in technology, is that most homes have a lot of work to do around the house. This is especially true in Bani Hassan, Yemen's largest IDP camp in the northern province of Hajjah. Girls often have to drop out of school to help their mothers at home, especially if their mothers are the heads of their families (Kalfod, 2017). Several middle eastern nations are among those where English language competency is improving, although the rest of the region's nations are among the worst worldwide. This information may be found in a report issued by the EF-English Proficiency Index, a yearly ranking based on the results of online tests taken by 2,000,000 individuals in 112 countries, 12 of which are in the Middle East. Yemen ranked bottom on the Middle East list and all other countries surveyed, whereas Lebanon was noted as having intermediate proficiency and topping the Middle East list. Given that most technical education is in English, this report demonstrates a language barrier for women working in technology (EPI, 2021).

CHAPTER III: METHODOLOGY

This chapter outlines the inquiry process of answering the research questions around the review topic, "Women in Tech in the Middle East: Experiences and Possible Solutions to their Challenges." The philosophical underpinnings and research approach adopted will also be discussed herein.

3.1 Overview of the Research Problem

There needs to be more existing literature on the factors affecting the enrollment of women into tech-related fields in the Middle East (Alserri, Zin, and Wook, 2016). According to Alserri, Zin, and Wook, 2016, studies on gender disparities in tech often fail to focus on the situation in the Middle East; this, therefore, justifies the gap in research identified by this study. Factors such as expected societal roles, gender stereotypes, and perceived male dominance in the tech field, among others, introduce barriers to women entering the tech space. (Hanton, 2015). Few studies have also attested to these challenges by presenting the personal experiences of various women in tech in the Middle East. For example, studies by Bella and Chandran (2019) and Popescu (2020) reveal that the inability to attain an optimal work-life balance linked to gender roles and cultural stereotypes is a predominant issue in the Middle East. Factors such as the gender divide and access to technology in the Middle East also present limitations for women's involvement in the tech industry in the Middle East (OECD, 2018).

Perspectives on how the lack of access to education may hinder progression into the field for women in tech are advanced by Masud et al. (2019). Giving a specific focus on the United Arab Emirates (UAE), Masud et al. (2019) used the personal experiences of Middle Eastern women to highlight how factors such as restrictive traditions and violence against women may hinder them from entering the field of tech by limiting their access to tech courses. Similar perspectives are shared by Lasic (2018) and Monk (2021), who assessed the situation of Syrian

refugees in Lebanon and Jordan to showcase how barriers to education for women may come in the form of not just restrictive traditions but also interference in the political order within the region.

Even as gender disparity in technology-related fields continues to be an issue of genuine concern with daunting societal biases and restrictions, Middle Eastern women face even more barriers from culture and religion. However, amidst so many prohibitions, they have taken giant leaps into tech careers and roles traditionally and culturally seen as domains for the male gender. According to a UNESCO report from 2020, women make up 57 % of STEM graduates in Arab nations, whereas they make up 61 % of STEM undergraduate students in the UAE. Despite these high rates of enrollment into tech education by women in Middle East countries, there is still an underrepresentation of this gender in the tech industry in the region. (Alghamdi,2016). This perspective offers a unique look into how access to opportunities in tech may still need to be improved, even in the face of the availability of tech education in the Middle East. This is worth understudying, hence the inspiration for this research inquiry.

The World Bank Group (2018) emphasizes the great potential of Middle Eastern women in IT, particularly their ability to get through the obstacles they face in the industry. Women might gain a lot from a change in the Middle Eastern social order, which would result in a change in how women are viewed in the region as well as a change in the political environment, according to the World Bank Group (2018) and Powell and Chang (2016). On the other hand, Srivastava (2019) and Holtzblatt and Marsden (2018) take a unique approach in proposing solutions for the challenges women in tech in the Middle East face, highlighting how corporations and businesses could play a role in mitigating challenges facing women in tech. Considering this perspective, this thesis attempts to understudy and proffer solutions to the challenges facing women in tech in the Middle East and the world by using the Yemeni situation as a case study.

3.2 Operationalization of Theoretical Constructs

This study adopted the interpretivism paradigm to answer the research questions in this review. Themes were developed and analyzed to aid in understanding the situation under consideration; this platform, the interpretivism paradigm, will provide us with the following few paragraphs and describe the interpretive research philosophy more vividly.

3.2.1 Interpretive Research

Rather than testing hypotheses to prove or disprove them, interpretive research explores the relationships between specific factors in different social settings (Saunders et al., 2009). Understanding cultural and contextual situations is necessary (Golkuhi, 2012). Therefore, interpretive research can help researchers have new meanings and interactions in situations. Keegan, 2009 opines that in conducting qualitative research, interpretive research is necessary for understanding research participants' thoughts and behavioral patterns that are context specific.

Interpretive research usually follows a subjective manner epidemiologically (Pranas et al., 2008). Therefore, interpretive research will reproduce subjective research findings as subjectivity from the social world forms the theoretical basis. Since interpretive research is entirely qualitative, it uses qualitative data-gathering methods, including participant observations, interviews, and document analysis, to comprehend and illuminate social, organizational, and cultural contexts (De Villiers, 2005). Qualitative data analysis in interpretative research will require identifying and analyzing themes appropriately (Joubish et al., 2011).

3.2.2 Interpretivism Paradigm

According to Creswell, 2007, interpretivism is ideal for conducting research involving participants from underrepresented groups. Statistics reveal that women are underrepresented in tech in the Middle East, especially in Yemen (Stephen, 2019; Ilyas, 2021). This, therefore, justifies the need for the adoption of interpretivism in the conduct of this study. Furthermore, since interpretivism explains situations in a social context which in this case are women in tech in the Middle East, especially in women, it is a critical stance for review. This stance helps the researcher to critically understudy and understand factors that influence the participation of women in tech.

Finally, interpretivism research techniques allow research participants and researchers to interact in a manner that draws their experiences to explain situations (De Villiers, 2005). The interpretivism paradigm had to be used to ascertain the causes of women's underrepresentation in tech in the Middle East.

3.3 Research Objectives and Questions

There aren't enough peer-reviewed studies on the topic; thus, more research is needed to understand women's IT situation in the Middle East fully. Consequently, the study's main goals can be summed up as follows;

I. To uncover issues with education and gender stereotypes that women in the computer industry in the Middle East experience and are evident in Yemen.

II. To draw attention to workable ideas that can help women in tech in the Middle East, particularly those in Yemen, overcome issues with education and gender stereotypes.

These objectives will highlight the plight of women in tech in the Middle East and establish approaches that can help women in tech in Yemen to alleviate the challenges they face., thereby promoting women in tech in Yemen. It will also benefit women's empowerment, businesses, and the economy in the region.

To answer the research goal of the study, this investigation will be led by two main questions based on the study's objectives. The following research queries will be addressed in this project;

1. What issues with education and gender stereotypes are faced by women in tech in Yemen, as evidenced by women's experiences throughout the Middle East?

2. What remedies exist to address the issues with gender stereotypes and education that Yemeni women in IT are facing?

3.4 Research Design

This study employed two methods - firstly, a review of secondary data on literature available on the topic and secondly, a collection of primary data via in-depth online interviews to understand and explain the factors influencing women's under-representation in tech in the middle east, especially the country Yemen.

Literature review as a research strategy helps identify research gaps and formulate theoretical frameworks. It also identifies significant methodologies and research techniques (Mustafa, Ahmed, and Adham, 2021). It is very useful in identifying main conclusions and explaining relationships. Materials are synthesized coherently and purposefully, showing what is known and what is missing about the topic. Available literature discussing women's underrepresentation in tech will be reviewed and included in the research.

An *in-depth interview* is a qualitative data collection tool that allows the researcher to capture rich data on people's thoughts, behavior, and experiences (Showkat & Parven, 2017). In-depth interviews are primarily extended and are conducted one-on-one to extract detailed information to better understand a problem (Showkat & Parveen, 2017). It involves much listening and less talking in a guided conversation manner. The In-depth interview for this study will be conducted online using the Zoom application for hosting online meetings.

3.5 Population and Sample

Yemeni women working in tech make up the study's sample. The study population for this investigation consisted of Yemeni women who tech companies now employ. Yemeni women have been excluded from decision-making roles (Al-Sakkaf, 2012).

The female labor force participation rate in 2020 will be 6.08 %, according to World Bank 2020. This implies that most Yemeni women still need formal employment in tech or other sectors. Ten Yemeni women who work in tech companies in Yemen were invited for an online interview in this study

3.6 Participant Selection

The first participant was identified through an internet search for women in the technology industry in Yemen, and snowballing approach was used to identify other participants. The first contact agreed to introduce some participants only if they received the SSBM's Identity card of the researcher and an official letter to their organization e-mail. After this, the first participant shared the e-mail and phone numbers of other participants. Another participant was identified through the first participant; they contacted them on the researcher's behalf before sharing their contact details. This was followed up by sending an e-mail and WhatsApp message (those whose phone numbers are registered on WhatsApp) to inform them about the study and the person who shared their contact.

3.7 Instrumentation

The detailed interview guide used to record the respondents' responses is displayed in Appendix A. An outline of the queries posed is given below;

Tech Education

- What causes a disparity in the proportion of female students enrolled in ICT courses over their male counterparts?
- Are you aware of any program that promotes female enrolment in Technology carriers?

Tech Industry

- Can you describe your experience since working in tech industries?

Factors

- What kind of work environment do women in IT now have where you work?
- How happy are women in IT with the direction of their careers?

Solutions

- Do you recall any past initiatives to boost women's engagement in the tech sector?

3.8 Data Collection Procedures

Interviews are often used for qualitative data collection (Myers, 2013). The researcher captured information from the participants directly without preconceiving information outcomes (Yin, 2011). A semi-structured in-depth interview guide was used to ask open-ended questions and receive answers that better understood the participant's experiences. The interview questions were first pretested by conducting an online interview with four (4) women in Israel and one (1) woman in Iran who work in tech companies. The data obtained was transcribed and used to assess the IDI guide's reliability and improve the guide to meet the needs of Yemeni women.

The interview responses were grouped into themes and transcribed for thematic analysis. The only interviews were conducted individually by one woman per time rather than grouping them to get their personal views and experiences. The interviews were recorded for easy transcription, and permission was sought from participants before recording commenced.

Data collection spanned through 5 weeks between 27th June and 1st August 2022. Thirteen In-depth Interviews were conducted among women who work in the technology industry. The first participant was identified through an internet search for women in the technology industry in Yemen, and snowballing was used to identify other participants.

A Zoom interview was conducted with the Israeli and Iran participants. However, we could not proceed with this plan among the Yemeni participants because the first participant, despite her understanding of English, had an accent that would be difficult to transcribe. After a brief conversation and realizing the language barrier, we agreed to receive written responses to our interview, which were adopted in the engagement of other Yemeni participants. Participants who received the interview guide sent their responses in English or Arabic through an e-mail or WhatsApp. An online Arabic translator was then used to translate the responses received into English. Further comments/clarifications were sorted after going through the responses, although this was not done for all the transcripts.

3.8.1 Interviews

Purposive sampling in qualitative approaches mainly yields the most abundant information about a research topic (Yin, 2011). When conducting this study, the researcher used a purposive sampling strategy. *Purposive sampling* is a deliberate selection that offers the researcher a wide variety (Qates, 2006). The sample consisted of 13 women who worked in different tech companies in Yemen, Israel, and Iran. The researcher applied to several tech companies requesting for women to participate in the research. One of the tech companies responded and linked up some other women in other companies. The interviews were conducted over an average of one hour each within five weeks.

3.8.2 Documents /Literature Review

Document/literature review collecting secondary data was used to provide evidence to answer the research questions. Evidence from the literature builds a more explicit picture than obtained from interviews (Myers, 2013). An examination of relevant material from the internet and library sources was conducted to supplement the information gathered from the interviews.

3.9 Data Analysis

The recordings were first turned into written documents by transcription. For the examination of textual material, thematic context analysis (TCA) is necessary (Clarke & Braun, 2013). It was decided to use thematic content analysis to examine the qualitative information obtained from the interviews. An inductive thematic analysis technique was used to analyze the transcripts. Tracking and highlighting the code and quotations in Microsoft Word allowed for analysis. Before coding, the qualitative analyst reviewed the transcripts to familiarise themselves with the data. Codes were created based on the preexisting study topics and fresh themes discovered in the transcripts.

The following phases of Thematic content analysis, as opined by Clarke and Braun, 2013 were adopted;

1. Acquaintance with qualitative data
2. Data coding
3. Thematic search
4. Theme review
5. Theme definition and naming
6. Writing

Since the data collected from the interview was qualitative, the data analysis was based on the researcher's perspective. Data was codified to make it smaller to fit within a text message. To make the analytic process easier, codes were given to similar data sets. Welman et al. (2015) state that codes offer meaning to the raw data allowing straightforward organization and categorization into themes. Open and selective coding was used to give particular codes to words and hone mental ideas.

3.10 Conclusion

This chapter clearly spelled out the research problem, design, theoretical viewpoints, data collection methodologies, and analysis methods. The limitations of the study were also emphasized. The study adopted the interpretive research paradigm to understand the situation in context clearly. A deductive research approach was also adopted. Yemeni women who work in tech companies were interviewed in-depth for the data. Data analysis was conducted using five stages of thematic analysis.

CHAPTER IV: RESULTS

4.1 Characteristics of Participants

A total of 20 respondents were invited to partake in the study; 13 responded and therefore constituted the participants for the study. The participants were, on average aged 28-56 years. More than half of the participants had a postgraduate level of education (n=7). Years of experience range between 1- 30 years. Participants work in various technology spaces, including information technology and engineering in the University and non-academic parastatal.

Table II: Professional Identity of Study Participants

Professional Identity	Number	Location
Application Operator	1	Yemen
Tech Coach	1	Yemen
Software Engineer	1	Israel
Sale Development Representative	1	Israel
Head of Information Security Department	1	Yemen
Assistant Teacher at the Faculty of Engineering	1	Yemen
Lecturer at the Faculty of Engineering	2	Yemen
Head of IT Department	1	Yemen
Information Security Officer	1	Yemen
Digital Marketer	1	Iran
Engineering Manager	2	Israel

Table III: Educational Attainment

Educational Attainment	Number
BSc	5
MSc	2
PhD	5
None (BSc in view)	1

Table IV: Location of Participants

Location	Number
Yemen	8
Israel	4
Iran	1
Total	13

4.2 Research Question One

4.2.1 Challenges of Women's Participation in the Technology Industry

The difficulties women face in technology have received more attention than other issues. The analysis results revealed that the majority (9 of 10) of the participants listed two or more barriers that have lowered interest in the number of women and girls pursuing careers in technology. These challenges included existing personal beliefs or opinions; family inclinations; societal norms; religio-cultural and organizational structure and practices, the low value attached to education, perception of childcare and women roles, unfavorable work hours, and difficulty getting managerial roles.

a. Personal belief

Participants thought that women *tend to 'believe'* that technology and its drivers favor men more than women. Hence, a need to allow men 'have their ways' into tech industries.

"The belief of women that technology does not suit them, but there is a slight and noticeable progress in recent times compared to before" (Yemen, 28 years, BSc Computer science, Application operation at telecommunication company).

"I think they think that men are more intelligent than me, and for you to get that job, you must work harder" (Iran, 42 years, MSc Software engineer, digital marketing).

"And it kind of discourages you, and you do not necessarily want to be in that super male-dominated, only going to be with young men" (Israel, 32 years, BSc Computer Science, Software engineer).

b. Family beliefs/ restrictions

Participants identified hurdles from family members, including attitudes toward technology held by the husband or father, as one of the major obstacles limiting women's and girls' enthusiasm for and interest in pursuing careers in technology. As documented:

"So, in my case, there was no family, religion, or any of these barriers, but I know women, and I know some of my friends where the family, like, just stood in their faces and said no. like computer engineering no, like you need to be a housewife and will take all your time. It's five years of studying, and you're getting older. It would help if you found a husband like, yes, I met those kinds of people" (Israel, 28 years, B.Eng. Computer Engineering, Sales Development Representative).

"If the parents do not welcome mixed studies, how will they welcome mixed work, so most female graduates tend to work in schools to avoid mixing or stopping work altogether" (Yemen, 56 years, Ph.D. information technology, University lecturer).

c. Organization interest/belief

Participants said that because of responsibilities, organizations and businesses were less likely to hire women than they were to hire men, like pregnancy and childbearing will increase their requests for leave and shorter work hours.

