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Toward Gender Diversity in Tech Entrepreneurship: Empirical Study on Female Entrepreneurs and a Software Design Solution Proposal

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Abstract

The founding of a technology startup is commonly known as a male domain. Today the gender disparity is greatest in the information and computer technology entrepreneurship sector. Norway is among the countries with lowest percentages of female tech entrepreneurs, and research on why this gender gap exists is limited. Female-founded enterprises are more likely to establish impact-driven ventures, which illustrates why increasing diversity in technology and innovation industries is crucial.

Current studies on the intersection between gender equity and tech entrepreneurship are limited. The research objective of this study is how to increase the amount of female tech entrepreneurs in Norway with software, by retrieving insight from Norwegian women that have founded a tech startup. The author used a design and creation strategy with semi-structured interviews as a data generation method to solve the research objective. The interviews were employed with a qualitative phenomenological approach to capture and analyze Norwegian female tech entrepreneurs' founder experiences and learning histories. The proposed solution was developed with a design and creation approach, including user testing and semi-structured interviews to evaluate the application's potential.

Female tech entrepreneurs appear to have learned to deal with and manage various disadvantages and problems met during their founder journey and subvert the conventional culture of entrepreneurship in technology. The evaluation of a mentor-connector mobile application clarifies that the software has the potential to provide early-stage female tech entrepreneurs with motivation, inspiration, and guidance through a mentor with expected qualifications and experience.

This study expands our understanding of the relation between gender diversity and tech entrepreneurship by examining the concept of encouraging women to start or sustain a tech startup. The research proposes a solution on how software can be developed to decrease the gender gap in the Norwegian tech entrepreneurship industry. The proposed solution is based on semi-structured interviews with five female tech entrepreneurs highlighting important characteristics experienced during their journey. This research reveals significant implications for future research on gender and entrepreneurial learning.

Sammendrag

Gründerskap i teknologibransjen er vanligvis kjent for å være et mannlig domene. Teknologisektoren inneholder de største kjønnsforskjellene innenfor entreprenørskap i dag. Norge er et av landene med lavest prosentandel kvinner som er gründere innenfor teknologi, og forskning på hvorfor denne kjønnsforskjellen er så markant er svært begrenset. Bedrifter startet av kvinner er mer sannsynlig til å etablere virksomheter som utgjør en viktig forskjell for samfunnet. Dette illustrerer hvorfor det er avgjørende at kvinneandelen i teknologi- og innovasjonsnæringer øker.

Det er en mangel på relevante og aktuelle studier om krysningen mellom mangfold og entreprenørskap innen teknologi. Målet med denne forskningen er å finne ut hvordan kvinneandelen bland norske teknologi-gründere kan økes med hjelp av teknologi i form av programvare, basert på erfaringer og innsikt fra norske kvinnelige teknologi-gründere. Forfatteren benyttet en design drevet strategi for å nå målet med forskningen, med semistrukturerte intervju som datakilde. Intervjuene ble analysert med en kvalitativ fenomenologisk tilnærming for å fange opp erfaringer og læringshistorier fra suksessfulle norske kvinnelige teknologi entreprenører. Prototypen til den foreslåtte løsningen ble evaluert gjennom bruker tester og intervjuer for å indikere applikasjonens potensial.

Kvinnelige teknologientreprenører ser ut til å ha lært å håndtere problemer og hindringer som ble møtt under deres gründer-reise og bidro til å undergrave den konvensjonelle entreprenørskapskulturen innen teknologi. Evalueringen av en mobilapplikasjon basert på å koble brukere med en mentor som har forventede kvalifikasjoner og erfaring, avdekket at programvaren har potensial til å gi nylig etablerte kvinnelige teknologigründere motivasjon, inspirasjon og veiledning.

Denne forskningen bidrar til å utvide vår forståelse av forholdet mellom kjønnsmangfold og teknologisk entreprenørskap ved å undersøke konseptet med å oppmuntre kvinner til å starte eller opprettholde en teknologi startup. Studiet foreslår en løsning på hvordan en applikasjon kan utvikles for å redusere kjønnsgapet i den norske entreprenørskap-industrien innenfor teknologi. Den foreslåtte løsningen er basert på semistrukturerte intervjuer med fem kvinnelige teknologigründere som fremhever viktige egenskaper de erfarte under sin gründer-reise. Denne forskningen redegjør for betydelige implikasjoner for fremtidig forskning på kjønn og entreprenør relatert læring.

Acknowledgment

I would like to share a significant gratitude to my supervisor and role-model, Professor Letizia Jaccheri, for providing excellent support and belief through the whole process. Further, I want to tank PostDoc J. David Patón-Romero for his help and feedback provided to this project.

I wish to thank Marte Stenvaag and Ingrid Volden Smehagen who inspired me to research on gender diversity in tech entrepreneurship. Also a huge gratitude to all the people who were interviewed or otherwise supported this project.

Finally, I would like to thank all the members of the *Software for a Better Society* research group for valuable meetings thorough the last year.

Preface

This thesis is part of the IT3920 - Master Thesis for Informatics course at the Norwegian University of Science and Technology (NTNU). Professor Letizia Jaccheri supervised the research, which was carried out with assistance from PostDoc J. David Patón-Romero at the Department of Computer Science at NTNU in Trondheim.

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Acronyms

AI Artificial Intelligence. 5–7

CEO Chief Executive Officer. 41, 43

CS Computer Science. 5, 9

DEI Diversity, Equity and Inclusion. 7

ICT Information and Communications Technology. 1, 2, 6, 8, 10, 16, 24

IPA Interpretative Phenomenological Analysis. 29–31, 67

IT Information Technology. 32

MRL Market Readiness Level. 54, 58

MVP Minimum Viable Product. 67

NSD Norwegian Centre for Research Data. 35

NTNU Norwegian University of Science and Technology. 34, 35, 39, 59, 61

RQ Research Question. 3, 15, 17, 26, 27, 32, 65

SDG Sustainable Development Goal. 1, 2, 7, 50

SMS Systematic Mapping Study. xv, xvii, 2, 3, 5, 13–19, 21, 23, 25, 27, 31, 32, 44, 47, 48, 51, 69

SRL Solution Readiness Level. 54, 58

STEM Science, Technology, Engineering and Mathematics. 9, 13, 16, 27, 61

TRL Technology Readiness Level. 54, 58

UI User Interface. 33

Chapter 1

Introduction

Founding a technology-based company is commonly perceived as a male domain [1], and the gender gap in early-stage Information and Communications Technology (ICT) entrepreneurial activity is concerning given that the majority of global venture capital funding is directed towards this sector [2]. Given the scarcity of research on the intersection between tech entrepreneurship and gender equality, a significant portion of the gender gap in entrepreneurship remains unexplained. In 2016, the percentage of women involved in tech entrepreneurship in Norway was only 14%, making Norway one of the countries with the lowest rate of female tech entrepreneurs.

This thesis aims to increase the amount of female tech entrepreneurs in Norway through developing a suggestion of mentor connector software. The following subsections will explain the motivation of the project (Section 1.1), followed by the project's description and research objective (Section 1.2 and 1.3). Lastly, the outline of the thesis is explained in Section 1.4.

1.1   Motivation

The founding of a technology startup is commonly known as a male domain [1]. Today the gender disparity in entrepreneurship is most significant in the tech sector[3]. Numerous solutions to our most major societal concerns in the areas of health and climate include the development and implementation of new technologies. We cannot rely on merely one-half of the population to solve these problems. Further, enterprises founded by women are more likely to establish impact-driven ventures[1], which illustrates why increasing diversity in technology and innovation industries is crucial.