"Most companies and organizations think that this field is suitable more for males than females because the woman needs more vacations for delivery and other situations so their work will be delayed" (Yemen, 37 years, Ph.D. in Computer Science, IT department in the University).

“In addition, I am not denied that some business organizations refuse to assign females to such jobs, claiming that males are freer and more flexible” (40 years, Ph.D., head of the information security department.)

d. Societal belief

Almost all of our participants agreed that a critical challenge is the Middle Eastern mentality which tends to consider the technology field unfit for women. Therefore, only men should study related courses at University and do such a job.

“Yes, I think for many dimensions, including what is related to the Arab mentality, especially in Yemen, which still views women as unfit for some jobs and monopolizes them over men(Yemen, 36 years, Msc Information technology, information security officers in a financial company.)

One more thing is the society's point of view on technology” (Yemen, 37 years, Ph.D. in Computer Science, IT department in the University).

“There is a prevailing idea, especially in the Arab community, that IT jobs are reserved for males, and only males are accepted, and competition in them is impossible” (Yemen, 40 years, Ph.D., Head Information Security department in the University).

e. Religio-cultural beliefs

A participant mentioned a religious practice among the Druze people. This practice has restricted women from traveling alone or leaving their community without men accompanying them. Therefore, any course or career dominated by men tends 'to pose several threats to the few women among hundreds of men; as such, they are seen as 'useful objects of the house' or 'slaves' for the male child:

“So, they are like a small religious community, so the woman is prohibited and cannot go out of the village without the male, okay? And of course, she’s not allowed to take a degree or drive a car, so, they’ll only work inside the hub, inside the village because they are just women” (Isreal, 28 years, B.Eng. Computer Engineering, Sale development Representative)

Nonetheless, most of our participants felt that religions pose no challenge to women in tech if well understood by their congregants.

“As for religion, I think the problem is in people's understanding of it; as for religion, Islam has allowed us to work and has shown us clear principles and policies, there is no doubt about that” (Yemen, 28 years, BSc Computer science, Application operation at telecommunication company).

f. Low value attached to female education

The belief that educating a female offers little profit and usefulness to the family also poses challenges to an experienced decline of women and girls pursuing a career in technology.

“I think the major factor is our tradition and culture. In our country, some parents think education is not an important and useful thing for females, because of their role to build a family and take care of the kids” (37 years, Ph.D. in Computer Science, IT department in the University).

g. Perception of marriage and child-care as a woman's role.

Participants mentioned that marriage and childcare demands had hindered many academically sound girls/women who studied Information Technology from entering the labor market.

“Certainly, there are always fewer women in IT jobs and fewer in senior positions in this field. First, many female students in the faculties of information technology do not enter the labor market. Unfortunately, they are very superior academically. The other reason is marriage and the lack of support to solve the childcare problem” (Yemen, 56 years, Ph.D. information technology, University lecturer).

h. Unfavorable/long working hours.

Participants said that because of responsibilities, organizations and businesses were less likely to hire women than they were to hire men.

“...their full belief that this specialization requires a lot of effort and time, especially since some have a phobia of working at home” (Yemen, 28 years, BSc Computer science, Application operation at telecommunication company).

“Some projects are limited to males only, linking work with khat sessions, working outside official working hours and even late at night” (Yemen, 35 years, B.Eng. Computer Engineering, University lecturer).

Furthermore, as the ICT business evolves, workers must constantly improve their skills to meet the demand for increasingly complicated technical talents. According to the 2012 ITU research, this puts women "at a disadvantage given their multiple commitments in job, family, and community, as well as the cultural bias that tends to prefer an investment in men's education over women's" (Tandon, 2012).

i. Difficulty getting into managerial roles

Participants mentioned that getting into a leadership role is more complicated as males tend to find it uncomfortable to work as subordinate to women, coupled with the belief that women do not have leadership potential.

“I think many men, for example, won't feel as comfortable with women as their manager, especially in tech. I know it isn't very pleasant, but that is the case. I think it is easier for men to step into authority roles. It doesn't have to be a manager, but it can be something like that. But I think it's much harder for women” (Israel, 32 years, BSc Software engineer).

“No equal opportunities, isolation, and leaders not seeing them as having leadership potential” (40 years, Ph.D., Head of the information security department). Middle Eastern women generally work at the bottom of the supply chain in ICT, performing duties such as data entry, administrative and secretarial work, and phone operations (Melhem & Tandon, 2009).

j. Past Programs Targeted at Increasing Women's Participation in the Technology Field.

Only a few programmes have been launched to enhance women's participation in technology, according to transcripts. While some are ongoing, others have stopped due to war in the country; however, those that are ongoing have their challenges relating to financial support. All our participants opined that these programs must be continued should a brighter future be envisioned for women. As described:

“I heard about Tech women. No, it is not. They stopped because of our country's status”
(Yemen, 37 years, Ph.D. holder in Computer Science, IT Department in the University).

“Ministry of technical education, and there is a platform called the science and technology platform, and we can say that it is emerging to focus on women's technology education (Yemen, 28 years, BSc Computer science, Application operation at telecommunication company).

“The other program is a “Arab Women in Computing,” it is an Arab program that works to encourage and support women in technology in research activities and conferences and to shed light on women workers in the IT industry. It still exists, and we have the Yemen chapter in it”
(Yemen, 56 years, Ph.D. information technology, University).

4.3 Research Question Two

4.3.1 Solutions to Women's Underrepresentation in the Technology Industry

a. Role modeling

Participants mentioned that having access to and encouragement from women in the field will help grow young girls' interest in technology.

“Reflecting to them the image of the successful women in this field” (Yemen, 37 years, Ph.D. in Computer Science, IT department in the University).

“So, I think when uh, for example, when students see that they can, you know, their future can become like that, that they would uhm, you know, they would get the motivation to go and study” (Iran, 42 years MSc Software engineering, digital marketing).

b. Establishing women-centered organizations and grants

Participants mentioned the need to establish a women-centered organization focused on raising awareness of the IT industry among school girls and parents to correct wrong perceptions and spur technology interest in the heart of parents and girls.

“The role of the mentioned organizations cannot be ignored, especially since some of them were directed at young women and schoolgirls, and it would be good if similar organizations were

established inside the country and were concerned with raising awareness of the IT industry among schoolgirls and parents” (Yemen, 56 years Ph.D. information technology, University lecturer)

c. Provision of grants for women

The Provision of training grants will help provide the required level of experience and infrastructure like computers for learning and teaching in schools and carrying out some tasks at home.

“Paid training, providing tools that help to learn, such as computers, and creating job opportunities that prioritize women” (Yemen, 28 years, BSc Computer science, Application operation at telecommunication company).

d. Favorable organization policy

A favorable organizational policy offering the flexibility and opportunity for women to carry out their duty of caring for their families was mentioned as a necessary consideration for pursuing a career in technology.

“But I guess most of the companies that I work with care very, very hard, like, for the women and care so much to keep women in their company that they give some benefits. They encourage women to join the high-tech companies and maternity leave all this stuff is made easier” (Israel, 28 years, B.Eng. Computer Engineering, Sales development Representative)

e. Education

The participants mentioned that educating the girls and doing that in their early years will be more beneficial than when they are adults.

“Okay. So we need to let the girls know that they can do more than being mothers and, like, being responsible for the family. And there’s no difference between a female and a male in this life. If you like, desire to do it, and have the intelligence enough to do it, then you can do it. And also, we should explain that even if your dream is to be a mom and to have a family, it won’t stop you. Because the high-tech companies now give so many benefits and will make it easy for

you like, you know-. If we try to explain the real-life when working on tech”(Isreal, 28 years, B.Eng. Computer Engineering, Sales Development Representative).

“I think for me that’s the biggest time to get women into this. When they’re looking for what they want to do in life, not when they are 18 or 20, something like that. When they are at kindergarten” (Yemen, 32 years, BSc Computer Science, Software engineer).

f. School curriculum reformation

Participants mentioned the need to design a school curriculum that promotes the interest of girls in science and mathematics, which offers them the opportunity to pursue a career in the technology industry.

“We should focus on curriculum reform (e.g., by promoting girls’ interest in math and science), change the negative stereotype” (Yemen, 40 years, Ph.D., Head of information security department in the University).

g. Government policy

Participants opined that government involvement in making policies like allocating quotas and removing travel restrictions for women would raise the number in the technology field.

“In my country, the only approach that can help to promote female participation is only that there should be a government orientation to involve women within the quota, especially in activities that suffer from male domination, such as the technological field” (Yemen, 40 years, Ph.D., Head of information security department in the University).

“Getting rid of societal constraints associated with long working hours and the need to exchange experiences from different people” (Yemen, 36 years, MSc, Assistant teacher at Public University).

4.3.2 Facilitators of Women's Participation in the Tech Industry

Participants mentioned some factors facilitating women's interest in technology education and industry. This includes a good salary, support from family, societal influence, and academic performance in courses like mathematics.

a. Salary

A participant mentioned that her choice of technology career was due to her knowledge that working in technology comes with a good salary.

“Another thing is that in terms of money wise, if you are in tech, you get good uh salary.... It motivated me to be honest” (Iran, 42 years MSc Software engineering, digital marketing).

b. Family support

Family support was mentioned by participants as motivation for their choice of technology education and industry.

“Uhm, yes, and uh, my motivation was my family. They always believed in me, and they said like you could do it just if you- if you like, fail now, it’s fine. You will learn from this failure and take it to the next step” (Israel, 28 years, B.Eng. Computer Engineering, Sales development Representative).

c. Society influence/family support

Participants mentioned that their interest in technology was spurred by the interest of most people around her in school and the community, and the family further supported this.

“Even my family, my family were supportive. They didn’t influence me to go to it, but because of society. When I was in, like, Uhm, high school, everybody wanted to go for engineering. Everybody wanted to go, and nobody wanted to become an, I don’t know, a designer or something” (Iran, 42 years MSc Software engineering, digital marketing).

d. Academic performance in required subjects.

Participants mentioned that good performance in mathematics facilitated her desire to pursue a career in technology.

“I think that’s more- I was quite, I was good at math so, uhm, I was quite successful. Uhm, you know, I’m happy that I chose to go through that route” (Iran, 42 years MSc Software engineering, digital marketing).

4.4 Summary of Findings

The identified challenges facing women in tech in the Middle East are multi-factorial as it transcends beyond the individual to the family, the tech industry, and society. Furthermore, increasing women's participation in tech in the middle east requires a multifaceted approach, such as a gender-friendly government and workplace policy development/reformation, increased awareness creation, social support, and mentoring/role-modeling.

CHAPTER V: RESULTS DISCUSSION

5.1 Results Discussion

This chapter looks at the conclusions drawn from the data in a critical way. It also talks about how the results of this study compare to the results of other studies used in the literature review chapter and to other related literature.

5.2 Discussion of Research Question One

5.2.1 Challenges Facing Women in Tech in Israel

Although there are numerous female STEM graduates in Israel, very few women work in the STEM areas (Islam, 2019). The reason why women's educational attainment in Israel does not match their involvement in tech career opportunities has been explored by many researchers. One of the problems identified by Islam 2019 is facing intimidation working in a male-dominated industry. An Israeli woman in our study also mentioned that the male-dominated nature of the industry influences women's participation as most women do not want to be in such a super male dominant place of career or work;

"And it kind of discourages you, and you do not necessarily want to be in that super male-dominated, only going to be with young men" (Israel, 32 years, BSc Computer Science, Software engineer).

It is much harder for women" (Israel, 32 years, BSc Software engineer).

Participants in the study disclosed that the working environment of a male-dominated industry might likely pose a source of pressure on female folk (Haghighat, 2013). Women have made great contributions to the tech industry in Israel. Despite the significant accomplishments of women in tech in Israel, this study reveals that male domination is still a very significant challenge they face. Our study also shows that most women in tech in Israel face gender bias during hiring and promotion. This supports research by the Israel Women's Network that found that roughly 62

% of Israeli women working in the tech sector experienced gender bias (Karram, 2018). The compensation of women reflects this gender bias. According to research by the National Council for the Advancement of Women in Israel, women in the IT sector in Israel earn 45 percent less than men. This is a big difference in pay (Ben-David & Schneider, 2019).

Due to gender stereotypes, men are more likely to work in hardware and women are more likely to work in software (Huyer, 2019). Women in tech are often seen doing things that seem to fit with their gender, like hosting guests (Paychex, 2018). Gender equality is one of the Sustainable Development Goals in the 2030 Agenda for Sustainable Development, which aims to achieve equality between men and women and give all women and girls more power (SDG). One of the most important goals of female empowerment is to make sure that women are fully and effectively involved in all economic, political, and public areas (UNESCO, 2010). Even though technology helps a lot with this goal, the fact that there aren't enough women working in technology makes social inequality worse (Haghighat, 2013). Men get one new job for every four jobs that are lost, but women only get one new job for every 20 jobs that are lost (WEF, 2016). This also means that a person's job security is often based on their gender.

The women in this study also mentioned that it was harder for Israeli females to get into managerial roles as most men find it uncomfortable working under women. This is further driven by the belief that women do not have leadership potential. Therefore women are not given equal opportunities in leadership in Israel as they suffer isolation and discrimination regarding their leadership potential. An Israeli woman had this to say;

"I think many men, for example, won't feel as comfortable with women as their manager, especially in tech. I know it isn't very pleasant, but that is the case. I think it is easier for men to step into authority roles. It does not have to be a manager, but it can be something like that. But I think it is a lot harder for women" (Israel, 32 years, BSc Software engineer)

"I did have a couple of scenarios where I did feel that I was being treated differently. Even though people around me try hard, I need to do more than a man to get the same appreciation. Everybody that knows me knows I do not feel like that with them, but I did have a

couple of experiences where I felt I needed to shout louder to make myself heard. It is true for everyone, pretty much like we all had those experiences, but I can't tell if it is because I am a woman. However, I think it is".

(Israel, 32 Years, BSc Student in Software Engineering, Engineering Faculty of the University).

The study's participants, who were women, also identified religion as a barrier to women's engagement in the IT industry in Israel. For example, our study reveals an existing religion in Israel that restricts women from being alone without the company of a man while going about in the community or in transit to another place. Women may be unable to work outside the home because religion forbids them from getting a degree or driving a car.

"So, they are like a small religious community, so the woman is prohibited and cannot leave the village without a male, okay? And of course, she is not allowed to take a degree or drive a car, so, they will only work inside the hub, inside the village because they are just women"
(Israel, 28 years, B.Eng. Computer Engineering, Sale Development Representative)

Similarly, an Israeli woman who was interviewed revealed that there is an existing religion in the country that does not allow women to take a degree and therefore reduces her chances of pursuing her dream career in tech or any other field at all;

And of course, she's not allowed to take a degree because they are just women" (Israel, 28 years, B.Eng. Computer Engineering, Sales development Representative)

While stereotyping is a significant factor presenting challenges to women in tech in the Middle East, they also face discrimination that inhibits women from gaining entry into tech in the form of "low education attainment." One of our participants had this to say about her experience as it relates to educational attainment;

"I had quite a bad experience with that in the past. When I was in high school, about 14 years of age, you got to pick a major, and you had to pick something extra that you wanted to do, and I wanted to do computers because I even did my website when I was 15. I was pretty much into it. But then I was called to cancel. I'm trying to translate, so that it might be weird. So let me

know if I need to clarify it. So, they told me, they were like, "Hey, listen. Are you sure that you want to do computers? It is only boys in that class, maybe you should do a cinema or something with more girls in it, and I was dumb enough to listen. So, it tore me quite a bit from this route. I only got back into it when I was 23 or 24 because of such a big detour. Like I did something in college that was completely different, and I was diverted from that track".

(Israel, 32 Years, BSc Student in Software Engineering, Engineering Faculty of the University).

The above statement reveals that gender bias exists in Israeli women's ambition to pursue tech education. One of the Sustainable Development Goals, which aims to enhance fair and inclusive access to education for all genders, is at odds with this (United Nations, 2015).

Work-life balance is also a challenge facing women in tech in Israel, like their counterparts in other industries. The demanding nature of many tech jobs often makes it difficult for women to balance their careers with their personal lives and family roles, mainly if they are also caregivers. One of the Israeli participants in this study shared her challenges with work-life experience;

"So, I uh- I think that is a main blocker for women working in the tech industry. Moreover, I think that's the biggest issue, and the rest is uh- I don't know. Women are pushed- I don't know if they are pushed, but women don't study mathematics at higher levels. I think like they are being told that it's too difficult and it would be easier for them to be, you know, teachers or something like that. Then again, that would be easier for them. The studies would be easier for them, and they could be home by 2 to pick up the kids from school ". (Israel, 31 Years, BSc in Computer Science, Engineering Manager).