Achieving gender diversity in tech entrepreneurship relates to the UN Sustainable Develop-

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[1]https://report2021.unconventional.vc/

ment Goal (SDG)s[2]: "*Achieving gender equality and empower all women and girls*". The goal maintains the following targets that can be solved by decreasing the gender gap in tech entrepreneurship:

- *Target 5.1: "End all forms of discrimination against all women and girls everywhere"*
- *Target 5.5: "Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life"*
- *Target 5.b: "Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women"*

Women's equality and empowerment are also integral to all dimensions of inclusive and sustainable development[3]. Hence, the all of the SDGs depend on the achievement of Goal 5. With an increase of diversity in the innovation of technology, new solutions will be developed that as crucial to solving several of the SDGs.

Given that the preponderance of worldwide venture capital financing is devoted to this sector, the significant gender discrepancy in early-stage ICT activity is particularly worrying [2]. Numerous initiatives, such as incubators and accelerators, aim to aid entrepreneurs in startup creation and funding processes. However, female-targeted entrepreneurship training programs and efforts tend to concentrate on industries and marketplaces where they are already well-represented. Incubator and accelerator programs that target technology companies often exclude women functioning in male-dominated industries[2]. Existing startup-related organizations and incubators based in Norway have not prioritized female entrepreneurs in technology during the last years. The lack of research on why there exist such a short amount of women founders of tech makes it harder to solve the gender gap[4]. The novel research on the area also makes it more difficult to spread awareness of the situation so actions can be made. Therefore it is crucial to acquire a better understanding of the intersection between gender and the entrepreneurial journey of a tech founder to develop solutions that could solve the problem.

1.2   Project Description

This Master's thesis presents a design study approach based on a mentor connector application software and its impact on encouraging more women to pursue careers in tech entrepreneurship. The application's features are established on information gathered from in-depth interviews with female tech entrepreneurs and the findings from the SMS [5]. The application aims to streamline the process of providing early-stage female entrepreneurs with guidance using a digital scheme based on an algorithm. The system offers a meeting with the most suitable mentor depending on the user's preferences, which increases the chance for a successful mentorship experience.

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[2]https://sdgs.un.org/goals
[3]https://www.unwomen.org/en/news/in-focus/women-and-the-sdgs/sdg-5-gender-equality

1.3   Research Objective

Current studies on the intersection between gender equity and tech entrepreneurship are limited. The research objective of this study is how to increase the number of female tech entrepreneurs in Norway with software by retrieving insight from Norwegian women that have founded a tech startup. The research direction was selected based on a Systematic Literature Review [5] conducted in the preparatory project autumn 2021. Findings from the SMS provided interesting factors of success and challenges that motivated the following research questions:

> **Research Question (RQ)1: What experience-based characteristics are essential for female tech entrepreneurs in Norway?**
>
> **RQ2: How to design software to decrease the gender gap in Norwegian tech entrepreneurship?**
>
> - **RQ2.2: Which features must be considered when developing a technical service to increase the amount of female tech entrepreneurs in Norway?**

1.4   Thesis Outline

The structure of the thesis proceeds as discussed in this section. Chapter 1 introduces the projects motivation, context and objectives. The background of the study is introduced in Chapter 2, explaining the context of technology entrepreneurship and gender diversity, as well as the current state of the art in Norway. Chapter 3 presents a summary of the SMS conducted in advance of this project. The research methodology undertaken in this research is explained in Chapter 4. Chapter 5 demonstrates the data analysis of semi-structured interviews with five female tech entrepreneurs from Norway. Chapter 6 presents the prototype development and evaluation of the proposed technology service TechSpire. The interview analysis and the prototype's potential are discussed in Chapter 7. At last, Chapter 8 provides a conclusion of the research.

Chapter 2

Background

The theoretical foundation of this Master's thesis is based on a preparatory project from the previous year that involved a SMS[5] of the literature on gender equality in tech entrepreneurship from a global perspective. Findings from the SMS will be presented in the next chapter. This Master's thesis will focus on the gender diversity and tech entrepreneurship context in Norway. The first section of this chapter defines and explains the significance of gender equality, equity and diversity. Section 2.2 provides additional information on entrepreneurship and startups in the tech industry, as well as data and facts on the intersection of tech entrepreneurship and gender equality today. At last, Section 2.3 describes initiatives and actions in Norway that target women and entrepreneurship.

2.1 Gender Diversity in Tech Industry

The world's first programmer was a woman called Ada Lovelace [6], however women continue to be underrepresented in technology education and employment [7]. In a 2022 article from McKinsey[1], Gayatri Shenai quoted: "*Tech holds a disproportionate share of impact, opportunities, benefits. It will shape economic growth. We Need a diversity of perspectives*". Users of contemporary technology are reliant on them in terms of their professional lives, domestic lives, daily routines, and requirements. If the offered technology is to be applicable to all members of society, its development team should reflect diversity.

2.1.1 The Technology Industry

In this Master's thesis, the term technology will primarily refer to the Computer Science (CS) aspect. Some of the most known categories within CS are Artificial Intelligence (AI), games,

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[1]https://www.mckinsey.com/about-us/new-at-mckinsey-blog/putting-women-at-the-forefront-of-technology

learning technology, Internet of Things (IoT), cloud, mobile application and web[2]. The development of new technologies makes it possible to interact with the environment in new directions, and the commercialization of these technologies makes them accessible to a larger audience outside of the research laboratory. New social norms around new technologies and gadgets have been developed by communities that utilize these technology as consumers [8]. Therefore, technology is essential to the future innovation of civilization. The technology sector is comprised of enterprises that provide goods and services in electronics, software, computers, artificial intelligence, and other ICT-related sectors, and this sector is often one of the most attractive growth investments in an economy[3].

As the usage of technological devices and services has increased, there have been instances in which the technology has been biased to women's requirements and preferences. When Apple released its "complete" health monitoring software, it lacked any features pertaining to women's periods, a crucial aspect of women's health[4]. Another issue is the effect of the AI workforce's lack of gender diversity. Voice and facial recognition have shown that artificial intelligence is biased towards women, since it performs better on males than on women and other social minorities[5]. Diversity is one of the most important concepts promoting creativity and social resilience, which will become crucial in a society exposed to changes caused by AI advancement [9]. Perhaps this has occurred because males have dominated the technological and product development fields.

2.1.2   Gender Equity and Equality

Gender *equity* acknowledges that, due to historical and societal obstacles, women and gender-diverse individuals are not in the same "starting position" as males[6]. Gender *equality* refers to women and men having equal rights, responsibilities, and opportunities[7]. The difference between gender equity and gender equality is unclear to the majority of individuals, and giving clarity and purpose to this discourse is a crucial step towards eradicating the gender equity gap. In relation to gender and the workplace, equity lays the groundwork for equality, as it refers to "fair treatment of women and men according to their unique requirements"[8]. If equality is the desired outcome, then equity is the process to achieve it. *Diversity* is often explained as the proportion of men versus women in a given group or sector[9].

Longstanding male dominance in the technology industry has fostered a work environment whose attitudes, practices, and culture exclude women [10]. Biased algorithms and technology

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[2]https://www.techbusinessnews.com.au/types-of-technology/
[3]https://www.investopedia.com/terms/t/technology$_sector.asp$
[4]https://www.theatlantic.com/technology/archive/2014/12/how-self-tracking-apps-exclude-women/383673/
[5]https://hbr.org/2019/05/voice-recognition-still-has-significant-race-and-gender-biases
[6]https://16daysallyship.whwest.org.au/challenges/actions/learn-what-the-patriarchy-is/
[7]https://www.un.org/womenwatch/osagi/conceptsandefinitions.htm
[8]https://www.pipelineequity.com/voices-for-equity/gender-equity-vs-gender-equality/
[9]https://www.igi-global.com/chapter/diversity-in-the-workplace/180491

are not the only arguments for why gender equity essential in the tech industry. According to the McKinsey analysis Burns *et al.* [11], when leaders and managers promote employee well-being and the firm prioritizes Diversity, Equity and Inclusion (DEI), people are happier, less burnt out, and remain in their employment longer. However, the same study indicates that very few organizations publicly acknowledge workers who excel in these areas, and suggests that this might change if the number of female leaders increases. Additionally, a group composed of diverse individuals increases the likelihood of developing innovative solutions[10].

2.1.3 UN Sustainable Development Goals

The 17 SDGs build on decades of work by countries and United Nations[11]. The SDG framework enables novel alliances and work streams that result in inventive solutions to persistent global challenges [12]. Multiple stakeholders, such as the education and business sectors, play a significant role in advancing the Sustainable Development Goals. The fifth SDG[12], "*Achieving gender equality and empower all women and girls*", is especially relevant to the contribution of this research. Particularly three of SDG5´s targets highlight the significance of reducing the gender gap in tech entrepreneurship:

- *Target 5.1:* "*End all forms of discrimination against all women and girls everywhere*", would be attained in the entrepreneurial sector if the stereotypes of entrepreneurs and their attributes disappeared.
- *Target 5.5:* "*Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life*", would be enhanced if more women become tech entrepreneurs.
- *Target 5.b:* "*Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women*", may be simpler to achieve if more women contributed to the development of future technologies that are suitable for all members of society.

The study of Vinuesa *et al.* [9] presents and discusses how AI may either facilitate or impede the achievement of the UN SDGs and ambitions. The reduction of the gender gap in technological innovation might help to the achievement of various other Sustainable Development Goals and targets via the development of new and creative technologies and solutions.

2.2 Tech Entrepreneurship and Diversity

Entrepreneurship may be many things, but it is typical to think of entrepreneurs as creative individuals who founded fast-expanding enterprises based on a novel concept or technology.

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[10]https://www.diversityintech.co.uk/the-benefits-of-diversity-in-tech
[11]https://sdgs.un.org/goals
[12]https://sdgs.un.org/goals/goal5

They often face more economic risks than workers since they do not get consistent payments and depend on customers for income [13].

2.2.1 Tech Startups

Startups is usually defined as newly established companies consisting of a small team, limited resources, and with a goal to rapidly scale the business model [14]. Startups commonly operate and evolve into an ecosystem with connections to various stakeholders, from types of investors to incubators, accelerators and third-party vendors [15]. Different from established companies that focuses on optimizing their already existing business model, startups focus on finding new business models by experimenting with different products in different markets [16]. The lifecycle of a startup maintains activities and stages which differs from startup to startup. An example of the startup lifecycle made by Salamzadeh and Kawamorita Kesim [17] can be seen in Figure 2.1.

Startups are often characterized as newly established firms with a small team, limited resources, and a mission to expand their business model rapidly [14]. Commonly, startups operate and expand into an ecosystem with interconnections to a variety of stakeholders, including funders, incubators, accelerators, and third-party vendors [15]. In contrast to established organizations, which concentrate on improving their present business model, startups experiment with various products and markets to discover new business models [16]. A startup's lifetime consists of activities and phases that vary from startup to startup. Figure 2.1 shows an example of the startup lifecycle created by Salamzadeh and Kawamorita Kesim [17].
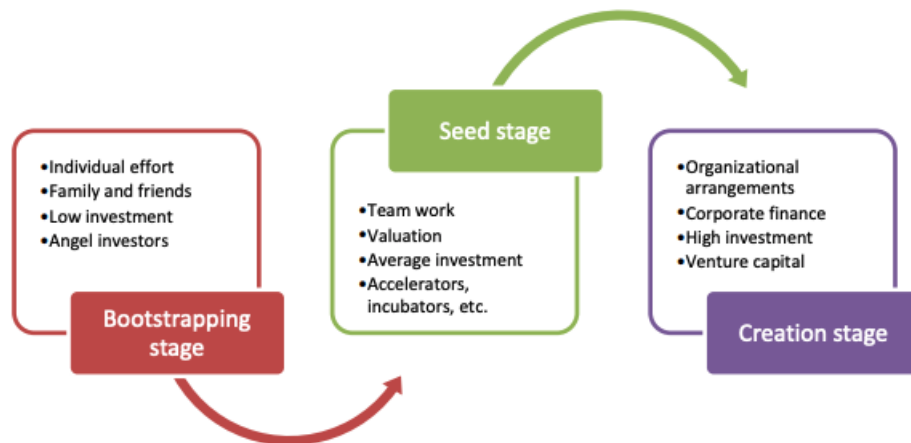
Figure 2.1: Lifecycle of startups example, retrieved from [17]

The industry has been significantly impacted by successful entrepreneurs, particularly those providing ICT goods and solutions [18]. A tech startup is a startup that creates a company out of technology by producing innovative technological goods or services[13]. In Section 2.1.1, a vari-

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[13]https://fundersclub.com/learn/tech-startups/overview-of-tech-startups/what-are-tech-startups/

ety of CS-based technologies on which current tech companies base their ideas and products are described. Over the last decade, the total number of technology startups economy has expanded rapidly by 47%[14]. According to the study of Marmer *et al.* [19], this growth is the result of three phases:

- The cost of launching a tech startup has decreased.
- Increasingly more people own mobile, digital devices and have access to internet
- The digitization of the society has made it easier to access potential customers and new markets

2.2.2 Women and Tech Entrepreneurship

According to a number of academics, creating a technology-based firm is generally regarded as a male domain. This argument is often based on the low number of female tech company founders [1]. It is also based on the assumption that entrepreneurial tendencies are stereotypically male and may be reinforced by gender disparities in entrepreneurial incentives[20][21], and the absence of women's representation in the conception of technological sectors [22]. As seen in Figure 2.2, the gender disparity is greatest in the information and computer technology entrepreneurship sector, where women compete at a rate that is one-third that of males on average [3].

Looking at the Norwegian report "*Female entrepreneurs in Norway*" [23], more women than males enrolled in Science, Technology, Engineering and Mathematics (STEM) courses at Norwegian high schools in 2016. Figure 2.3 depicts a significant decline in the proportion of women who continue to work in technology as they go from high school through college to the workforce. The same year, women comprised just 26% of the workforce in IT services, architects, and technical consultants, and only 14% of tech entrepreneurs.

The plurality of research and studies on entrepreneurship, especially those pertaining to technological entrepreneurship, do not include gender equality in the context of entrepreneurship and startups [5]. According to a prior research by Jennings and Cash [24], personal attributes and history have a substantial impact on whether or not women choose to become entrepreneurs. Important explanatory criteria for choosing a job as an entrepreneur include education, social environment, age, place of residence, money, and talents [25]. Due to the strong masculinity associated with the established standards of technical areas, women entrepreneurs in these industries tend to adopt masculine behaviors [26]. According to Marlow and McAdam [10], gender dissonance is accentuated, providing an extra dimension to the identification work necessary for women in male-dominated sectors to seek and claim entrepreneurial legitimacy.