Similarly, another participant in this study attested to family life expectations and pressures such as being a housewife and getting married at an early age seem to present themselves to them when considering tech jobs and careers;

"So, in my case, there was no family, religion, or any of these barriers, but I know women, and I know some of my friends where the family, like, just stood in their faces and said no. like

computer engineering no, like you need to be a housewife and will take all your time. It is five years of studying, and you are getting older. It would help if you found a husband like, yes, I met those kinds of people" (Israel, 28 years, B.Eng. Computer Engineering, Sales Development Representative).

Lastly, women in tech in Israel need more access to mentorship and networking opportunities so they can move up in their careers (Maimon, 2018). Women have made notable contributions to Israel's tech industry with notable accomplishments. Such women ought to serve as mentors and role models to other women trying to build careers in tech. Speaking on the role of mentorship in increasing women's participation in tech, an Israeli participant in our study had this to say;

"You know they feel, uhm, computer science is like some of the stereotypes around it. You sit all day in a dark room in front of a computer. And then in these mentorship programs they show you, they get you to experience a different type of this uh- a whole different view of this aspect" (Israel, 31 Years, BSc in Computer Science, Engineering Manager).

One of our study participants pointed out that Mentorship programs are currently ongoing in Israel to address this challenge; "There is 'SHE CODES' providing support to increase female participation in the tech industry;

They go to school. They talk to, uh, like young teenagers. Uhm, and try to get them interested in tech. Er, she codes mainly around classes, so they do, for example, er, full-stack, or Python first. It's not a university degree or anything like that, but it gives you a taste of what it means." (Israel, 32 Years, BSc Student in Software Engineering, Engineering Faculty of the University).

In summary, women in tech in Israel face significant challenges, including under-representation and unequal pay. However, with government support initiatives, support from private organizations, and growing awareness of the importance of diversity and inclusion, Israel is effectively reviving a more equal and diversified tech sector, providing a role model for other Middle Eastern nations like Yemen and Iran, which were included in our study.

5.2.2 Challenges Facing Women in Tech in Yemen and Iran

Women's personal beliefs about technology are said to be more damaging than men's, therefore serving as a deterrent to employability in the sector (James & Cardador, 2007). Some of the Iranian and Yemeni participants in this study had a personal belief that technology does not favor them or suit them since men are more intelligent than them;

"I think they think that men are like more uhm, uh, intelligent than me, and for you to get that job, you must work harder" (Iran, Msc Software engineer, digital marketing).

According to Wajcman, 2007, technology has been given a masculine image by the male gender domination of symbols and values with masculine connotations. Such a masculine image of technology is a potential driver of exclusion for women folk from participation in the tech industry. A study by Panteli et al. in 2001 found that most women in the ICT industry work in less technical jobs. This fits with what this study found, since the women who took part in the study thought that the sector required a lot of hard work and that this might keep many women from joining.

"I think they think that men are like more uhm, uh, intelligent than me, and for you to get that job, you must work harder" (Iran, MSc Software engineer, digital marketing).

The STEM sector has been stereotypically seen as masculine (Diekman et al., 2010). The difficulties women in STEM confront include being outnumbered, working nearly exclusively with male counterparts, and experiencing negative gender stereotypes (Veelen et al., 2019). Women's career confidence and participation in STEM fields are constrained and limited by gender stereotyping, which is frequently tied to societal norms (Peters et al., 2013). Being a woman in the heavily male-dominated field of STEM could present a social identity threat that could have negative career-related repercussions.

Veelen et al., 2019 examined the influence of social identity threat on women in STEM. The women in this study revealed that some organizations do not assign females to tech jobs because females are not as free and flexible as males due to variations for delivery and other situations hence may cause a delay in work delivery;

"In addition, I am not denied that some business organizations refuse to assign females to such jobs, claiming that males are more free and flexible" (Yemen, 40 years, Ph.D., head of the information security department)

Studies show that female engineers spoke about feeling incompetent and lacking confidence because of feelings of gender identity at their workplace (Hal et al., 2018). STEM skills are more strongly linked to men than women, according to a global survey conducted in 66 nations (Miller et al., 2015).

Threats against gender identity severely impact how women in STEM view their careers (Veelen et al., 2019). These influences include poor career perceptions, poor career confidence, restricted work engagement, and a higher disengagement rate. (Veelen et al., 2019). All these are associated with their influence on their self-esteem, well-being, cognitive functioning, and decision-making (Inzliaht & Kancy, 2010; Thoman et al., 2013).

In contrast to the field of SEM, technology has a larger rate of female employees who leave their occupations (Glass et al., 2013). Unfavorable work experiences, such as a lack of access to innovative technical responsibilities and difficulty ascending to leadership positions, are frequently cited as reasons for leaving their workplaces (Hewlett et al., 2008; Nash, 2014). The Yemeni women in this study pointed out that it was harder for them to get to leadership roles as most men do not find it comfortable working under women as women are told not to possess leadership potential and hence are isolated;

"No equal opportunities, isolation, and leaders were not seeing them as having leadership potential" (Yemen Ph.D., Head of the information security department).

This restriction from leadership and promotional roles could affect women's job satisfaction in the industry, as job satisfaction is vital to women's involvement in tech in Yemen. A 2014 poll of 25 prominent IT businesses found that, on average, women in tech report poorer job satisfaction than their male counterparts (Glassdoor, 2014). Women in our study pointed out that women are still viewed as unfit for some IT jobs researched for males, thus no room for

compensation between both genders in the sector. This impedes actual job satisfaction for women in the tech industry.

Some studies have pointed out that women do not have the traits for senior managerial or executive leadership roles (Derks et al., 2010). Such masculine traits needed to be adopted self-confidence, strength, competition, and aggression. This study agrees with past studies that reveal that corporate interest and preferences for masculine skills influence women's participation in the tech industry. Participants in this study attested to the fact that the chances of hiring males in tech companies are higher than that of hiring females, often attributed to the need for females to take maternity leaves and work for shorter hours regularly;

"Most companies and organizations think that this field is suitable more for males than females because a woman needs more vacations for delivery and other situations so their work will be delayed" (Yemen, 37 years, Ph.D. in Computer Science, IT department in the University).

All the odds mentioned above challenge women folk in the tech industry. A Centre for Talent Innovation study revealed that unfavorable workplace conditions and lack of access to managerial roles contribute to female attrition in the tech industry (Mukhwana et al., 2020). Meaningful advancements in the industry can provide opportunities for women to make meaningful contributions, drive job satisfaction, and facilitate women's retention in the industry. Gender inequality is a limitation for women impeding harnessing their full potential and influential contribution to development (Mukhwana et al., 2020). UNESCO study from 2015 indicates that women are fairly represented in various scientific disciplines.

Nevertheless, women are a poor minority in the technology and engineering fields. In the Middle East region, increased gender parity is observed in most Arab States except in countries like Yemen, Iraq, and Mauritania (Mukhwana et al., 2020). This can be linked to the beliefs imbibed by women folk as disclosed by the participants in this study;

"...the belief of women that technology does not suit them, but there is a slight and noticeable progress in recent times compared to before" (Yemen, BSc Computer science, Application operation at telecommunication company).

“I think they think that men are like more uhm, uh, intelligent than me, and for you to get that job, you must work harder” (Iran, Msc Software engineer, digital marketing).

Personal assessment of a woman's ability to succeed in the tech field also influences their participation. Women who believe they can succeed in male-dominated industries will thrive at all costs. The women in this study had a common personal conviction that men already had advantages over them. Hence they needed to be extraordinary to succeed in the male-dominated tech business.

“Some projects are limited to males only, linking work with khat sessions, working outside official working hours and even late at night” (Yemen, 35 years, M.Eng Computer Engineering, University lecturer).

These negative personal beliefs of women about tech often stem from the environment and societal beliefs and attitudes, including family expectations (Ekine et al., 2013). Women experience self-imposed dread, lack of confidence, and fear of not adhering to traditional social norms as a result of this (Mukhwana et al., 2020);

“There is a prevailing idea, especially in the Arab community, that IT jobs are reserved for males, and only males are accepted, and competition in them is impossible” (Yemen, 40 years, Ph.D., Head Information Security department in the University).

One more thing is the society's point of view on technology” (Yemen, 37 years, Ph.D. in Computer Science, IT department in the University).

” Of course, many women now want to work in the IT industry, and this is a beautiful thing. Still, some of them adhere to the job without matching their male colleagues in interacting with scientific and academic events. From this standpoint, they are excluded because many do not accept the challenge, and some stumble through customs, traditions, and family/ husband restrictions” (Yemen, 40 years, Ph.D., Head Information Security department in the University).

According to Hewlett et al. (2008), women are less likely to advance to leadership positions, have less access to creative technical positions, and have worse work experiences than men (Nash, 2014). Women's participation in technology depends on job satisfaction. In general, women in tech report poorer job satisfaction than their male counterparts, according to a 2014 poll

of 25 prominent IT businesses (Glassdoor, 2014). While the global average for women in the workforce is roughly 50%, women's participation in the Middle East workforce might be as low as 25%. (World Bank, 2019). In a study by Anderson et al. in 2013, women were asked if their tech company provided solid support to match the vocal support around improving women's advancement in tech; 36.4 % of the women responded that the vocal support did not match the actual support. This information was used to assess the support women in tech in Yemen receive. In this study, participants did not seem to express getting much support for career advancement from their organizations, as it seemed it was more about their efforts to outsmart the men;

“No equal opportunities, isolation, and leaders were not seeing them as having leadership potential” (Yemen, 40 years, Ph.D., Head of the information security department).

“I think some women working in the IT industry lack the strength of character and perseverance, and many of them are afraid of appearing and participating, and still many of them do not want to share their photos or their photos in public, academic events. Unfortunately, most of them sit in the back rows on academic occasions despite their distinction”. (Yemen, 40 years, Ph.D., Head of the information security department).

According to the International Journal of Business and Management, 2015, patriarchal cultural gender roles and status are to blame for the sociopolitical, organizational, and individual challenges that Arab women face (e.g., Metcalf, 2006, 2007). Due to differences in gender ideologies between and within Arab countries, they were the same throughout the Arab world but had various subtleties in each country (AFESD, 2006).

Cultural norms are regulations and moral guidelines which specify acceptable gestures in a particular society. Norms in some societies affect how females perceive tech, which is what has created a gap between the male and female gender in tech in the Middle East, although this varies from one country to another (Sonja, 2013). According to Sonja (2023), girls in Middle East countries scored better than boys in science comprehension (2013) by 8%. Women shouldn't have affairs outside of the home because they have to live and work alone because of strict cultures and

traditions that say women are physically and emotionally weak and need to be protected and controlled for their safety and to keep the family's honour.

According to participants in this study, an Arabic mentality considers the technology industry and education unfit for women. In Yemen, IT jobs are monopolized over men; only males are accepted and given room for competitive roles.

“Yes, I think for many dimensions, including what is related to the Arab mentality, especially in Yemen, which still views women as unfit for some jobs and monopolizes them over men. (Yemen, 36 years, MSc Information technology, information security officers in a financial company)”

The decision to pursue and succeed in an IT career is heavily influenced by socioeconomic variables (Mukhwana et al., 2020). Some societal beliefs include the assumption that the male brain develops differently from the female folk (Ceci et al., 2009). These perceived biological differences hinder women from taking up seemingly technical education and career opportunities. Negative gender stereotypes of the female gender are a result of these ideas. Negative stereotypes limit women's potential for success in the tech sector, which promotes male dominance (Hill et al., 2010). Women's participation in tech in the area is substantially impacted by the issue of workplace intimidation caused by being in a male-dominated environment as well as other cultural variables.

The female gender in the Middle East region is considered to be caregivers and mainly support and raises a family. Even though female gender biases still prevail in other parts, the issues are more pronounced in the Middle East. Women are restricted by culture and religion from any role that brings them to the fore. By this background, they are molded right from infancy, within the family setting, by what they see in society, and up to the classroom. Up until now, both formal and informal educational systems, like schools and the media, have helped to reinforce gender stereotypes. They also don't encourage people to learn, get involved, or join the political system as a whole. For example, elementary Arabic textbooks often show a family in which the mother cooks, the father works, the daughter sews, and the child plays football. People's thoughts and ideas about what happens can be shaped by their networks. (“Yemen's Women and the Quest for

Change," by Nadia Al-Sakkaf). In this study, Yemeni women said that men still think women aren't good enough for some jobs, so IT jobs are only open to men.

“There is a prevailing idea, especially in the Arab community, that IT jobs are reserved for males, and only males are accepted, and competition in them is impossible” (Yemen, 40 years, Ph.D., Head Information Security department in the University).

Since the technology field is seen as unfit for Yemeni women, only men are expected to study tech courses and build careers in the tech industry. The women admitted that because there are often fewer women working in the IT sector, they feel that men are more qualified than they are.

Stereotypes designate women's roles to be communal, focused on family life and child upbringing, and the men to be problem-solving, skills building, and financial gains (Howes, 2002). This can influence how women view technology-related courses and their participation in the tech industry. Society has placed gendered expectations, feminine identities, and ideologies that exclude women from taking up specific learning opportunities and work (O'Brien & Crandall, 2003). Gender stereotyping has made women associated with the arts and humanities and men with the science and engineering fields (Eccles, 2009). This implies that competency in these fields is primarily associated with men and exists in cases where women exceptionally stand out (Hill et al., 2010).

“There is a prevailing idea, especially in the Arab community, that IT jobs are reserved for males, and only males are accepted, and competition in them is impossible” (Yemen, 40 years, Ph.D., Head Information Security department in the University).

One of the Iranian women in this study expressed the belief that men are more intelligent than her; therefore, she has to work harder to be able to get a tech job;

“I think they think that men are like more uhm, uh, intelligent than me, and for you to get that job, you must work harder” (Iran, 42 years, MSc Software engineer, digital marketing).

Such perspectives have continued to drive male dominance in the tech industry and must be addressed. Researchers have also shown that some countries hold negative stereotypical views

about science, tech, and Mathematics (STEM) courses being for boys while non-science, Tech, and Mathematics sources are for girls (Ekine et al., 2013). Yemen, Pakistan, Benin, and Chad have lower ratings for gender inequality than other countries, according to the World Economic Forum's Gender Gap Index (Emma, 2003). Marriage and childbirth diminish women's career possibilities in most Middle Eastern nations because caring for the family is their primary responsibility (Haghighat, 2013). For instance, in Iran, divorced, widowed, and single women are more likely to be employed than their married counterparts; likewise, in Egypt, women's employment potential is lower throughout the marriage and childbearing years (Assad & El-Hamidi, 2002).

In this study, some Yemeni women pointed out that marriage and childcare demands have hindered many women who study Information Technology from entering the tech labor market or building careers in the industry;

“Certainly, there are always fewer women in IT jobs and fewer in senior positions in this field. First, many female students in the faculties of information technology do not enter the labor market, and, unfortunately, they are very superior academically. The other reason is marriage and the lack of support to solve the problem of childcare” (Yemen, 56 years, Ph.D. information technology, University lecturer).”

Participants disclosed that fewer women take up IT jobs and are even fewer in senior or managerial positions in the field. This has been linked to marriage and lack of support for child care which is supposedly the women's derogatory primary role in society.

Female education attainment is critical to their participation in the tech industry. The women in this study disclosed an existing belief in Yemen that there is no profit in educating a female child as their role is to build a family and care for their kids.

“I think the major factor is our tradition and culture. In our country, some parents think education is unimportant and useful for females. Because of their role to build a family and care for the kids” (Yemen 37 years, Ph.D. in Computer Science, IT department in the University).

As a result, there is a discrepancy between Yemeni women's educational level and labor force involvement. This suggests that there may not always be employment opportunities for

women who attend college (Haghighat, 2013). Since gender norms specify that a woman's primary function is that of a homemaker and mother, her social standing and participation are reduced to her family and close friends (Haghighat, 2013). Various circumstances influence women's willingness and desire to work in technology. However, social culture and gender stereotypes pop out frequently (Haghighat, 2013). Women's educational options, learning achievements, and ultimately decisions about studying and working are greatly influenced by societal norms and gendered expectations about their roles (Ekine et al., 2013);

“Oh yeah. You know what? You know what? I can say that, for example, in our university, the university where I studied software engineering back in Iran, for some of the engineerings, it was like women and men, you know, we could go for it. But, for like mechanical engineering, like civil engineering, all other engineerings they couldn't even apply” (Iran, 42 Years, Master's Degree Holder Software Engineering).