The gender difference in entrepreneurship remains largely unexplained, notably in Norway, despite the fact that research has identified crucial criteria associated with establishing a busi-

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[14]https://itif.org/publications/2017/11/28/how-technology-based-start-ups-support-us-economic-growth/
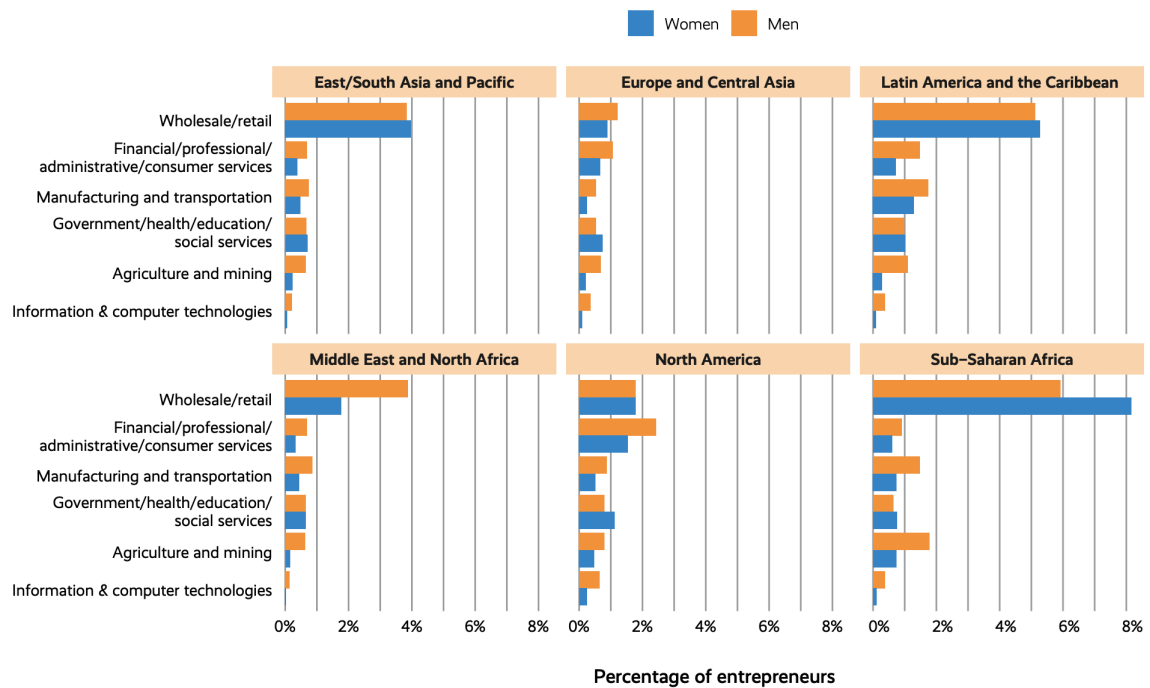
Figure 2.2: Percentage of men and female entrepreneurs worldwide 2018 from [3].

ness. According to the Unconventional Ventures report[15] from 2021, female-founded or mixed-gender enterprises are 73% more likely to establish impact-driven ventures, illustrating why it is crucial to strive towards bringing more women into the technology and innovation industries. Furthermore, according to the research of Poggesi *et al.* [26], the growth of women in technology is essential because women tech entrepreneurs may serve as vital role models and mentors for younger women. Hence, encouraging girls to pursue studies in these subjects.

2.3 Initiatives and Actions

Given that the preponderance of worldwide venture capital financing is devoted to this sector, the significant gender discrepancy in early-stage ICT activity is especially concerning [2]. There are numerous initiatives, such as incubators and accelerators, whose objective is to aid entrepreneurs in the startup creation and funding processes. However, female-targeted entrepreneurship training programs and efforts tend to concentrate on industries and marketplaces where they are already well-represented. Incubator and accelerator programs that target technology companies often exclude women functioning in male-dominated industries [2]. These accelerator and incubator programs are examples of efforts that might play a significant role

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[15]https://report2021.unconventional.vc/
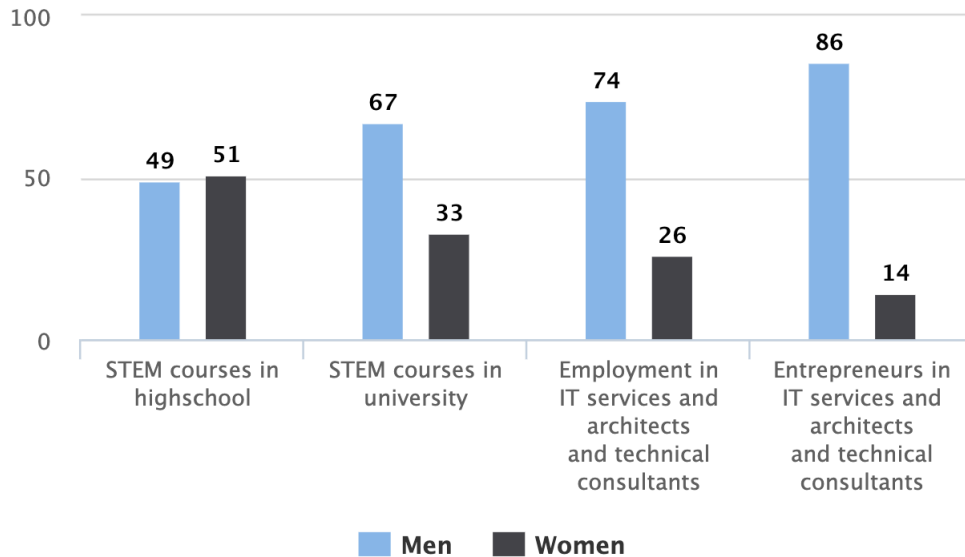
Figure 2.3: This graph shows the percentage of Norwegian women on the way to establishing a technology company in 2016. Source: UDIR, SSB (05576, 08536 and 07359)

if they concentrate on inclusive programming and assessment to guarantee that women are adequately supported and encouraged to establish outstanding firms with long-lasting effects on markets and sectors.

2.3.1 Initiatives in Norway

The "Female entrepreneurs in Norway" report [23] identifies a variety of policies that may be relevant and beneficial in encouraging more women to become entrepreneurs, including the establishment of more extensive mentorship programs for women. The report's findings indicate that women lack role models and female entrepreneurs in their networks. Innovation Norway[16], which assists businesses in improving their competitive edge and promotes innovation in Norway, is one of the organisations that provide mentorship programs for Norwegian entrepreneurs. The programs provides conclusive evidence of its favorable influence on the growth of firms, particularly among female entrepreneurs. However, it is advised that these sorts of mentor programs should be developed and enhanced to become more successful for the benefit of women. [23].

The Norwegian entrepreneurial society has several programs aimed at increasing the number

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[16]https://www.innovasjonnorge.no

of women in entrepreneurship in general, such as the newly established *Google #WeStart*[17] incubator, the *Boost Henne*[18] project at NTNU, various awards celebrating women in entrepreneurship and tech[19][20][21], and sub events organized by larger organizations such as Innovation Norway and Startup Norway[22]. The Norwegian government also developed a strategy to encourage more women to start their own businesses[23]. The strategy outlines thirteen actions that would make it simpler for women to establish and expand their own businesses.