Family, society, and country-level factors often affect the jobs that women choose (Mukhwana et al., 2020). Women's performance and aspirations can be hurt by negative stereotypes about their ability to do well in the tech industry. For career opportunities in the industry over time (Hill et al., 2010). An environment that facilitates women's career choices to take up tech-related opportunities is a crucial driver of women's involvement in tech (Mukhwana et al., 2020). The African Academy of Sciences 2020 study discovered that 60% of the women also agreed that men have more career opportunities than them. This is also the case in this study, as revealed in the in-depth interview results.

“In addition, I am not denied that some business organizations refuse to assign females to such jobs, claiming that males are more free and flexible” (Yemen, Ph.D., head of the information security department.)

With the start of the "Arab Spring upheavals," women are rising up against tyrants and traditional, conservative ideas and mindsets that fear women as agents of change. In some communities today, after the revolutions in Egypt and Tunisia, the relationship between women and freedom is controversial and goes against tradition. In this way, an Egyptian woman protester

spoke to Catherine Ashton, the head of EU foreign policy, when she went to Tahrir Square. "The guys wanted me to be there when we were calling for Mubarak to step down. But now that he's gone, they want me to go back home." (From April 23, 2011, The Guardian). Surprisingly, some educated women strongly back laws that make it legal to limit women's rights in the name of "honour" and "obedience." (Ikhlas, 2015).

Unconscious bias is a big problem that must be solved if the tech industry is to change. People often act in ways that show their biases without being aware of it. This is especially true when it comes to hiring, because leaders might think that men are better at software development just because most software engineers are men and most businesses have a lot of them. Women who see this male-dominated environment may not even consider a tech career. Cultural changes are necessary to address these issues, and successful women in tech often do not conform to cultural stereotypes or expectations. To influence a shift in these cultural expectations, it is essential to celebrate and make visible the accomplishments of women in tech by giving them role models that will motivate future generations (Graham, 2016). Tech-related women need to be given the credit they need and access to networks to help them succeed.

Family issues in Yemen, Iran, and other nations greatly influence women's job advancement in STEM fields (Mukhwana et al., 2020). For women to succeed in the computer business, they must be able to raise a family by advancing their jobs (Mukhwana et al., 2020). According to research by the African Academy of Sciences, women were more likely to pursue employment in technology if the company offered childcare services (87%) and had a pregnancy leave policy (91%). In the study, family-based issues were the identified dominating reasons behind the involvement of women in tech, as the ability to find a work-life balance seemed to weigh them down (Mukhwana et al., 2020). 56% of the women in the study quoted family responsibility as a reason for having fewer women in the Science, Technology, and Mathematical field; 50% agreed to be experiencing difficulty finding work-life balance.

Women who want to work in tech have access to a supportive workplace where they can take time off to care for ill children or attend to other family obligations during working hours

without fear of retaliation from their employers (Mukhwana et al., 2020). Therefore women's advancement in their careers/jobs is strongly dependent on family matters. The ability of women to strike a work-family balance is often influenced by negative beliefs and perceptions of women's place in society. Long workdays are common in the tech industry, which makes it hard to find a good balance between work and family, especially when employers aren't helpful.

In some places, women are expected to depend on men for everything, so they don't need to go to school or work to get what they need. Society's ideas about "women's place" and women's reproductive years often make it hard for career women in all fields, with the exception of the tech field, to find a good balance between work and life. Studies have shown that employers are often biased against hiring women because they don't want to take time away from their families. (Braun and Turner, 2014). People who took part in this study also point out this;

“Most companies and organizations think that this field is suitable more for males than females because the woman needs more vacations for delivery and other situations so their work will be delayed” (Yemen, 37 years, Ph.D. in Computer Science, IT department in the University).

More dangerously, some employers imposed limits on female applications by defining "married women with children" (Human Rights Watch, 2018). According to reports, corporations in Japan prioritize employing women without children as regular employees over hiring women with children (IMF, 2019). The rigorous nature of science-related occupations makes starting or sustaining a family challenging while juggling work schedules. For example, in cases where the need for collaborative linkages demands international travel, it is harder for women to manage, especially when they already have a family to cater to. Therefore, striking an equitable balance between the decision to start or cater to a family alongside career demands makes it harder for women to pursue tech careers and educational opportunities, as pointed out by a participant.

Working in STEM occasionally includes long hours and complicated schedules frequently conflicting with family duties and arrangements. Highlights (2013) lists a few factors that contribute to female gender discrimination, such as the perception that women are less physically and psychologically fit than men, that women are less dedicated to their families than men, and

that paying for maternity leave costs money, even in the face of fierce competition in the tech sector. Haghighat (2013) said it is more difficult for women to find jobs and advance their careers in the computer business because of these biases and stereotypes, which are more pervasive there. Since women typically handle most household duties, juggling work and life might be more difficult (Eccles, 2009). The difficulty for women to find a balance is compounded by the lengthy workweeks typical of the technology sector. For example, a program in some technology companies works overtime to boost efficiency and reduce costs (Haghighat, 2013).

With women still expected to perform domestic tasks, especially in the Middle East region, the pressure to be available at work and home may often limit them from sustaining a tech career. Bella and Chandran (2019) called attention to the fact that the demands from jobs in the tech field and the demands of raising a family may take up a significant amount of energy and time, which may subsequently affect women's work-life balance in tech. Therefore, the view that women should remain at home and focus on raising the family puts pressure on women in tech. They leave the field to focus on caring for their families, even when highly qualified for their positions. Gender stereotyping, according to the Gender Equality Law Center, is the overgeneralization of a certain group's traits and traits depending on gender.

The family-friendly tech industry in its policies could help increase job satisfaction and encourage more women participation (Chen et al., 2016). Women often bear the consequences of a career that conflicts with family responsibility more than their male counterparts. According to one of the women interviewed, marriage and childcare demands have hindered many academically sound girls/women who studied Information Technology from entering the labor marketplace. Of respect for and acknowledgment of women, harassment and other unfavorable workplace conditions are all caused by gender preconceptions and biases regarding women.

More women than males in tech companies have expressed dissatisfaction with their career achievements (Hewlett et al., 2014). According to reports, gender bias keeps them from advancing in their careers at the same rate as their male peers (Campbell, 2019). Women have consistently faced gender discrimination in the tech sector, from the hiring process to the performance review

process to the promotion/leadership process (Ashcraft et al., 2016; Hewlett et al., 2008). Despite having strong academic credentials in the IT sector, the study's female participants claimed fewer prospects for them to find employment in the tech sector.

Regarding the hiring process, women are often viewed as less committed due to family responsibilities, thus serving as an impeding factor and pointing to male preference in the tech industry. The tech industry is often characterized by long working hours and stringent deadlines, which burden women who have to combine jobs and housework. Regarding promotion and leadership roles, research shows that there is a lack of females in leadership roles, which impedes women from career advancement in the tech industry (Haghighat, 2013). This seems to suggest that rather than being based on performance and merit, promotions and career advancement opportunities are often gender - biased (Mukhwana et al., 2020).

The Arab states report the lowest female labor participation rates worldwide, with a 20% record as of 2013 (Haghighat, 2013). This marginalization of women is also seen in women's leadership opportunities, as the record shows that women are less likely to take up managerial positions than their counterparts globally. (Haghighat, 2013). The women in this study pointed out there are fewer women in senior positions in the I.T. field, reasons attributable to the fact that most academically sound women who studied Information Technology do not get to have opportunities to enter the labor market either due to marital demands /lack of support to meet the challenges of childcare or general biases in the organizational settings of Tech Industries.

The Iranian woman in this study also mentioned that it was harder for females to get into managerial roles as most men find it uncomfortable working under women. This is further driven by the belief that women do not have leadership potential. Therefore, women must be given equal leadership opportunities in the Middle East tech industry - as they suffer isolation and discrimination regarding their leadership potential.

“No equal opportunities, isolation, and leaders were not seeing them as having leadership potential” (Iran, Ph.D., Head of the information security department).

In a study by Anderson et al. (2013), women were asked if their company provided support through programs /training to advance women in tech. 36.4 percent said they didn't have solid support, and 16.9 percent said their company doesn't help women advance in the tech industry. Only 24.5 percent said they had solid support from their company to help women advance in the tech industry. Ashcraft, McLain, and Eger (2016) say that women who work in tech may be less likely to look for other, more fulfilling jobs if they don't like their jobs and don't have many chances to move up in their careers.

The rate of women leaving the tech industry is higher than in other fields (Ash Craft, McClain, and Eger, 2016). Ashcraft, Mclain, and Eger (2016) say that women leave the tech industry more because of bad work conditions than because of family responsibilities and roles. Women's job satisfaction is often low because they don't have access to core, creative, and innovative technical roles and don't have many chances to make meaningful contributions. For example, women are underrepresented in technology patenting. Only 10–15 percent of all tech patents are made by women (Ashcraft & Breitzman, 2012). The employment practices of the technology sector are biased against female applicants because of ingrained cultural norms and gender roles. For instance, family obligations are cited as a major issue when employing female employees because they are often linked to a lower level of dedication to work (Braun & Turner, 2014). The final cost of parenthood is that working mothers are typically more systemically undervalued regarding competence (Ashcraft & Breitzman, 2012). It might be difficult for female employees to request time off to care for ill children or handle specific home duties during working hours without feeling intimidated by the employer.

In certain nations, women in the digital industries make noticeably less money than their male counterparts. 2019 (Sey and Hafkin). The fact that men generally have longer working histories than women, particularly among professionals and other similar workers, is one of the causes of the gender wage difference. According to the 2019 Survey Report on Labor Conditions by Employment Type, the average number of years men work as "Professionals and Related Workers" is 7.4 and the average number of years women work is 4.8. (MOEL, 2019).

Women struggle to rise into leadership positions in tech-related businesses, as only a small fraction of women hold CIO positions, board seats, and other administrative positions (Ashcraft, McLain, and Eger, 2016). Amongst the 8 Yemeni women interviewed in this study, only two held Leadership roles serving as the heads of their respective departments, and the other six held low and middle-level roles in their companies. On the contrary, 2 of the 4 Israeli women interviewed held managerial roles as engineering managers in their respective companies. Kawamoto (2013) pointed out the following Top Tech positions for males and females, which some participants in this study also pointed out;

Two of the 13 participants in this study were engineering managers, and 2 were lecturers at the faculty of engineering in universities. Other positions recorded among the women in this study included software engineer, application operator, head of IT department, information security officer, and digital marketer.

The Yemeni women in this study reported difficulties in accessing more demanding, creative, and innovative projects as compared to their male counterparts;

“Some projects are limited to males only, linking work with khat sessions, working outside official working hours and even late at night” (Yemen, 35 years, M.Eng Computer Engineering, University lecturer).

A study (Glassdoor, 2014) discovered that women in tech industries generally reported lower job satisfaction in their careers than men. As disclosed by the participants, the tech industry is often associated with prolonged and seemingly unfavorable hours as it sometimes involves projects that involve working outside official working hours, even late at night. This, therefore, brings about discrimination in job roles as some projects are limited to males only. According to one of the Yemeni women, such situations make it more challenging for women to combine work and family, reducing women's participation and retention in the tech industry.

Even when women demonstrate solid academic performance in tech-related courses, they rarely find employment in the tech field as they should (Ashcraft et al., 2016). Employers in the technology industry have doubts about the skills of women employees, according to a study by

Ziadeh and Al-Ahmad. They must thus be given the same possibilities as their male colleagues to express themselves. Because employers typically expressed higher confidence in their male workers' masculine abilities and reinforced the assumption that men were better at programs than women, women in the survey claimed that programming assignments were typically assigned to male employees. Cultural attitudes and customs also impact organizational variables since they significantly impact female employment decisions, particularly in jobs that entail long hours and frequent travel. All applicants seeking employment have to be men.

The tech industry is noted to require a lot of effort and time, and according to one of the Yemeni women interviewed, most women have a phobia of working at home hence may not be able to meet up with the work demands of the industry;

“...their full belief that this specialization requires a lot of effort and time, especially since some have a phobia of working at home” (Yemen, 28 years, Bsc Computer science, Application operation at telecommunication company).

These organizational factors, seemingly peculiar to the tech industry, further contribute to the male domination of the tech industry as the odds are against the familial responsibilities of the women and more in favor of the men.

Another problem for women in ICT in Yemen and Iran, as it was in Israel and was already talked about above, is that they don't have enough female role models and mentors in their academic and professional lives. Girls and women who want to work in ICT or other fields where men are more common can be inspired by role models. Role models can also help women and girls who want to work in other fields where men are more common by giving them support, networks, and advice throughout their careers. Many case studies show how important role models are for women in ICT and give specific examples of how to get them (Powell & Chang, 2016). The youth need role models who can show them how to use STEM skills to make the world a better place.

More than two-thirds of respondents in a poll of views in the UN region conducted by the UN Women agency and Promundo agreed that a woman's primary responsibility should be caring for the home. At least 50% of the women surveyed believed this was their most crucial

responsibility (Feki et al.,2017). Elaborating on the challenges, another interviewee responded, "As a woman having worked in finance, then tech, and now at the intersection of finance and tech, I've unfortunately seen fewer women role models as I've progressed in my career" (Rahal, 2022).

When the women in this study were asked about their knowledge and experiences of past programs targeted at increasing women's participation in the tech industry, their response showed that only a few programs had been implemented in Yemen and Iran as compared to Israel;

"I heard about Tech women. No, it is not. They stopped because of our country's status" (Yemen, 37 years, Ph.D. holder in Computer Science, IT Department in the University).

Some programs were said to have stopped due to the War in Yemen, and others currently being run are battling with poor financing. However, as opined by one of the Yemeni women, there is an ongoing Arab program that supports women in tech, and a chapter is currently running in Yemen. The program has recorded significant accomplishments which are worthy of replication in other countries in the Middle East, including Iran, as discussed in the next few paragraphs that follow;

"Arab Women in Computing" is an Arab program that encourages and supports women in technology in research activities and conferences and sheds light on women workers in the IT industry. It still exists, and we have the Yemen chapter in it" (Yemen, 56 years, Ph.D. information technology, University).

The Arab Women in Computing Association (ArabWIC) is one example that comes to mind when talking about women in computing. Sana Odeh, a clinical professor, started the Initiative to promote, retain, motivate, and foster collaboration among Arab women in computing, improve their exposure, and help raise their standing so they can pursue their professional goals. Arab Women in Computing says that, unlike in New York, where few women take computer classes, women make up half or more of the students in computer science and IT classes at universities in the Arab world. But once women finish college, things start to change. Women often face bias when they try to get hired in their field. Because of this, these women start their own businesses and become entrepreneurs.

ArabWIC was created as a result of the rising number of Arab women who are working as engineers. After holding three international conferences on Arab Women in Computing sponsored by NYUAD in Abu Dhabi, ArabWIC today has chapters in 17 Arab nations with nearly 2,000 women and 200 leaders from all technological sectors (academics, students, industry, and entrepreneurs). Additionally, seven women have received scholarships from the QRC and, in collaboration with ABI, to attend GHC for a while. In some Arab nations, including Sudan, Oman, the UAE, Saudi Arabia, Palestine, Jordan, Lebanon, Tunisia, Algeria, and Morocco, hackathons and other technical events have been organized to encourage tech women. In conjunction with other well-known organizations, Lebanon recently hosted two successful hackathons and a training session where 500 high school girls learned app development and engineering. Children in Qatari schools were also introduced to coding by ArabWIC.

A symposium on Arab women in computers was conducted internationally for the first time in Algeria, as well as in Morocco, Palestine, Saudi Arabia, Jordan, Oman, and Sudan. They currently have events almost daily in various Arab nations. Arab Women in Computing wants tech women from around the world to join them and take part by mentoring Arab women, running a webinar, or working on other projects. They are open to collaborating with international or regional tech organizations.

Religion is less of a general problem in Yemen than in Israel, where it was mentioned as a barrier to women's engagement in the IT industry. For example, one of the Yemeni participants revealed that Islam allows them to work and is therefore not a limitation except in cases where people have a different notion or understanding of the religion;

“As for religion, I think the problem is in people's understanding of it. As for religion, Islam has allowed us to work and has shown us clear principles and policies. There is no doubt about that” (Yemen, 28 years, BSc Computer science, Application operation at telecommunication company).

According to Islam, 2019, Middle Eastern women face oppression by their religion. They are denied access to education and other fundamental rights that are part of local cultural traditions

but do not necessarily stem from Islam as a religion. Similarly to this, Bishin and Cherif 2017 suggested that patriarchal norms rather than religious beliefs constitute a significant problem when it comes to the barrier to gender equality in countries with a majority of Muslims, which is in line with the following statement made by one of our studies participants;

“There is no doubt that gender bias exists, and the ratio of female students to male students in the classroom is very low, although female students are studying in the field of information technology in universities that allocate separate classes for female students. If the parents do not welcome mixed studies, how will they welcome mixed work, so most female graduates tend to work in schools to avoid mixing or stopping work altogether”.

(Yemen, 28 years, BSc Computer science, Application operation at telecommunication company).

Only a tiny minority of Middle Eastern countries have been able to create systems that offer Middle Eastern women quality technical education. Most of the region's countries need to give women in technology the requisite education (Masud et al., 2018). Due to restricted traditions and inadequate infrastructure that prevents access to training institutions, women in the Middle East frequently need more training options (Lasic, 2018; Masud et al., 2019). As in Israel, where restrictions in educational attainment present a challenge to women's full participation in tech, the case is similar in Yemen, as seen in one of the interviews with a Yemeni participant;

“Few females are studying in this field. One of the most important factors is the lack of knowledge about IT. ICT integration in schools and higher education institutions are still very hard in Yemen. Most schools have inadequate computer infrastructure and internet connectivity to match student numbers. As a result, it cannot encourage or qualify the student to choose the IT specialization in the future. This specialization is considered vague and unknown except for some students who meet people specialized in this field in their surrounding environment...”. (Yemen, 40 Years, Ph.D. Holder in Information Technology, Department of Information Security of the University).

According to one of the Yemeni women interviewed, there is an existing traditional and cultural belief in the country that female education is not essential as it does not offer much profit to the family as much as their role of building a family and taking care of the kids.;

“I think the major factor is our tradition and culture. In our country, some parents think education is unimportant and useful for females. Because of their role to build a family and care for the kids” (Yemen 37 years, Ph.D. in Computer Science, IT department in the University).

More than two-thirds of Yemeni girls get married before they turn 18, and almost half of them get married before they turn 15. This is what research from 2016 by UNICEF shows. Early marriage keeps girls from finishing school and puts them at risk of domestic violence and physical abuse (Sharaf, 2019). Because of this, it's hard for women to get jobs in the tech industry.

All levels of education in Yemen are hurt by the terrible civil war, but female students lose the most in terms of opportunities. 2019 (Sharaf). "The road is dangerous, and the university is a long way away. So, my dad decided that I didn't need to go to college because I did well enough in high school. 2019 (Sharaf). A young Yemeni woman said in response that "Even though they are good, families are afraid to send their daughters to schools or universities because of the ongoing war and the worsening security situation in some governorates. Forces on both sides of the conflict have kidnapped, killed, and attacked schools. They would rather have their daughters get married young to keep them safe. There aren't many girls in school because there aren't enough girls' schools in rural areas, family finances, and social norms (Sharaf, 2019). Islam says that women's access to higher education in the Middle East has gotten a lot better in recent years. The number of women going to college is going up, and at least half of all science, technology, and math majors are women.

One of Yemen's biggest problems is that boys and girls get different educations. This makes it one of the least developed countries in the Middle East, according to the Human Development Index (Islam, 2019). In the 2017 Global Gender Gap Report, Yemen was ranked 141st out of 144 countries for the difference between men and women in how much education they have (Islam, 2019). The United Nations Population Fund reports that Yemen's child marriage rate was 6.6% in

2017. This is a significant deterrent to girls' education in Yemen. The civil wars that have lingered in Yemen since 2014 are also a significant factor militating against girls' education in Yemen as the nation's economy is significantly impacted. It is interesting to note that the Yemeni government and some international bodies are making significant attempts to help more girls in Yemen access education hence bridging the gender gap in the country's education sector. This is seen in the characteristics of our study participants, as all the eight Yemeni women who participated in the study have at least a BSc. Degree. This shows that Yemeni women are taking up educational opportunities despite all the odds against them.

Women's access to higher education in the Middle East is significantly improving over the years (Islam, 2019). This is attributable to the countries' governments' efforts to improve access to education among females. One such effort is that of the Yemeni government, as pointed out by one of the Yemeni women interviewed in this study, which revealed that there is an ongoing program by the Ministry of technical education aimed at increasing women's opportunities in technology education;

“Ministry of technical education, and there is a platform called the Science and Technology platform. It is emerging to focus on women's technology education (Yemen, 28 years, BSc. Computer science, Application operation at telecommunication company).

The reason why educational attainment does not match the career opportunities taken up by women in tech in the Middle East has been debated by many researchers. According to reports, more women than males enroll in universities in most Middle Eastern nations (UNESCO Institute of Statistics, 2019). The economies of the majority of Middle Eastern nations are based on innovation, science, and technology (Islam, 2019). Islam claims that in 2019 there is gender equality in the enrollment of STEM majors at Middle Eastern universities because women make up about half of all STEM major students.

Families typically devote greater attention to the education of male relatives, especially when they can only afford to pay for one child to study at the university level at a time, which is one reason for the difference in female educational levels. They select the male virtually

exclusively. In some places, ladies frequently get married just after finishing their undergraduate degrees, denying them the chance to pursue higher education. The absence of support for girls in primary and secondary schools in Yemen is a big barrier for women who wish to attend university. Only a few schools in Yemen have enough teachers to teach many females because Yemeni households sometimes forbid men from teaching their daughters. Those girls might go to college and return home to become teachers (Darem, 2014).

The problem of poor educational attainment levels as a barrier for women in tech in the Middle East is highlighted by studies such as Masud et al. (2019) and Lasic (2018). Masud et al. (2019) attribute low education attainment to a lack of training opportunities from situations arising from restrictive traditions. On the other hand, organizations such as OECD (2018) attribute the low-tech education attainment to factors such as the gender digital divide, which denies women and girls equal opportunities to acquire tech knowledge and skills, leading to low education attainment levels for women.

5.2.3 Discussion of Identified Facilitating Factors for Women's Participation in the Tech Industry in the Middle East.

What little research there is on women's career boosters shows that education, an inner drive to succeed, a supportive family background, and self-confidence all help women's careers (e.g., Wilkinson, 1996; Omair, 2008). Also, it seemed that family background was more important than patriarchy when it came to women's career advancement (Omair, 2008; Karam & Afioni, 2013). Omair (2010) said that the quality of women's social capital—a term she made up to describe their relationships with bosses, coworkers, family members, and strategic sponsors—was one of the most important things that helped them get ahead in their IT careers. Nearly 60 percent of Arab women leaders polled by DWE (2009) said that the support of their dads or husbands helped them move up in their jobs. Omair (2010) said that social support from male relatives helped Arab women's professional confidence and encouragement. These results back up what Nicolaou-Smokoviti said in 2004: "women elites, more than men, need more structural and cultural resources to make up for structural and cultural weaknesses in their gender."

After considering all the challenges mentioned above-affecting women in tech in the Middle East, it is essential also to outline the factors that facilitated the participation of the women in this study in the Tech Industry amidst these challenges. This will provide a clearer picture of possible recommendations for surmounting these challenges. The following are facilitating factors identified by the women that were interviewed.

a. Salary/Remuneration

STEM areas have quickly risen to the top of the most in-demand and profitable careers (Islam, 2019). Some women in this study pointed out that their choice to work in the tech industry was influenced by their knowledge of its being very lucrative with good salaries...

“Another thing is that in terms of money wise, if you are in tech, you get good uh salary.... It motivated me to be honest” (Iran, 42 years MSc Software engineering, digital marketing).

In a study by the African Academy of Sciences 2020, the need for higher salaries was not the main attraction to STEM. However, some opinions stated that the participants' drive to pursue STEM courses was motivated by financial rewards. This viewpoint originated from persons working in the public sector who thought that STEM-related vocations and jobs were connected to fair financial pay, suggesting that enrolling in a STEM degree would assure a good income in the future.

b. Society Influence

The fact that everyone around wanted to take up a technical course rather than a non-technical course served as motivation for some women in this study as regards their choice of tech education and careers;

“Even my family, my family were supportive. They didn't influence me to go to it, but because of society when I was in, like, Uhm, high school, everybody wanted to go for engineering.

Having other peers of the same gender take up tech courses alongside support from their male peers contributed to women's success both in school and in the tech industry.

Everybody wanted to go, and nobody wanted to become an, I don't know, a designer or something” (Iran, 42 years MSc Software engineering, digital marketing).

According to a study by Mukhwana et al., 2020, supportive teachers of tech courses, especially at higher levels of education was highlighted as an essential factor that reinforced the interest of females in tech-related careers—simply encouraging the girls by letting them see how that they could succeed as much as their male counterparts were seen as an excellent push for them to build their careers in the tech field.

c. Academic Performance in Required Subjects

Being good in mathematics and other tech-related subjects motivated the women in their choice of building a career and working in the tech industry. *“I think that’s more- I was quite, I was good at math so, uhm, I was quite successful. Uhm, you know, I’m happy that I chose to go through that route”* (Iran, 42 years MSc Software engineering, digital marketing).

5.3 Discussion of Research Question Two

5.3.1 Practical Solutions to the Challenges facing Women in Tech in the Middle East

Our study participants shared their thoughts on practical solutions to the challenges facing women in tech in the Middle East, gleaning ideas from their experiences. The suggested solutions are outlined and discussed alongside available literature to buttress the point in the next few paragraphs that follow;

a. Role Modeling/Mentorship/Sponsorship

According to an assistant professor at the engineering applied science and technology faculty of a Middle Eastern institution, the findings on women in technology are universal. According to her, "most women with great potential and the ability to integrate and flourish in engineering have a mistaken idea of engineering, they think it is difficult, and they are frequently terrified" (MALEK, 2021). A participant in the interview added that because the area is used to adopting and implementing solutions, it requires more coders. But since software engineering is a relatively new discipline, additional research is required. Scholarships and training for young women can help them develop their goals (MALEK, 2021). The statements below made by two

Yemeni Women in our study further stress the need for role modeling as a tool for facilitating women's involvement in tech;

"As long as they are cool-looking. I think image is important, so if a female role model went to a school and looked kind of geeky, the kids would laugh and say, "Ha ha, a geeky IT person!" I think it's important to find the right kind of role model." (IDI)

Technology occupations are the most sought-after and desired professional goal in the current generation, with almost one in five young people interested in pursuing them (OECD, 2018). The youth need role models to serve as role models and teach them how to apply STEM abilities to transform the world. A survey done by Emirates Global Aluminum shows that more and more young UAE citizens want to work in science, technology, and math. Still, they need famous people to look up to and internships to make this happen (Islam, 2019). It would be helpful to set goals in these areas so that you can learn from the experiences and success stories of well-known people who have had successful careers in STEM.

"You know they feel, uhm, computer science is like some of the stereotypes around it. You sit all day in a dark room in front of a computer. And then in these mentorship programs they show you, they get you to experience a different type of this uh- a whole different view of this aspect" (Israel, 31 Years, BSc in Computer Science, Engineering Manager).

According to some surveys, a significant obstacle to women's retention and success in the computer industry is an absence of mentors, role models, and sponsors. For instance, in one study, 30% of the women said they felt completely alone at work because they lacked mentors. They lacked symbols of possibilities, essential sources of inspiration, optimism, assertiveness, and identity formation due to the lack of role models. Islam (2019) claims that possibilities for internships and mentoring, as well as role models who are prominent women in the tech sector, will boost the participation of women in the sector. Lack of role models, mentors, and sponsors is implicated as a severe impediment to female career advancements in the tech industry. Participants in this study pointed out that if women and girls can have access to other women who are already in the tech field, this could be instrumental in growing their interest in involvement;

“Reflecting to them the image of the successful women in this field” (Yemen, 37 years, Ph.D. in Computer Science, IT department in the University).

“So, I think when uh, for example, when students see that they can, you know, their future can become like that, that they would uhm, you know, they would get the motivation to go and study” (Iran, 42 years MSc Software engineering, digital marketing).

The role models will serve as success images for them to envisage what their future in tech would look like and thus give them the drive to take up tech-related courses in school and build a career in tech. Similarly, in a study conducted among women who had Science, Engineering, and Technology jobs in the US, 40% reported lacking role models, and about half reported a lack of mentorship. In comparison, 84% reported a lack of sponsorship (Hewlett et al., 2014). Mentors help their mentees enhance their work performance by offering networking opportunities, advice, and tactics for developing their skills (Hewlett et al., 2014). Sponsors help to make accomplishments visible and create opportunities for promotion, thereby enabling career advancement (Ashcraft et al., 2016). In the scarcity of female leaders in the tech industry, women are unlikely to find role models and mentors that could provide guidance and support on issues such as work-life balance and training needs advice (Ashcraft et al., 2016).

In a study by Mukhwana et al., 2020, 95% of the women said that having mentors and role models helped them succeed in science, technology, and math. Similarly, in a 2016 study by Ashcraft et al., more than 80% of the women stated that they had no sponsors, and around half reported having no mentors in the technological industry (Ashcraft et al., 2016). Increased social support and mentoring for female students enrolled in tech-related courses, such as the creation of clubs for them, as seen as being particularly effective in the United States with the establishment of clubs in colleges like Carnegie Mellon University and the University of Maryland-Baltimore, will help increase female participation in the tech industry (Mukhwana et al., 2020).

According to the OECD, in 2017, the inequalities between the careers of men and women employees are frequently caused by the decisions they make in their early adolescence, and they can choose their area of academic specialization. Only roughly 0.5 % of girls in the OECD

countries who are 15 want to work in the ICT industry, compared to 5 % of boys. This culminates in fewer women taking up tech careers and ultimately working in the tech industry. This implies that mentoring and support ought to begin in secondary schools even before they reach higher institutions where females can be encouraged to choose IT academic-related courses. Mentorship programs and supportive leadership are essential avenues for encouraging women's participation in the tech field as successful women, especially those occupying leadership positions, can influence women's cause for the better.

From now on, Women who are successful in the tech fields could organize visits to university campuses to organize special programs for university students to reach out to them with their own success stories in pursuing education in the tech field. Such changes will significantly change the notion that the tech industry is male-dominated and thus unsuitable for women. Technical schools can recruit senior tech women to feature in their social and extracurricular events as a platform for these women to meet and mentor students that have an interest in the tech field.

Several mentoring efforts are already under way in the Middle East to promote, develop, and motivate women in tech and inspire others to enter the field, even though more action is required to enhance women's representation in the technology industry. One example is the DIFC FinTech Hive in the Dubai International Financial Centre, which has a female-focused career mentorship accelerator called AccelerateHer. This program provides aspiring female executives with the necessary tools and experience to expand their knowledge and network in the industry, allowing them to play a more active role in shaping the future of the financial landscape. So far, the program has facilitated 104 mentorship pairings, presented around 80 workshops, and supported almost 50 women (Santosdiaz, 2021). In Israel, SHE CODES is a supportive community aiming to increase female participation in the tech industry.

b. Provision of Grants for women/Scholarship

“Paid training, providing tools that help to learn, such as computers, and creating job opportunities that prioritize women” (Yemen, 28 years, BSc Computer science, Application operation at telecommunication company).

The scholarship is a big reason why women are doing well in the tech field (Mukhwana et al., 2020). It has been said that women's success in the tech industry depends on getting financial help. Together with the U.S. Department of State's Providing Opportunities for Women's Economic Rise (POWER) Initiative, Google's Women Tech Makers will hold the Women Tech Founders Program this year. Google's tech and start-up experts made this virtual programme to help and train women in the Middle East and North Africa who want to start their own tech businesses. The goal is to create a network of potential tech change agents in the region. At the end of the programme, 50 female tech startup founders from Algeria, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestinian Territories, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates, Western Sahara, and Yemen would have had access to Google startup training, networking opportunities, and mentoring (Women Tech Founders Program, 2022).