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[17]https://westart.no/

[18]https://www.boosthenne.no/

[19]https://www.innovasjonnorge.no/no/om/nyheter/2019/arets-kvinnelige-grunder-sigrun-syverud-i-fjong/

[20]https://www.digi.no/artikler/innovasjon-norges-pris-hvem-av-disse-blir-arets-kvinnelige-grunder/455884

[21]https://www.abelia.no/arrangementer/2022/kvartal-1/50-fremste-tech-kvinner/50techkvinner/

[22]https://www.startupnorway.com/

[23]https://www.regjeringen.no/globalassets/departementene/nfd/dokumenter/vedlegg/192578-handlingsplan-uu.pdf

Chapter 3

Systematic Mapping Study

Prior to the Master's thesis, an SMS [5] was undertaken to get a current overview of available information and to identify research gaps on gender equality and tech entrepreneurship. Figure 3.1 depicts the research context, the primary emphasis of which was the relationship between women with STEM backgrounds via school or industry and the technology entrepreneur industry. The intersection was investigated by determining which original research exists on the subject and which patterns of challenges and success variables associated with female tech entrepreneurs could be gleaned from the publications. There were a total of 19 publications considered as primary studies.
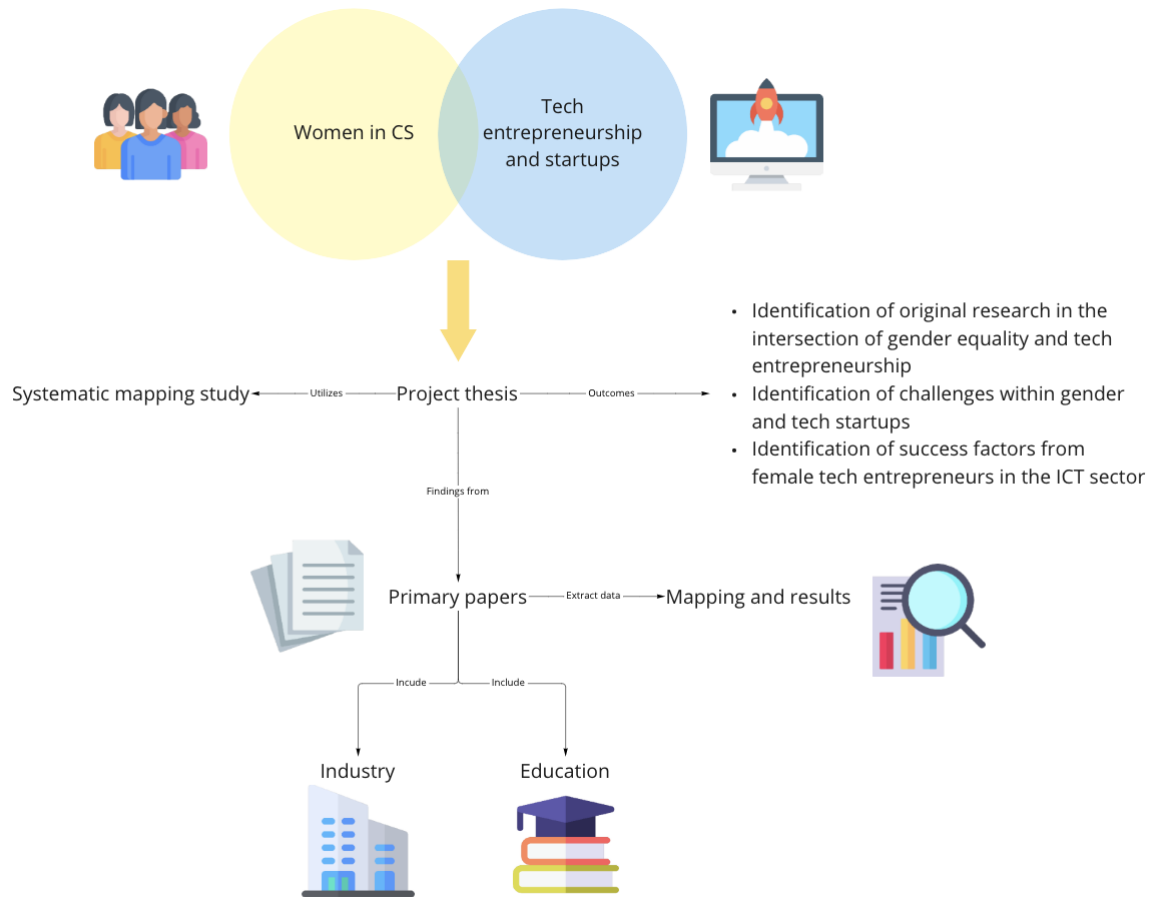
Figure 3.1: Research context of SMS [5] autumn 2021.

3.1   Research Method

A SMS is a research method that provides a coarse-grained overview of the existing literature within the area of topic [27], and is therefor convenient to perform in research areas with a lack of relevant studies of high quality which was the case for this thesis. The study followed the guidelines and examples established by Petersen *et al.* [28][27] and Kitchenham *et al.* [29]. The following four steps of the research process were conducted: *1) Defining the research scope; 2) Search strategy and screening; 3) Data extraction and analysis; and 4) Mapping and results*. The procedures are shown in figure 3.2.
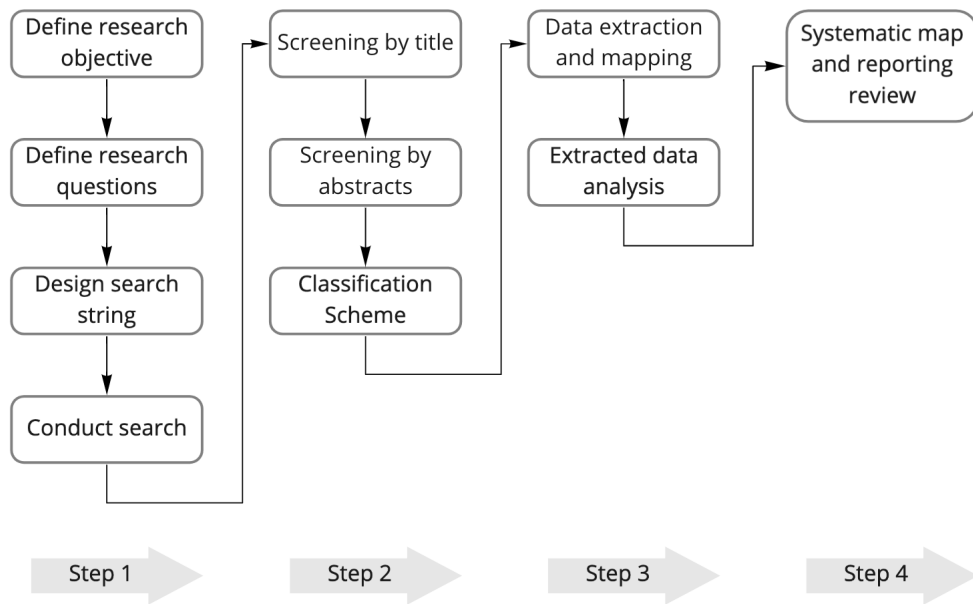
Figure 3.2: Systematic Mapping Process - SMS [5] autumn 2021.

3.1.1 Research Questions

The purpose of this study was to collect data about the intersection between gender equality and tech entrepreneurship. Table 3.1 provides the research questions designed to address this particular scope, followed by the rationale for each question.

Research Question	Motivation
RQ1: What original research exists in the intersection of gender equality in tech entrepreneurship?	Determine the type, number of publications, research method, and trend over recent years in relation to gender equality and tech entrepreneurship.
RQ2: What are the main challenges with gender and tech entrepreneurship?	Determine different types of challenges related to be a female tech entrepreneur
RQ3: What are the main factors adopted by female tech entrepreneurs to be successful in the tech industry?	Determine success factors related to female founding of a tech startup/business/company

Table 3.1: Research questions of SMS [5] autumn 2021.

3.1.2 Data Sources and Search Strategy

An initial search was undertaken in the *Scopus*[1] database to identify relevant studies. Scopus was chosen since it accommodates sophisticated search phrases and contains sources from a variety of fields. The search string, which can be seen in table 3.2, was generated using startup- and female-related terms from the research questions. The string only included studies released after 2009, since they are the most recent studies on this topic, given that the technological landscape is continually expanding and changing.

Database	Search string	Hits
Scopus	(entrepreneur* OR (startup* OR start-up* OR "Start Up*")) AND (gender OR women OR female) AND ("Information Technolog*" OR software OR tech OR ict OR "Information System*") AND (PUBYEAR>2009)	398

Table 3.2: Search string - SMS [5] autumn 2021.