According to Tiedeu et al, (2019) who conducted a study in Kenya found out that women felt higher education institutions should provide specialized scholarships for women because these programs, which are frequently highly expensive to fund, are tied to technology. Using Kenya as example on thoughts of how to fund technology courses. The attempts to increase women's participation in the tech business must include scholarships for women to take up educational opportunities since not all students passionate about computer courses may have the financial resources to do so. Scholarships will allow women to further their education and enroll in the STEM courses they want to without being constrained by a lack of funding.

c. Increasing Female Educational Attainment

Higher education is valued in the Middle East because the number of women going to college has gone up a lot in recent years. Women's rights and access to education are also highly regarded (Islam, 2019). More than half of the study participants (7 out of 13) had a postgraduate degree. Others had a Bachelor of Science degree, but only one had a BSc. Islam, 2019, says that tech courses are becoming more popular in the Middle East because both public and private universities give students of both sexes the same chances to learn. 2016 UNESCO and the World

Bank have found that about half of the tech students in the Middle East are women, but more men are studying engineering (UNESCO Institute for Statistics, 2019). This shows that women in the Middle East are getting better at school. Studies show that the Middle East's average spending on education as a share of all government spending is rising quickly (UNESCO Institute for Statistics, 2019).

Two-thirds of the adults in Middle Eastern countries who can't read or write are women. Women are twice as likely to be illiterate as men. In Middle Eastern countries, girls and boys go to school in very different ways. But these gaps are usually bigger in countries where fewer people can read and write and fewer people go to school. In Yemen, 54% of young women are illiterate, which is three times as many as young men (17 percent). Still, countries like Jordan and Tunisia that have made political and financial pledges to end illiteracy have made significant progress and narrowed the gap between men and women. The Population Reference Bureau says that in 2022.

A 2018 World Bank study found that girls in the MENA region do better in school than boys. This shows that the biggest gender gaps in school achievement are in favour of girls (World Bank, 2019). In KSA and Jordan, boys did better in science than girls by 29 points. The UAE (26 points), Lebanon, and KSA were next (5 points). Several studies and books show that women still do better than men at the university level in all academic subjects (DiPrete & Buchmann, 2013).

More women are entering the work sector due to Middle Eastern countries' rising educational levels for women in recent years. It is still the lowest when compared to other world locations, though. Only 20% of Middle Eastern women aged five and older are employed, according to the Population Reference Bureau (PRB). Assistance rendered to resource-poor countries like Yemen by the more affluent countries both inside and outside the Middle East region for the improvement of their educational systems will improve access to quality education, thereby investing in female education as well as accelerating the region's economic and social development by stalling population growth, improving human capital, and easing poverty. (Population Reference Bureau, 2022).

Initiatives like paying the tuition for girls interested in tech courses would help them finish their education and allow them to get involved in and start careers in the tech sector (Mukhwana et al., 2020). The Yemeni government must also exert special effort to make it easier for those from poor households and those living in remote areas to access education. The requirement for girls to finish school and the quality of education should be considered. In 2022, the Population Reference Bureau.

"Okay. So we need to let the girls know they can do more than be mothers and, like, responsible for the family. Moreover, there is no difference between a female and a male in this life. If you like, desire, and have the intelligence to do it, then you can do it. Moreover, we should explain that even if your dream is to be a mom and to have a family, it will not stop you. Because the high-tech companies now give so many benefits and will make it easy for you like, you know-. Suppose we try to explain the real-life when working on tech" (Israel, 28 years, B.Eng. Computer Engineering, Sales Development Representative).

"I think for me that is the biggest time to get women into this. When they are looking for what they want to do in life, not when they are 18 or 20, something like that. When they are at kindergarten" (Yemen, 32 years, BSc Computer Science, Software engineer).

d. Gender Friendly Government policy

“In my country, the only approach that can help to promote female participation is only that there should be a government orientation to involve women within the quota, especially in activities that suffer from male domination, such as the technological field” (Yemen, 40 years, Ph.D., Head of information security department in the University).

“Getting rid of societal constraints associated with long working hours and the need to exchange experiences from different people” (Yemen, 36 years, Msc, Assistant teacher at Public University).

“Yes, there is a lack of government regulations that should impose the participation of women in the technology industry as part of this society and increase their job opportunities and

integrate them in various institutions” (Yemen, 37 Years, Ph.D. Holder in Information Technology, Engineering Faculty of the University).

According to the African Union Development Agency (AUDA-NEPAD), which used to be called the New Partnership for Africa's Development, STEM education in the Middle East, and especially in Yemen, has problems with participation, equity, exclusion, quality and relevance, resources, and expertise that are similar to those in Africa (NEPAD). Government policies in the Middle East area should try to solve these problems by making plans, policies, and departments that deal with setting up systems and networks that give equal, relevant, cheap, and high-quality STEM education. These policies need to take the mystery out of science and technology and support more targeted funding for the field. They also need to encourage more women to enrol in science, technology, engineering, and math (STEM) programmes, build the institutional and human capacity for science and technology, and protect and advance indigenous knowledge systems. Systematic gender-separate data collection is needed to help policies and research be put into action.

The practical advantage healthy government policies deliver can be seen in Saudi Arabia, where women's participation in the IT industry is jerked from 11% to 24% in 2021 due to the concerted efforts of the council set up by the government to support the growth of women in education. By these figures, the growth of women in tech is remarkably promising if such government effort is sustained (Mann-Kler, 2022). There is a significant need for the government to create awareness and advocate for women's ability to succeed in tech fields and design and implement policies that encourage gender equity and fair representation of both genders in tech employment opportunities. According to Mukhwana et al., 2020, gender equity can be made a law in the hiring and recruitment process for tech industries.

Considered one of the developing countries and the poorest country with the surrounding GCC counterparts, Yemen has been given considerable attention by the USA and Europe to develop it and establish security and education. As a result, the Golf Cooperation Council (GCC)

has funded many projects to develop the country's infrastructure. This has crucially helped implement ICT policy in the education and communication sector. (Al-Madhagy, 2013)

Although Yemen has its own ICT policies that it seeks to accomplish by engaging strategic plans, they need to be clearly and concretely articulated in a well-organized form to be understood as a separate entity within the Yemeni General National Policies (Al-Madhagy, 2013). The significant points of ICT policy in Yemen are thus outlined;

To develop the country through technical education. A bold step was taken to propagate the importance of information technology in the Yemeni Society by establishing the Yemen Center for Information Technology in Higher Education (YCIT-HE). This organization was saddled with the responsibility to enable information technology services in Yemen Universities for the students and academic and non-academic staff to automate.

A conference was held in Aden, the economic City of Yemen, on April 18th - 22nd, 2004, with the support of all Yemeni Universities, the Ministry of Higher Education and Scientific Research, as well as private entities to develop a plan of higher education National ICT policy in Yemen. This policy was developed under the supervision and approval of TUDelft University in Holland, producing a National Master ICT plan for higher education in Yemen. (YCIT-HE,2007). This policy, like the World Bank, eventually attracted the global community's support. Establishment, supervision, and funding were received from World Bank on the automation of transactions in the customs authority. Though the policy created an opening for new entrants into the tech space, women were given little consideration or inclusion. Furthermore, as part of the Government ICT Policy, huge investment was made in developing telecommunication infrastructure and IT systems. The government deployed fiber optic cables to connect the remote site with the Capital, Sana'a, and by 1996 internet usage started in Yemen with two service providers, namely: TeleYemen and Public Telecommunication Company (PTC), being affiliate companies of the Ministry of Telecommunication

e. Favorable Organizational/ Work-place Policy

“But I guess most of the companies that I work with care very, very hard, like, for the women and care so much to keep women in their company that they give some benefits. They encourage women to join the high-tech companies and maternity leave all this stuff is made easier” (Isreal, 28 years, B.Eng. Computer Engineering, Sales Development Representative)

Even though Yemen is trying to make policies and start programmes to help girls and young women get an education in STEM fields, social, cultural, and institutional barriers keep girls and young women from going to school and college and doing as well as boys (Tiedeu et al., 2019). Even though data shows that women's success rates in academic and senior positions are the same as men's, women tend to apply less and move up more slowly than men. By fixing the fact that women in higher education move up in their careers more slowly, it will be possible to hire more women, which is a great step (Tiedeu et al., 2019). A real Middle Eastern women in IT partnership could also help and encourage women to work in the field. Combining the skills of women with projects that are led by women will raise awareness, have an effect, and encourage policies that help women in technology. For example, The San Francisco International Women Entrepreneurs Forum is one of the top three organisations in the United States and California with programmes, initiatives, and events for women entrepreneurs. The Forum gives many international groups a place to talk, share resources, and promote projects, start-ups, and businesses that are for or led by women (San Francisco International Women Entrepreneurs Forum, 2014).

By offering equal opportunities on the job market and access to competitive benefits within the ICT sector, tech companies should encourage positive behaviors toward women in tech. Women can benefit from this career option by earning higher pay, enjoying greater freedom in structuring their work schedules, and being less prone to unemployment if given a chance to contribute and enjoy similar circumstances in the creation and development of ICT. With appropriate remuneration of women in tech without gender biases, including having equal pay during maternity leave, women will be able to further their education and meet other needs serving as a reinforcing factor for their participation in the tech industry.

As pointed out by our study participants, women who are well-paid, well-represented, and supported by organizations to strike a family-work balance will be more successful in the tech industry. Furthermore, implementing policies that protect women from workplace harassment, such as the availability of gender-sensitive toilets and gadgets, as well as paying attention to skills and professionalism instead of gender during hiring and promotion processes, will provide an enabling environment for the success of women in the tech industry (Mukhwana et al., 2020). Providing incentives such as awards and recognition of outstanding women will further drive women's hard work, commitment, and success. Ensuring a fair representation of women at every level of the tech industry will also be instrumental to women's success. Gender equity in the tech work sector will mean providing equal opportunity for career development, decision-making, and job roles despite maternity leaves, lactation, and other family demands; tailoring the training needs of women in such a way that it does not always interfere with family demands like involving frequent travels example use of online platforms to deliver the training (Mukhwana et al., 2020).

Tech industries could also harness the ingredient of creating networking opportunities for women in tech to communicate and relate with one another, learn from each other, and keep themselves abreast of new professional trends and practices in technology. Female networks can help women build confidence and feel more like a part of the sector by providing opportunities to meet women of like minds and build their confidence and morale. (Graham, 2016).

Formulation and implementation of policies sensitive to women's reproductive health and family-life needs, such as a creche for nursing mothers while working, and a place for breastfeeding, will help facilitate women's participation in tech (Mukhwana et al., 2020). Tech employers need to show flexibility in the working conditions of women by supporting them to effectively manage their work schedules without any discouragement. This would involve the provision of a supportive environment for child care that still gives room for the success of women in tech.

f. Social Support

In Yemen, men and women have very clear roles, and young girls are put under a lot of pressure to get married and have children. Because of this, some girls may decide to stop going to school (Mehress et al., 2017). Yemen's weak economy harms women. Most families with an average annual income of \$2,500 carefully plan how much they will spend on their children's education (Darem, 2014). Because of this, it is hard for women to get technical training. A woman who answered said, "Most Yemeni families with money choose to send their sons to school, not their daughters" (Darem, 2014). Girls in primary and secondary schools in Yemen don't get much help, which makes it hard for women to go to college. Only a few schools in Yemen have enough teachers to teach many females because Yemeni households sometimes forbid men from teaching their daughters. Those girls might go to college and return home to become teachers (Darem, 2014).

As seen in this study, providing parents with adequate information about assisting their children in decision-making on tech careers as well as spouses supporting women who are already in tech, could help increase women's participation in the industry;

“Uhm, yes, and uh, my motivation was basically my family. They always believed in me, and they said like you could do it just if you- if you like, fail now, it is fine. You will learn from this failure and take it to the next step” (Israel, 28 years, B.Eng. Computer Engineering, Sales Development Representative).

“Even my family, my family were supportive. They didn't influence me to go to it, but because of society. When I was in, like, Uhm, high school, everybody wanted to go for engineering. Everybody wanted to go. Nobody wanted to become an, and I don't know, a designer or something” (Iran, 42 years MSc Software engineering, digital marketing).

g. Harnessing the Platform/Gig Economy

A new dimension in the tech industry that can aid women's full participation against all odds is the Platform economy or gig economy. The demand for online services has led to significant growth in the gig economy or platform economy. This growth has made it easier for

people, especially women, to get jobs by creating platforms where they can work for different clients or projects. In countries that aren't as well off, these platforms can help women move from the informal, unofficial economy to regular work. However, it is essential to implement effective policies to ensure that online platforms provide real opportunities and do not just replace traditional sweatshops with digital ones (OECD, 2017b). For women, the flexibility offered by platform work is desirable as it allows them greater control over their work life.

” Working remotely allowed us to compete as a woman, enter the work environment and do all the job duties without any shortcomings.”

(Yemen, 28 Years, Masters Holder in Public Administration, Application Operator at a Telecommunication Company).

According to research, preconceptions and biases against women both consciously and unconsciously prevent them from using internet platforms (OECD, 2017). Most women work as independent contractors for digital labour platforms like Upwork and Freelancer, which offer services like data entry, administrative support, translation, design, coding, legal advice, and business consulting (OECD, 2017). In 2016, only these two networks had about 49 million users who had signed up. Freelancer, which started in 2000, has done 10.2 million jobs worth USD 3 billion in its six years of operation (Freelancer, 2017). Other platforms include those for direct sales like Mary Kay and Rodan and Fields, those for services like TaskRabbit and Care.com, those for transportation like Uber and Lyft, those for vacation rentals like Airbnb or HomeAway, those for home furnishings like Etsy, and those for food delivery like Grubhub or Postmates. These platforms have expanded, yet biases still prevent women from participating fully.

Digital platforms offer significant benefits for women in both emerging and industrialized economies (OECD, 2017). These platforms make labor market searches and skills matching more efficient and allow women to reach a broader global customer base without engaging in traditional marketing. Additionally, platforms provide opportunities for women to improve their skills by gaining access to a broader range of clients and tasks. Digital platforms also enable women to enter

the workforce, boosting household income and enabling them to juggle parenting and professional goals. This, in turn, supports fertility growth, particularly in aging societies.

According to Hyperwallet's survey of 2,000 women, many join the gig economy because of its flexibility, allowing them more time with their families and work around their schedules (Hyperwallet, 2017). The same study found that 96% of women surveyed cited flexible working hours as the key benefit of gig work. Other studies, such as those conducted by MGI (2016b) and JPMorgan Chase (2016), have reached similar conclusions. Forty % of the women surveyed said they are motivated to work gigs because they can augment their income and have more control over their pay. Other advantages cited by respondents included having more free time (39%) and eliminating commuting (26%) and its associated stress reduction (36%), as well as having more opportunities to pursue personal hobbies (34 %).

Nearly one-third of the respondents (29%) in the gig economy appreciated the diversity of projects and clients, allowing them to improve their skill sets and advance in their careers (OECD, 2017). Although concerns have been raised about job quality, one of the main benefits of digital platforms is that they provide workers with greater flexibility to choose when, where, and how they work. With more flexibility, employers may hire more people and find it easier to juggle work and family obligations, which is especially helpful for women who are often the main domestic carers (Elance, 2013). A 2013 survey by Elance found that 32% of women who switched from regular employment to working as independent contractors on digital platforms did so to have a more flexible career and 28% to have more time to care for family members at home. Additionally, the OECD discovered that the nations with the largest percentages of women working from home also had the highest employment rates (OECD, 2017).

5.4. Research Design Limitations

This study has the following limitations;

1. Non-Probabilistic Sampling

Purposive sampling, as opposed to random sampling, was used for the survey. Therefore, this may only reflect a small portion of the Middle Eastern population of women working in technology. Only tech companies willing to grant access to women in their companies were included in the study.

2. Online interviews

In-person interviews are gold-standard (Rubi, 2011); however, in-person interviews were impossible in the study. Technological interference, such as network signal strength, influenced the outcomes of the interviews.

CHAPTER VI: SUMMARY, CONSEQUENCES, AND RECOMMENDATIONS

6.1 Summary

Several studies have shown that women in STEM (Science, Technology, Engineering, and Math) fields face a lot of challenges (Cech & Blair-Loy, 2019; Guo et al., 2018; Hawthorne et al., 2018). In general, this study has shown that women in tech in the Middle East face important problems. It has also found and described the things that make it easier for women to work in the tech sector.

The challenges facing women in tech, as disclosed by participants, were categorized into personal beliefs or opinions; family inclinations; societal norms; religio-cultural and organizational structure and practices; low value attached to education; perception of child care and women role; unfavorable work hours and difficulty getting managerial roles. Complete lack of or, in some cases, low educational attainment of the girl-child due to restriction from culture and religion or civil unrest, lack of female role models, intimidation and sexism, social interaction between males and females at the workplace, discrepancies in pay structure and lack of funding for the female tech start-ups add to the many barriers facing women in the Middle East countries and causing their under-representation in the tech industry (Islam, 2019).