3.1.3 Study Selection

The search string conducted in Scopus retrieved a total of 398 studies. The studies were filtered and analyzed using selection criteria which can be seen in table 3.3.

Inclusion Criteria	Exclusion Criteria
1. The study mentions entrepreneurship and startup.	**1.** Duplicate works where the similar result by the same author is presented.
2. The study focuses on the gender diversity and equality problems within computer science and technology.	**2.** The study deals with ICT and/or technology in general among female entrepreneurs with no technological background.
3. The study is published between 2010 and 2021 in a journal, conference, or workshop.	**3.** The study is about women entrepreneurs in fields other than STEM.

Table 3.3: Inclusion and Exclusion criteria - SMS [5] autumn 2021.

After the selection criteria was applied on every title and abstract of the studies, 27 potential studies remained. A more detailed analyse was conducted on each of the remaining studies, which resulted into 14 primary studies. An additional search was preformed by using the snowballing technique [30], which means including new studies retrieved from some of the primary studies own references. The additional search identified 5 studies that were not discovered in the original search, making the total number of primary studies 19. The study selection process is visualized in figure 3.3.

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[1]https://www.scopus.com/search/form.uri?display=basicbasic
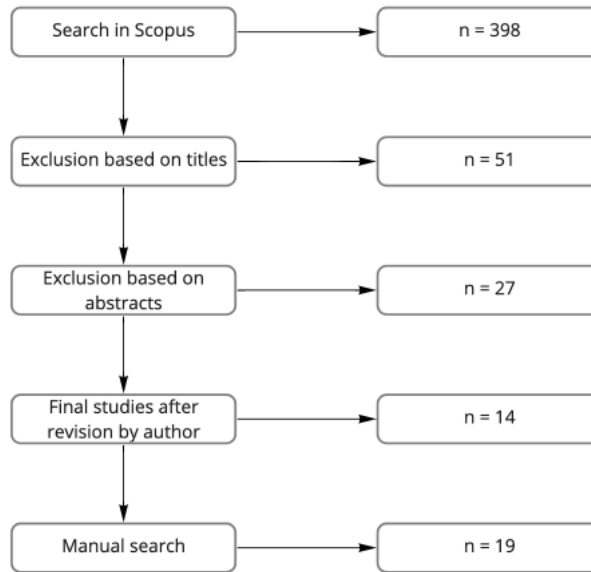
Figure 3.3: The study selection process - SMS [5] autumn 2021

3.1.4 Data Extraction and Synthesis

The classification scheme seen in table 3.4 was defined containing attributes based on each research question, and some of them were inspired by other relevant mapping studies read in the process. The primary studies were systematically classifies according to the attributes in the schema:

RQ1	RQ2	RQ3
• Study focus • Research method • Geographical focus	• Challenges	• Successful factors

Table 3.4: Classification Scheme Attributes of SMS [5] autumn 2021

The attribute "Study focus" was given to indicate if the study centered its research on educational or industrial findings. When collecting data from the original sources, the phrases "tech startup" and "tech entrepreneurship" were coded to guarantee that the results are relevant to the subject of this study. Figure 3.4 depicts the mapping of primary publications according to the classification scheme.

ID	RQ1: Research			RQ2: Challenges		RQ3: Success Factors	
	Focus	**Method**	**Geographic**	**Internal**	**External**	**Internal**	**External**
[S01]	Industry	Survey	Poland			Competencies	
[S02]	Industry	Analysis	North America	Educational			
[S03]	Education	Survey	Malaysia	Educational			
[S04]	Industry	Analysis	Greece	Educational		Educational	
[S05]	Industry	Interviews	Asia	Competencies	Stereotypes & Role	Non-Economic	Gov. Policies
[S06]	Industry	Interviews	South Korea	Competencies		Non-Econ. & Revers.	
[S07]	Education	Survey	USA			Educational	
[S08]	Industry	Survey	Saudi Arabia			Competencies	
[S09]	Education	Interviews	Africa	Family	Role		
[S10]	Education	Survey	Greece	Educational		Educational	
[S11]	Industry	Survey & Interview	Greece		Stereotypes & Role	Competencies	
[S12]	Industry	Interviews	UK		Stereotypes		
[S13]	Industry	Interviews	Europe		Stereotypes		
[S14]	Industry	Interviews	Norway		Male	Reversing	
[S15]	Industry	Survey & Interview	Finland	Competencies	Role		Gov. Policies
[S16]	Industry	Analysis	Germany		Male		Partnership
[S17]	Industry	SLR	Global	Adapting			
[S18]	Industry	Interviews	Global	Adapting			
[S19]	Industry	Interviews	Canada	Family	Male		

Figure 3.4: Mapping of Answers to the Research Questions of SMS [5] autumn 2021

3.2   Synthesized Results

The following subsections presents a summary of the findings from the SMS [5] related to the provided research questions defined in Section 3.1.1.

3.2.1   RQ1: What original research exists in the intersection of gender equality and tech entrepreneurship

Figure 3.5 visualize the results from the data extraction of the 19 primary papers. 74% of the studies was focusing on data collected from the industry, 21% on education, and 5% of the papers was mixed. The different types of research methods observed in the primary studies was categorized into either qualitative research, quantitative research or a mix. The majority of 58% used a qualitative research approach, which often included case studies with different types of interview methods. 32% used a quantitative approach where surveys and questionnaires were mostly preformed. The last 10% used a mix of qualitative and quantitative research methods. Regarding the geographical area the papers were focusing on, it was noticed that the majority of the papers based their research on modern countries compared to developing countries. As revealed in figure 3.5, most of the studies basing their research from the industry perspective used qualitative methods, while those who focused on the student perspective mainly used a quantitative research method.

Figure 3.5: Mapping of original research exists in the intersection of gender equality and tech entrepreneurship - SMS [5] autumn 2021

3.2.2 RQ2: What are the main challenges with gender and tech entrepreneurship?

16 of the 19 primary studies contained results of challenges relevant to gender and tech entrepreneurship and are listed in table 3.5. It was noticeable that many of the challenges were overlapping and related to each other among the different studies. Barriers that recurred in several of the studies was gendered stereotypes associated with masculinity, gendered social roles, perceived behaviour, lack of knowledge and competence, self-efficiency, and lack of mentors and role models.

Study	Challenge findings
S02 [31]	Woman tech entrepreneurs are not granted the same resources as male tech entrepreneurs, and women are likely to benefit less from their involvement in tech startups as they tend to join after the funding stages.
S03 [32]	The data demonstrates that there is no difference existing between male and female students tech entrepreneurial intention on educational level.
S04 [33]	Women face increased barriers to entrepreneurship compared to men mainly due to gender stereotypes and gendered social roles, which tend to display lower levels of perceived behavioral control. Women are less likely than men to convert their entrepreneurial intentions into start-up activities, indicating that the particularly marked gender difference in tech entrepreneurship rates seems to emerge at the action stages of the entrepreneurial process rather than at the intention formation stage.
S05 [34]	Two major types of challenges that women entrepreneurs faced: external ones and internal ones. External challenges as gendered social structures and norms, women tech entrepreneurs encounter obstacles arising from gendered social practices, specifically social prejudices against women as agents of change in domains traditionally considered male. Lack of mentors and role models is also an external challenge. Internal challenges as lack of business skills and knowledge, and tension from rapid technological changes.
S06 [35]	Women entrepreneurs' personal factors (e.g., positive outlook) were the most critical factor in overcoming the challenges they face in IT business development.
S09 [36]	Lack of networks, lack of mentors and difficulties in establishing a balance between work and family
S10 [37]	Personality traits stereotypical associated with masculinity have a bold positive effect on students' entrepreneurship interest, in contrast to personality traits stereotypical associated with femininity. Additionally, social norms has also a relatively stronger effect on entrepreneurship interest, in certain contexts.
S11 [38]	Cultural norms, stereotypes, and lack of role models prevent women from fully exploiting their potential, making women less interested in an entrepreneurial career and less confident in their capacities as entrepreneurs. The low number of female graduates in technology fields and the limited number of women in executive positions generate human capital and networking disadvantages for women in business.