Possible solutions to mitigating these challenges, as disclosed by participants and other related studies, including

- Access to role models and grants and scholarships for female tech education.
- Enactment of favorable government and organizational policies that allow women to thrive in the sector.
- Awareness creation to debunk negative perceptions around women's involvement in tech and social support for young women with tech aspirations.

The literature review also suggested a few possible solutions, such as encouraging high school students to take more technology classes and teaching them about career opportunities in

the field; helping female students in college and graduate school by giving them mentorship and networking opportunities and telling them about career opportunities in the field; and encouraging employers and people who work in the field to hire more women. These are only some of the possible answers that were given.

The tech industry is characterized by long working hours and tight and demanding schedules. However, the women in this study were making waves and succeeding in their respective companies despite such tight demands. Most women in the study had at least a degree in tech-related courses, with a good number even having post-graduate degrees. Identified factors that facilitated the women's interest and choice of technology education and industry included that tech jobs came with a good salary, support from family, societal influence, and good academic performance in courses like mathematics. In the Middle East, there have only been a few programmes set up to help women get involved in technology. But some haven't been running regularly because they don't have enough money, and others have stopped completely because of how safe the country is. At the moment, the Arab Women in Computing organisation is doing a lot to change the storey of women in tech in the Middle East. An active chapter of the organisation can be found in Yemen. The "SHE CODES" programme in Israel is also making a difference for women in tech.

If policymakers want the Middle East to be able to compete with other regions, they need to make employment laws and rules more flexible. This will make hiring and recruiting more effective. This will help set up institutions that give women the chance to reach their full potential. Platforms like Arab Women in Computing that give women a chance to have their voices heard in the IT industry should be strongly supported. Furthermore, to enhance the participation of women in technology, opportunities offered by digital platforms should be taken advantage of. According to a recent study, digital platforms can help women in both developed and developing nations by supporting more effective job searches, expanding access to a wider range of clients, and advancing women's skill sets. In addition, digital platforms can expand the size of the customer base worldwide without engaging in traditional marketing methods. Furthermore, OECD analysis

reveals that countries with the highest rates of women working from home, which may include those who work through digital platforms, are also the ones with the highest rates of employment.

6.2 Implications

Women deal with problems, including the perception that they are less intelligent, emotionally, and physically capable than men, as well as challenges like how expensive it is for employers to pay salaries during maternity leave (Human Rights Watch, 2018). The male dominance of the technology industry is attributed to gender stereotypes and discrimination against women, which prevent women from enrolling in technical programs and pursuing technical employment. Job adverts also reflect the predilection towards hiring men. The public and commercial sectors must work together to develop gender equity policies and program designs to achieve gender equality at work and empower women in the technology industry.

6.3 Recommendations for Future Research

Even though more women are enrolling in STEM programmes, there is still a big difference in pay between men and women in the workplace. So, there needs to be more research on the gender gap in tech education and career advancement for women in the Middle East to find out why women don't have the same number of tech jobs as they do tech degrees. Also, it's important to figure out how the platform or "gig" economy affects women's participation in the digital and tech space around the world.

It's important to point out that research in other fields where men are more common than women has shown that women may be discouraged from entering those fields during recruitment 2016 (Graham). According to several studies, advertisements for jobs where men predominate the workforce tend to use more masculine language. In advertisements emphasizing masculinity, more women might feel these positions are less desirable or less likely to apply. A considerable study in

this field is required to explore these difficulties in the Information Communication and Technology (ICT) sector.

6.4 Conclusion

It is a worldwide issue that women are underrepresented in roles involving information, communication, and technology. Despite numerous initiatives to change this narrative by increasing female participation, countries still need to achieve parity in these fields (Graham et al., 2016). The success of women already in the tech industry will depend on a multi-pronged approach that addresses their challenges by implementing policies that will address the gender gap in tech holistically while tackling issues from the home to the society to the work settings. (Mukhwana et al., 2020). Companies will gain from gender equality in various ways, including talent attraction and retention, increased employee productivity and innovation, improved organizational performance, and higher profitability (Moen et al., 2016). There must be a good reason for women to continue using science and technology as spectators rather than active contributors to its research, use, and advancement. Therefore countries, companies, and families must make deliberate efforts to bring women on board at all costs by providing an enabling environment for them to thrive and giving them all the necessary support to soar to the highest heights alongside their male counterparts. As the number of women working in tech grows, families, countries, and the tech industry as a whole will all benefit in many ways.

APPENDIX A
INFORMED CONSENT

**Title of Research: Women in Tech in The Middle East: Experiences and Possible
Solutions to Their Challenges**

Name of researcher: This study is being conducted by Rita Sharon Ikhuoria from the Business Administration department of the Swiss School of Business Management.

Purpose of the research: This study aims to understudy women's experiences in technology in the Middle East to fully comprehend the issues that this population group faces. It also seeks to explore potential solutions to relieve the hurdles women in tech face in the region, notably in Yemen. This information would inform approaches to increasing women's participation in the Tech Industry in the Middle East, especially in Yemen.

The procedure of the research: Women working in different tech companies in the Middle East will be contacted and invited to participate in an online interview.

Expected duration of the research and participant(s)' involvement: This study is expected to last about two months. You are to answer the question in the interview guide, which will last approximately 1 hour.

Risk(s): There are no risks in women participating in the study.

Costs to participants, if any, of joining the research: You won't be charged for participating in this study.

Benefit: The results of the study would be made available for your consumption and that of the wider public.

Confidentiality: No names will be used; all information gathered for this study will be assigned coded numbers. Your name or any other form of identification won't be utilized in any publications or study reports in any way that could connect this to you.

Voluntariness: It is totally up to you whether or not to take part in this study.

Consequences of a participant's decision to stop taking part in research and how to end participation in a fair way: You may also decide to stop participating in the study whenever you want. Please be aware that some of the data collected about you before you decided to withdraw may have been altered or utilized in publications. These are now irremovable. The researchers commit to working as hard as they reasonably can accommodate your requests.

Statement of the person giving consent:

I read the research summary or translated it into a language I could understand. I also had a satisfying discussion with the researcher. I am aware that my involvement is entirely optional. I am knowledgeable enough about the research study's goals, procedures, risks, and advantages to decide whether or not I want to participate. I know I can withdraw from this study at any time. I have a copy of this permission form and related information sheet for my records.

DATE: _____ SIGNATURE: _____

NAME: _____

WITNESS' SIGNATURE (if applicable) _____

WITNESS' NAME (if applicable) _____

APPENDIX B
INTERVIEW GUIDE

**Title: Women In Tech In The Middle East: Experiences And Possible Solutions To
Their Challenges**

Demographics

Age

Level of education

Qualification at entry level to the industry

Years of employment

What is your role/position in your organization?

Give a brief description of your role

Tech education

1. The number of female students in the ICT courses is less than the male counterpart, especially in the Middle East. Do you share a similar opinion? If yes, what do you think are the factors responsible for these differences? Probe for (less value on and had lower expectations for success in ICT fields), lack of role models, lack of confidence, and negative stereotypes.
2. Are you aware of any program (currently or in the past) intended to help promote female enrolment in Technology courses? If yes, are they still in operation? If yes, describe them and their impact on women, and if no, why were they stopped?
3. What approaches do you think can be used to motivate female students' enrolment in technology courses?

Tech Industry

1. Can you share the process that led to your getting this job offer?
2. Can you describe your experience since working in this industry? Challenges, motivators, and opportunities.

Factors

1. What do you think has led to the low number of women working in technology at your workplace and in the Middle East? Check for sexism in the tech industry, in education, and among tech industry models.
2. Find out about the person's personality and traits, such as being proactive and assertive, being self-controlled, and having a positive outlook.
3. Look for things like government rules, family life, orientation, religion, education, and the patriarchal system (gender roles).
4. Can you say something about how women stay in the IT field? Do you think that the IT industry in your workplace and the Middle East is set up in a way that makes it easier for women to stay?
5. What is the culture like at your workplace and in the Middle East for women who work in IT?
6. What parts of your workplace culture and those in the Middle East have made it hard for women in IT to move up in their careers? What parts of the culture of your workplace and the Middle East have helped women in IT advance their careers?
7. How happy are women in IT with the way their careers are going?
8. What do you think the benefits of women working in tech and going to school could be?

Solutions

1. Do you know of any actions that have been taken in the past to encourage more women to work in tech and industry?
2. If yes, are they still in operation? If yes, describe them and their impact on women, and if no, why were they stopped?
3. What approaches can be used to promote female participation and retention in the tech industry?

REFERENCES

- Al Akayleh, F., (2018). Impact of Technological Progress on Economic Growth and Employment: A Case Study of Saudi Arabia. *The Journal of Social Sciences Research*, 4(12), pp.606-617.
- Alghamdi, F., (2016). Women in Computing In Saudi Arabia. *Proc. 3rd ACM-W Europe Celebration of Women in Computing*, pp. 1-3.
- Al-Haidari, S. (2021). Women in tech in Yemen: Challenges and opportunities. Arab News Retrieved from <https://www.arabnews.com/node/1905111/middle-east>
- Alserri, S.A., Zin, A.M. and Wook, T.S.M., (2017). Gender Enrolment Factors In ICT Studies. *SOFTAM Postgraduate Symposium December*, pp. 52-58.
- Anderson, M.J., Gilmour, N., & Castro, M. (2013). Women in technology: Leaders of tomorrow. *Evolved People Media, LLC, and Accenture*.
- An Overview of Women Entrepreneurship in the Middle East and Africa Available at < <https://thefintechtimes.com/an-overview-of-women-entrepreneurship-in-the-middle-east-and-africa/>>
- Aronson, J., Steele, C.M., Brown, J., Lustina, M.J., Good, C., & Keough, K. (1999). When white men can't do the math: Necessary and sufficient factors in stereotype threat. *Journal of Experimental Social Psychology* 35, 29-46.
- Arthur Z., (2020.) 41 Women in Tech Statistics: 2020/2021 Data, Growth, and Predictions. *Compare Camp*.
- Ashcraft, C., & Breitzman, A. (2012). Who invents IT? Women's participation in information technology patenting, 2012 update. *Boulder, CO: NCWIT*.
- Ashcraft, C., & DuBow, W. (2015, May 28). The tricky (and necessary) business of being a male advocate.
- Ashcraft, C., McLain, B., and Eger, E. (2016). Women in Tech: The Facts. Available at https://www.ncwit.org/sites/default/files/resources/womenintech_facts_fullreport_05132016.pdf
- Barzilay, R. (2019). Israel's Tech Ecosystem Must Address Gender Gap. Retrieved from <https://www.forbes.com/sites/startupnationcentral/2019/03/07/israels-tech-ecosystem-must-address-gender-gap/?sh=697a0f125e47>
- Bella, K.M.J. and Chandran, M., (2019). A Study on Work-Life Balance and Challenges Faced By Working Women in IT Sector. *International Journal of Research in Engineering, IT and Social Sciences*, 9, pp.520-532.

- Bishin, B. G., and Cherif, F. M. (2017, July). "Women, Property Rights, and Islam" Retrieved April 19, 2019, Available at: <https://www.ingentaconnect.com/contentone/cuny/cp/2017/00000049/00000004/art00005?crawler=true>
- Braun, S., and Turner, R.A. (2014). Attitudes and Company Practices Predict Managers' Intentions to Hire, Develop, and Promote Women in Science, Engineering, and Technology Professions. *Consulting Psychology Journal: Practice and Research* 2014, Vol. 66, No. 2, 93–117
- Brimacombe, T. and Skuse, A., (2013). Gender, ICTs, and indicators: Measuring inequality and change. *Gender Technol Dev.*;17(2):131–57.
- Campbell, N., Wozniak, H., Robyn, L., Raechel A. (2019) Peer-supported faculty development and workplace teaching: an integrative review <https://doi.org/10.1111/medu.13896>
- Calcalist. (2020, March 8). Intel Israel Promotes Women to Senior Management Roles. Retrieved from <https://www.calcalistech.com/ctech/articles/0,7340,L-3795267,00.html>
- Camera L. (2015). Women Still Underrepresented in STEM Fields. Retrieved from <https://www.usnews.com>
- Ceci, S.J., W.M. Williams, and S.M. Barnett, Women's underrepresentation in science: sociocultural and biological considerations. *Psychol Bull*, 2009. **135**(2): p. 218-61.
- Central Bureau of Statistics. (2020). Women and Men in Israel 2020. Retrieved from https://www.cbs.gov.il/he/publications/doclib/2021/women_and_men_2020/pdf/h_pri nt.pdf
- CIA World Factbook – Middle East: Yemen and World Bank (2017). Company diversity data. (2019). Retrieved from <http://opendiversitydata.org/>
- Courtney C., (2012.) Unveiling the Revolutionaries: Cyberactivism and the Role of Women in the Arab Uprisings.
- Daley, S. (2022). Women in Tech Statistics Show the Industry Has a Long Way to Go. <https://builtin.com/women-tech/women-in-tech-workplace-statistics>
- Dancheva, T., Keysan, A. O., Lewis, N. and Zhao, Y. (2020). Women in tech: breaking down barriers to female leadership
- Darem, F.,(2014). Yemeni Women's Uphill Struggle for Education. <https://www.al-fanarmedia.org/2014/06/yemeni-womens-uphill-struggle-education/>
- Diana M., (2013). Freelance Trends in Elance Q1 2013 Report Available at: <https://www.dianamarinova.com/freelance-trends-in-elance-q1-2013-report/>

- DiPrete, T. A. and Buchmann, C., (2013). The rise of women: The growing gender gap in education and what it means for American schools, *Russell Sage Foundation*
- Diekman A.B, Brown E. R., Johnston A. M. (2010), Seeking Congruity Between Goals and Roles: A New Look at Why Women Opt for Science, Technology, Engineering, and Mathematics Career. *Sage Journals* 21(8) 1051–1057 DOI: 10.1177/0956797610377342
- Deepa M. (2022). When Women Win: How The Middle East is Showcasing Female Success Across Entrepreneurship And Tech. Available at: < <https://www.entrepreneur.com/article/429614>>
- Eccles, J., (2009) Who am I and what will I do with my life? Personal and collective identities as motivators of action. *Educational Psychologist*, 44(2): p. 78-89.
- Edelstein, S. (2019). Women in tech in Israel: achievements and challenges. Retrieved from <https://blogs.timesofisrael.com/women-in-tech-in-israel-achievements-and-challenges/>
- Ekine, A., M. Samati, and J.-A. (2013) Walker, Improving Learning Opportunities and Outcomes for Girls in Africa.
- El-Swais M. (2015). Ten facts you didn't know about women in the Arab world. Retrieved from <http://blogs.worldbank.org/arabvoices/ten-facts-about-women-arab-world>
- El-Swais, M. (2016). Despite high education levels, Arab women still don't have jobs. *The World Bank Group Blogs*. <https://blogs.worldbank.org/arabvoices/despite-high-education-levels-arab-women-still-don-t-have-jobs>
- Emma M., Abdella D., Marsha P., (2003) “Women in Tunisia: Between State Feminism and Economic Reform,” Women and Globalization in the Arab Middle East, eds. (London: Lynne Rienner Publishers, 172-173.
- Forbes Middle East (2018). The future belongs to STEM. Retrieved from <https://www.forbesmiddleeast.com/the-future-belongs-to-stem>
- Freelancer (2017), “2016 annual report”, https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwixu5r_kPjaAhWF0RQKHZh6BTIQFjAAegQIABAq&url=https%3A%2F%2Fwww.tr.freelancer.com%2Ffiles%2Fdownload%2F43444663%2FAnnual%2520report%25202016%2520v11.1%25pdf&usg=AOvVaw0NdevOVL19EM8NEVpKBRB.
- Federal Ministry for Economic Cooperation and Development, n.d. Women in Tech: Inspiration, No Fairytales. Available at: <https://www.eskills4girls.org/wp-content/uploads/2019/02/Buch_LiT_Online_compressed.pdf> [Accessed 16 Mar. 2022].

- Feki S., Heilman, B., & Barker, G. (2017). Understanding Masculinities: Results from the International Men and Gender Equality Survey (IMAGES)—Middle East and North Africa. New York: UN Women. *Open Journal of Social Science Volume 9, number 10*
- Glass, J.L., Sessler, S., Levitte, Y., & Michelmores, K.M. (2013). What's so special about STEM? A comparison of women's retention in STEM and professional occupations. *Social Forces*, 92(2), 723-756.
- Glassdoor Team. (2014, November 17). The gender pay gap revealed in tech; Glassdoor report. Available at: <<http://www.glassdoor.com/blog/tech-salaries-glassdoor-diversity-hiring-survey/>>
- Government of Japan. (2006). Science and Technology Basic Plan (Provisional Translation). 25. Retrieved from <https://www8.cao.go.jp/cstp/english/basic>
- Government of Japan. (2016). The 5th Science and Technology Basic Plan (Provisional Translation).35. Retrieved from <https://www8.cao.go.jp>
- Graham, H., Fuertes, V., Egdell, V, and Raeside, R. (2016) “An investigation of the barriers to women entering, staying, and progressing in the sector, and actions to ameliorate this; Executive Summary.*Employment Research Institute, Edinburgh Napier University*
- Gross, D. (2018). Orna Berry was the first woman to serve as a Vice President of EMC Corporation. Retrieved from <https://www.jpost.com/jpost-tech/business-and-innovation/orna-berry-first-woman-to-serve-as-a-vice-president-of-EMC-corporation-556405>
- Haghighat, Elhum (2013). Social Status and Change: The Question of Access to Resources and Women's Empowerment in the Middle East and North Africa. *Journal of International Women's Studies*, 14(1), 273-299. Available at: <https://vc.bridgew.edu/jiws/vol14/iss1/17>
- Hallak, J., Burlinson, G., Ghattas, H. and Machado, M. (2019), Women in Tech: Social Innovation in MENA. Engineering for Change.
- Hardey, Mariann, (2019) The Culture of Women in Tech: An Unsuitable Job for a Woman, *Emerald Publishing Limited*. Pro Quest Ebook Central, <http://ebookcentral.proquest.com/lib/brookes/detail.action?docID=5967829>.
- Hanton, P.B., (2015.) The lack of women in technology: The role culture and sexism play.
- Hewlett S. A., Sherbin L., et al. (2014). Accelerating Female Talent in Science, Engineering & Technology. Retrieved from <https://www.talentinnovation.org/publication>
- Hill, C., C. Corbett, and A. St. Rose. (2010) Why So Few? Women in Science, Technology, Engineering, and Mathematics. *American Association of University Women*. Retrieved from <https://eric.ed.gov/?id=ED509653>

- Holtzblatt, K. and Marsden, N., (2018.) Retaining Women In Technology. *IEEE International Conference on Engineering, Technology, and Innovation (ICE/ITMC)*, pp. 1-8.
- Howes, E., (2002) Connecting girls and science: Constructivism, feminism, and science education reform.: *Teachers College Press*.
- Human Development Report (2015), “Briefing note for countries on the 2015 human report – Saudi Arabia”, available at: http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/SAU.pdf.
- Humans Rights Watch (2018), World Report 2018, Our annual review of human rights around the globe, <https://www.hrw.org/world-report/2018>
- Ikhlas A. (2015). Career Facilitators and Barriers of Arab Women Senior Executives.
- IMF (2019). Japan’s gender gap. *Finance & Development*, Vol. 56, No. 1. Available at <https://www.imf.org/external/pubs/ft/fandd/2019/03/gender-equality-in-japan-yamaguchi.htm>
- Islam, S. I., (2019). Science, Technology, Engineering, and Mathematics (STEM): Liberating Women in the Middle East. *World Journal of Education*, 9(3). <https://doi.org/10.5430/wje.v9n3p94>
- Israeli Innovation Authority. (2019). The Authority and the Ministry of Social Equality Announce the Launch of a Program to Support Women-Led Startups. Retrieved from <https://innovationisrael.org.il/en/news/authority-and-ministry-social-equality-announce-launch-program-support-women-led-startups>
- Israeli Innovation Authority. (2021). The Israeli Tech Ecosystem Report 2020. Retrieved from <https://innovationisrael.org.il/en/content/israeli-tech-ecosystem-report-2020>
- Israel Women's Network. (2020). Women in High-Tech in Israel. Retrieved from <http://iwn.org.il/wp-content/uploads/2020/07/Women-in-High-Tech-in-Israel.pdf>
- ITU (2019), “Measuring Digital Development: Facts and Figures”
- James, K and Cardador, J. (2007) Cognitions about Technology and Science: A Measure and its Relevance to Career Decisions. *Journal of Career Assessment* Vol.15. No.4 <https://doi.org/10.1177/1069072707305766>
- Jacobs, C. (2019). Inbal Arieli's startup Synthesis raises \$2.5m. Retrieved from <https://en.globes.co.il/en/article-inbal-arielis-startup-synthesis-raises-25m-1001276166>
- Kaspura A. (2017). The Engineering Profession: A Statistical Overview. 13: 32. Retrieved from <https://www.engineersaustralia.org.au/resourcentre/resource/engineering-profession-statistical-overview-13th-edition>

- Kawamoto, D. (2013, March 22). Parity for some, but tech women's pay lags overall, Dice. Available at: <<http://insights.dice.com/2013/03/22/it-salaries-for-women/>>
- Kayla M. (2020.) Women in Cyber security. *Cyber Security*.
- Kemppainen, R.P., (2019.) Saudi Female Innovators As Entrepreneurs–Theoretical Underpinnings. *International Journal of Gender and Entrepreneurship*.
- Kirsner, S. (2012). Ladyada: The woman behind Adafruit Industries. Retrieved from <https://www.bostonglobe.com/business/2012/12/23/ladyada-the-woman-behind-adafruit-industries/zpY28KQQJdgyRfr0e9X63K/story.html>
- Lasic, L. (2018.) Digital Social Entrepreneurship and the Path to Ending Intimate Partner Violence in the Syrian Refugee Population. *Doctoral dissertation, Boston College. College of Arts and Sciences*.
- Lunden, I. (2017). Qwilt raises \$30 million to help carriers stream video. Retrieved from <https://techcrunch.com/2017/03/08/qwilt-raises-30m-to-help-carriers-stream-video/>
- Marie- Christine H. (2016.) Women's Role in Peace and Security in Yemen. *Center for Applied Search in Partnership with the Orient (CARPO)*.
- Masud, M., Siddiqui, A.T., Alkhamash, E., Visvizi, A., Lytras, M.D., Alhalabi, W. and Zhang, X., 2019. Building ICT Knowledge Capacity for Female Entrepreneurship for Sustainable Socio-economic Growth in the Middle East. The New Silk Road Leads through the Arab Peninsula: Mastering Global Business and Innovation. *Emerald Publishing Limited*.
- Metcalf, B. D. (2006). Exploring Cultural Dimensions of Gender and Management in the Middle East. *Thunderbird International Business Review*, 48(1), 93-107. <http://dx.doi.org/10.1002/tie.20087>
- Metcalf, B. D. (2007). Gender and Human Resource Management in the Middle East. *International Journal of Human Resource Management*, 18(1), 54-74. <http://dx.doi.org/10.1080/09585190601068292>
- Metcalf, B. D. (2008). Women, Management, and Globalization in the Middle East. *Journal of Business Ethics*, 83(1), 85-100. <http://dx.doi.org/10.1007/s10551-007-9654-3>
- Milica K. (2020.) What are the Challenges for Women in Tech? *3 Plus International*.
- Monk, A. (2021.) Futures under Threat: Education Policy and Barriers to Access for Syrian Refugees in Jordan and Lebanon.
- Ministry of Planning and International Affairs, R.O.Y. (n.d.). Retrieved October 7, 2012, from <http://www.mpic-yemen.org>

- Moen, P., Kelly, E.L., Wen Fan, S., Almeda, D., Kossek, E., Orfeu M. Buxton (2016), Does a Flexibility/Support Organizational Initiative Improve High-Tech Employees' Well-Being? Evidence from the Work, Family, and Health Network
<https://doi.org/10.1177/0003122415622391>
- Moussa, R., n.d. An Unstoppable Force Of Transformation And Tech-Driven Progress.
- Mukhwana A.M., Abuya T., Matanda D., Omumbo J., Mabuka J. (2020). 'Factors which Contribute to or Inhibit Women in Science, Technology, Engineering, and Mathematics in Africa. *Nairobi, African Academy Journal of Sciences*
- Nadia A., (2012.) Yemen's Women and The Quest for Change: Political Participation After the Arab Revolution. *Friedrich-Ebert-Stiftung*.
- National Science Board. (2014). Science and Engineering Indicators 2014. Arlington VA: National Science Foundation (NSB 14-01). Available at: <
[http:// www.nsf.gov/statistics/seind14/content/etc/nsb1401.pdf](http://www.nsf.gov/statistics/seind14/content/etc/nsb1401.pdf)>
- National Council for the Advancement of Women in Israel. (2020). Women's Employment in High-Tech in Israel. Retrieved from

http://www.ncw.gov.il/Publications/NCWPublications/Women_Employment_HighTech_2020.p
- Nir k., Maya C. (2022.) Gender Asymmetry in Cyber-Security: Socio-Economic Causes and Consequences.
- O'Brien, L.T. and C.S. Crandall, (2003). Stereotype threat and arousal: effects on women's Math performance. *Pers Soc Psychol Bull.* 29(6): p. 782-9.
- OCHA. (2021). Humanitarian needs overview: Yemen. Retrieved from
https://www.unocha.org/sites/unocha/files/2021_Yemen_Humanitarian_Ne
- OECD, 2018. Bridging The Digital Gender Divide: Include, Upskill, Innovate. Available at
<<https://www.oecd.org/digital/bridging-the-digital-gender-divide.pdf>>
- Omair, K. (2008). Women in Management in the Arab Context. Education, Business, and Society. *Contemporary Middle Eastern Issues*, 1(2), 107-123.
<http://dx.doi.org/10.1108/17537980810890293>
- Omair, K. (2010). Typology of Career Development for Arab Women Managers in the United Arab Emirates. *Career Development International*, 15(2), 121-143.
<http://dx.doi.org/10.1108/13620431011040932>
- Panteli, N., Stack, J., Ramsey, H., (2002). Gendered patterns in computing work in the late 1990s *New Technology Work and Employment* 16(1):3 - 17 DOI:10.1111/1468-005X.00073

- Peters, K., Chen, Y., Kaplan, A., Ognibemi, B. (2013). Social Media Metrics — A Framework and Guidelines for Managing Social Media. *Journal of Interactive Marketing* 27(4):281–298 DOI:10.1016j.intmar.2013.09.007
- Popescu, P., (2020.) Women in STEM Education. Conferința tehnico-științifică a studenților, masteranzilor și doctoranzilor, 1-3, pp. 368-371.
- Population Reference Bureau, (2022). Women, Developing Society: Female Education in the Middle East and North Africa Available at:
< <https://www.prb.org/resources/empowering-women-developing-society-female-education-in-the-middle-east-and-north-africa/>>
- Powell, C. and Chang, A.M., (2016.) Women In Tech As A Driver For Growth In Emerging Economies. *Council on Foreign Relations*.
- Ramady, M.A. (2010), “Population and demographics: audition and the labor market,” in Ramady, M.A. (Eds), *The Saudi Arabian Economy: Policies, Achievements, and Challenges*, Springer, New York, NY, pp. 351-393.
- Rima, A. and Chiara, M., (2020). Women at work: Job opportunities in the Middle East set to double with the Fourth Industrial Revolution. McKinsey and Company.
www.McKinsey.com
- Richie S (2021). Women Tech Founders Program. Available at:
< <https://events.withgoogle.com//wtmxdos/>>
- Sabatera. Maria L.P., (2013) Breaking gender stereotypes in technology education: Developing Strategies in the English classroom. *English for Specific Purposes World*, ISSN 1682-3257, <http://www.esp-world.info>, Issue 38, vol. 14.
- Sahar K., Courtney C., (2013). In Their Voice: Technologically Mediated Empowerment and Transformation among Young Arab Women. *Feminist Media Studies*.
- Samira I., (2017). Arab Women in Science, Technology, Engineering and Mathematics Fields: The Way, Forward.
- Shahryan A., (2016). Gender Enrollment Factors in ICT Studies in Kuwait, Saudi Arabia, and Jordan. *ResearchGate*.
- Sonja B., (2014). Women in IT in the New Social Era: A Critical Evidence-Based Review of Gender Inequality and The Potential for Change.
- Sonja, B. (2019). The Barriers Women Face Entering and Progressing in the Tech Sector. *Empiric*.
- Srivastava, S., (2019). Women In Technology – Reasons For Underrepresentation And What Can Corporates Do To Improve The Gender Diversity, pp. 1-11.

- STEM Women. (2018). The Issues and Barriers Facing Women in Technology. Available at: <https://stemwomen.net/2018/10/25/the-issues-and-barriers-facing-women-in-technology>
- Taufiq Hail Ghilan Al-Madhagy (2013), *ICT Policy in Yemen* The Office of the High Commissioner for Human Rights (2022). Gender Stereotyping. Available at: <https://www.ohchr.org/en/women/gender-stereotyping>
- The Organization for Economic Co-operation and Development (OECD)* (2017). Enlarging The Contributions Of Smes In A Global And Digitalised Economy.
- Tiedeu, B.A., O.J. Para-Mallam, and D. Nyambi, Driving Gender Equity in African Scientific Institutions. *Lancet*, 2019. 393(10171): p. 504-506.
- Tlaiss, H. (2013), "Women entrepreneur motivation: evidence from the United Arab Emirates," *International Small Business Journal*, Vol. 33 No. 5, pp. 562-582.
- Tlaiss, H.A. (2014), "Conformers, fighters, and rebels: the unfolding of women's careers in the United Arab Emirates," *Human Resource Development International*, Vol. 17 No. 3, pp. 339-357.
- UNDP-POGAR: Program on Governance in the Arab Region: Gender Retrieved from <http://www.pogar.org/themes/gender>
- UNESCO., (2017). *Cracking The Code: Girls' & Women's Education in Science, Technology, Engineering, and Mathematics (S.T.E.M.)*.
- UNESCO, Women's and Girls' Access to and Participation in Science and Technology. (2010): Paris, France.4. *Crawford, C. and J. Cribb*.
- United Nations, Economic, and Social Commission for Asia and the Pacific (ESCAP) (2021). *The Future is Equal: Gender Equality in the Technology Industry. What is the Middle East?* Retrieved from <http://teachmideast.org/articles/what-is-the-middle-east>
- Veelen R, Derks B and Endedijk MD (2019) Double Trouble: How Being Outnumbered and Negatively Stereotyped Threatens Career Outcomes of Women in STEM. *Front Psychol.* 10:150. doi: 10.3389/fpsyg.2019.00150
- Wajcman, J, "From women and technology to gendered technoscience," *Information, Communication & Society*, vol. 10, no. 3, pp. 287–298, 2007. [15] K
- WEF (2016), *The Global Gender Gap Report 2016*, World Economic Forum, Geneva, http://www3.weforum.org/docs/GGGR16/WEF_Global_Gender_Gap_Report_2016.pdf.
- Women Who Tech, "State of Women in Tech and Start-Ups" Survey (2020) World Bank. (2019). Retrieved from <http://www.worldbank.org>

- WorldBank, (2019) Expectations and aspirations: A new framework for education in the Middle East and North Africa, worldbank.org, figures from Trends in International Mathematics and Science Study (TIMMS),
- World Economic Forum (WEF) (2020), "3 Things to Know About Women in STEM UNESCO Institute of Statistics (2019). Retrieved from <http://data.uis.unesco.org>
- World Economic Forum. The global gender gap report 2018.
<https://www.weforum.org/reports/the-global-gender-gap-report-2018>.
- World Economic Forum. (2014). The Global Gender Gap Report. Retrieved from http://www3.weforum.orghttps://www.theglobaleconomy.com/Yemen/Female_to_male_ratio_secondary_school_students/
- World Bank (2016). The Arab World. Retrieved from <http://data.worldbank.org/region/arab-world> retrieved April 6, 2017
- World Bank Group, (2018). A New Economy: For The Middle East And North Africa. Available at: <<https://www.worldbank.org/en/region/mena/publication/mena-economic-monitor-october-2018-a-new-economy-for-mena>> [Accessed 16 Mar. 2022].
- World Population Review. (2022) Most Technologically Advanced Countries 2022. Available at: <<https://worldpopulationreview.com/country-rankings/most-technologically-advanced-countries>>
- Yemen Centre for Information Technology in Higher Education (YCIT-HE), 2007
- Zakham, F. and Juton, K., (2019). Supporting female scientists in Yemen.*Lancet.*; **393**: 526-527.
https://www.theglobaleconomy.com/Yemen/Female_to_male_ratio_secondary_school_students/