Table 3.5 – continued from previous page

Study	Challenge findings
S12 [39]	Women face the additional challenges of overcoming their "unusual" status in gaining acceptance and credibility.
S13 [40]	Both women and men contribute to perpetuating and undermining gender stereotypes. Gender identity strengthened by stereotyping may be used as a resource to eliminate others when seizing a position of power or to gain an advantage by pleading incompetence (plea for leniency, aid or withdrawal from tedious tasks, etc.). Overt behavior that falls outside this framework (e.g., launching an innovative start-up company) can be sanctioned as it calls into question the very basis of gendered divisions.
S14 [4]	Women experience structural disadvantages from the outset, hindering them in resourcing their enterprises and establishing strategic alliances.
S15 [41]	Self-doubt is a limit. Challenges were also risk-tolerance, ability to mitigate economical risks, social connections and lack of leader skills.
S16 [1]	For the very-high-tech and high-tech sectors it is essential to acknowledge that gender and technology are the socially constructed result of structures, influenced by the history, behaviour, expectations and attitudes of all the members involved.
S17 [26]	Women entrepreneurs involved in tech sectors tend to adopt men related behaviours to fit in.
S18 [10]	Identity and identity work (enacted as a gendered performance in the context of technology entrepreneurship) and the overlap between the masculinized discourses of ICT and entrepreneurship placed these women at the boundary edge of the incubator community.
S19 [42]	At the industry level, women were challenged by differentials in male-female performance standards, a lack of female role models, and stiff competition with male-owned businesses. They also experienced resistance on the part of various industry stakeholders including clients, financiers, and peers. At the societal level, they struggled with pressures to conform to their gender identity and to devote themselves to either work or family. Lack of support that women experienced from other women was particularly painful.

Table 3.5: Mapping of challenges found in the primary studies of SMS [5] autumn 2021

3.2.3 RQ3: What are the main factors adopted by female tech entrepreneurs to be successful in the tech startup indus- try?

11 of the 19 primary studies delivered results on success factors among female tech entrepreneurs. Most of them were types of competencies and skills useful to have in the process of founding a successful tech startup. Some of the findings also proposed key factors that could increase entrepreneurial intention, especially among tech students or women connected with tech through their working place or side hobbies. Several studies mentioned how success stories from female tech entrepreneurs can have a positive influence. Table 3.6 shows an overview of the success factors that were found in the different studies.

Study	Success factors findings
S01 [43]	The competencies that are of key importance to women running ICT start-ups are: the ability to seize business opportunities; the ability to manage change; business knowledge; leadership skills; and communication skills.
S04 [33]	Entrepreneurial intention is best represented by three factors: choice intention, commitment to entrepreneurship, and nascent entrepreneurship.
S05 [34]	Data analysis identified two major types of success factors: external factors and internal factors: External factors were government policies, changes in the participants social and technological environment, mentoring support. Internal factors were entrepreneurship philosophy - value addition.
S06 [35]	Technical expertise, positive outlook, adherence to business principles, work centrality, mentor guidance and networking.
S07 [44]	Female CS students conceptualized self-efficacy as separate from actual entrepreneurial behaviors; hence they gave more weight to the critical factors such as feasibility and opportunity.
S08 [45]	Women who have a high attitude toward entrepreneurship (e.g., high advantage expectations or high interest in technology innovation) are more likely to become IT entrepreneurs. Women formulate intentions to become IT entrepreneurs most directly because they are high in Entrepreneurial self-efficacy. Self-efficacy is a key determinant to behavioural intention in the entrepreneurial context. Attitudes toward entrepreneurship will be stimulated if individuals exhibited higher beliefs regarding their capabilities.
S10 [37]	Gender typed personality and social norm are two highly influential factors in the development of entrepreneurship intention.

Table 3.6 – continued from previous page

Study	Success factors findings
S11 [38]	Skills that appear as most important for entrepreneurship nowadays. Innovation, vision/imagination, organizational skills, creativity, negotiation abilities, resourcefulness, and initiative were found to be the most important.
S14 [4]	The entrepreneurs in this study highlight gendered learning experiences, leading them to make conscious and strategic decisions of both alignment and resistance to negotiate their enterprise in a highly masculine sector. Their prior learning histories of not belonging seem to underpin their preparedness for entrepreneurship in the sector. Counter to prevailing theorizing, not belonging is an enabling condition, allowing women entrepreneurs to subvert and challenge a highly masculinized context. This condition empowers them to mobilize their "otherness" to create change within their own ventures and make the rules on their own terms.
S15 [41]	Support from the environment (government, mentors, social connections, family etc.) is more important than indicated. Success stories from women do matter.
S16 [1]	They believe that the benefit for women of a partnership with a man is that it brings them into industries or cultures that exclude them on the basis of their sex. Therefore, the strategy of female-male partnering can help women to gain entry into male-dominated industries, as a first step.

Table 3.6: Mapping of success factors in the findings of SMS [5] autumn 2021

3.3 Conclusion

There are currently few studies on the convergence of gender equality and digital entrepreneurship, despite the importance of more women becoming entrepreneurs and achieving gender parity in the tech industry. However, as the number of female tech entrepreneurs increases, more relevant stakeholders will be accessible for qualitative and quantitative analysis in future research. Since entrepreneurial competencies seem to be disproportionately masculinized, there should be a change in how the "usual" competencies and skills are seen. Instead of feeling forced to adopt masculine behaviour, women should chart their own path, build a network, and seek guidance from experienced mentors in the field. The success criteria identified and described in this study should not be used as a manual for women who wish to create a tech startup, but rather as suggestions and inspiration to encourage entrepreneurial behavior and progress through the many stages of startup funding and creation.

Several of the primary papers included in this SMS examine the shortage of female role models

and mentors, and the absence of a like-minded support network. Women are less engaged in an entrepreneurial profession and less secure in their entrepreneurial abilities when they lack role models. Several of the primary studies repeatedly cited the significance of mentorship and advice from others as important success factors. The success stories of other female tech entrepreneurs who are well-established in the startup industry also play a significant role in fostering an entrepreneurial mindset. As a consequence of a poor awareness of the relationship between sector culture and the reality of women's life, women struggle more than men to comply to their gender identity and choose between work and family. Hence, it should no longer just be a female concern. Everyone in the technology industry, regardless of gender, should serve as role models and eradicate gender preconceptions as a starting point. Instead, there should be a gender-neutral standard for basic entrepreneurial competencies and abilities that applies to everyone.

3.3.1 Future Work

Future work could include interviews with female tech startup and company founders and co-founders. To solve the problem, technical solutions, such as a platform or service that encourages computer science students and women working in ICT to become tech entrepreneurs, should be created. A technical solution could include a mentor-connector, the sharing of experience from successful (and unsuccessful) founders, raising awareness and providing information about the importance of gender diversity in the tech startup industry. Another suggestion is an idea-development tool to assist women in processing their entrepreneurial ideas and visions.

The author seeks to explore how software might be designed to streamline and simplify the link between mentors and newly established female tech entrepreneurs. Before establishing the requirements for a prospective application, interviews with Norwegian female tech entrepreneurs will be conducted to get more nuanced information on the Norwegian context. The interviews and proposed solution for the mentor connector solution will be discussed in further detail in the next chapters.

Chapter 4

Methodology

This chapter presents the research methods used as part of the Master's thesis. The methods described further are inspired by Oates *et al.* [46] and Recker [47]. As Recker discusses in his research, it is recommended to acquire at least three types of knowledge before the research is started. Number one is "*Knowledge about the domain and topic of interest*", which in this case is retrieved from the literature in the Background Chapter (2) of this thesis and results from the SMS [5] presented in Chapter 3 which gives insight to the domain of gender equity and tech entrepreneurship. Regarding number two, "*Knowledge about relevant theories that help you frame questions and phenomena*", the author have used a combination of existing theories used in other similar research on the same domain, which will contribute to examine the research questions of this thesis. The third and last requirement of knowledge is "*knowledge about relevant research methods that you can apply to develop new knowledge, build innovative artefacts or articulate new questions*". The research methods chosen for this thesis was design and creation approach including interviews as data generation method, which will be explained more in detail in this chapter. Figure 4.1 visualises the research methodology used in this thesis.

4.1   Research Questions

In the findings from the SMS [5] presented in Chapter 3, there is revealed that there is still a lack of existing studies on the intersection of gender equity and tech entrepreneurship. What was found from the existing literature, was that competences and skills related to entrepreneurship and founding of a startup are masculinized, and it is suggested that women should contribute to form competences that is general and independent from gender. Some of the most common success factors for female entrepreneurs in the tech sector, was the effectiveness of having a network, guidance from mentors and role models. The research objective of this thesis is how to increase the amount of female tech entrepreneurs in Norway with technology, where the aim is to retrieve more insight from Norwegian women that have founded a tech startup. This insight together with the findings from the autumn projects, will give useful
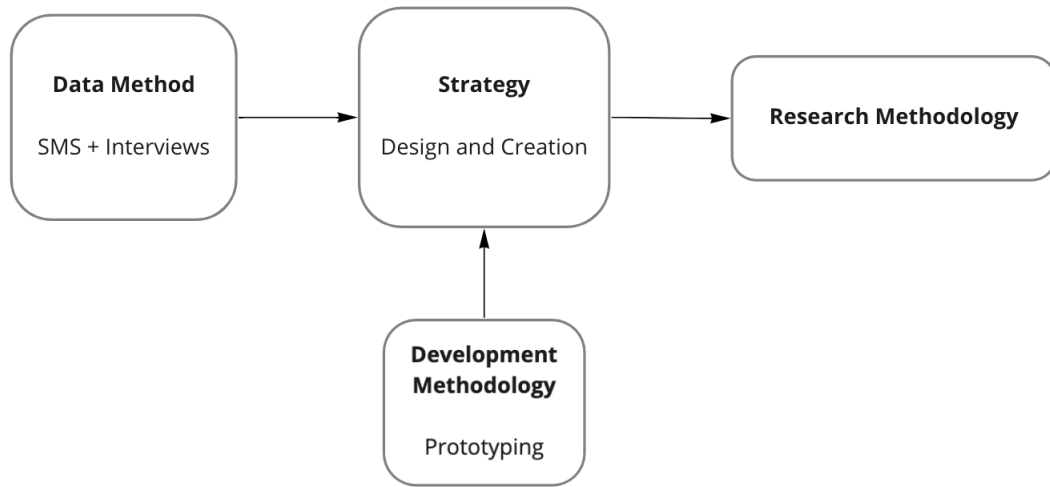
Figure 4.1: Research Methodology.

knowledge to how software can be designed to decrease the gender gap in the Norwegian tech startup industry. The following RQs were made:

> **RQ1: What experience-based characteristics are essential for female tech entrepreneurs in Norway?**
>
> **RQ2: How to design software to decrease the gender gap in Norwegian tech entrepreneurship?**
>
> - **RQ2.2: Which features must be considered when developing a technical service to increase the amount of female tech entrepreneurs in Norway?**

4.2 Theory

According to Recker [47], theories play a significant role in the planning phase of research since they may influence the study's direction. Theories also contribute to the research execution process and can support the analysis of acquired data and observations. The approaches can detect patterns and themes in the data and provide ideas that can be utilized to explain the results and make sense of the obtained data. The author acquired relevant theories through reading comparable works on the same topic.

In the study by Kubberød *et al.* [4], which is based on empirical data from the entrepreneurial learning of female entrepreneurs in the technology industry of Norway, they used the research

of Stead [48] to synthesis the gender and entrepreneurial learning theories. Stead [48] theorizes that women entrepreneurs employ various practices to counter negative gender perceptions in order to achieve belonging. The same research introduces the concept of belonging, which could contribute to a more nuanced understanding of how women entrepreneurs address gender-related challenges that may influence their entrepreneurial learning process and outcomes. Marlow and McAdam [10]´s adoption of a feminist perspective to reveal business incubation as a gendered process influencing the identity work undertaken by women seeking legitimacy as technology ventures was another theory extracted from the SMS [5]. This adaption was assumed sufficient to supplement the data collected from the interviews together with Stead [48].

Regarding RQ2, The research done by Kuratko *et al.* [49] was deemed pertinent to the creation of a software application that might encourage more women to pursue tech entrepreneurship via mentoring technology. The article investigates the elements that determine an entrepreneur's coachability, how coachability translates to venture results, and if the mentor-mentee relationship meets the expectations of the entrepreneur. Kuratko *et al.* [49] theorizes that entrepreneurs that are more coachable are eventually more successful and contented throughout their time in mentor meetings. Another research that was assumed relevant to answer RQ2 was a study by Elliott *et al.* [50] that provides relevant theories of the intersection between female entrepreneurship in STEM and peer mentoring in terms of entrepreneurial self-efficacy (ESE).

In this thesis, the theory from Stead [48], Marlow and McAdam [10], Kuratko *et al.* [49] and Elliott *et al.* [50] will be used as a supplement for synthesising, analysing, and integrating the empirical findings and observations from the chosen research methods that are further described in this chapter. It is worth mentioning that the research by Stead [48] and Kuratko *et al.* [49] are based on gender and entrepreneurship without the technology perspective, which is a key element in the objective of this thesis. However, since there was a lack of theory found covering all of the areas together, general insight about gender equity and entrepreneurship separate from each other was considered valuable.

4.3 Interviews

Interviews were selected as the data collection approach to answer RQ1. The interviews were also used as a data generate method to provide valuable information for the design and creation strategy described in the next section. Regarding the gender gap in the Norwegian tech entrepreneurship industry, semi-structured interviews with relevant participants were considered suitable due to time constraints and the difficulty of recruiting relevant contributors. The technique is also highly suitable for qualitative data analysis, which is pertinent to this field of study due to its discoverable methodology that allowed respondents to freely express their own viewpoints on experiences connected to women and tech entrepreneurship [51]. The semi-structured interview technique may also be used to validate what is previously known while also offering a chance to learn [47], which is applicable in this situation since the interview questions are based on results from the SMS [5].

4.3.1   Recruitment of Relevant Participants

Due to the limited number of female tech entrepreneurs in Norway, it was simple to identify prospective participants. The primary objective was to conduct interviews with at least five women with a technical background from school or industry who had founded a tech startup. Five participants underwent a semi-structured interview that lasted between 40 and 60 minutes. One of the interviews was in-person, while the others were conducted digitally through a Microsoft Teams[1] meeting. All interviews were digitally recorded and afterwards transcribed in their entirety. During the recruiting process, triangulation [52] was achieved because the author read numerous media articles about the interviewees, searched for information on social media sites such as LinkedIn[2] and Instagram[3], and participated in conferences and seminars that were relevant to women entrepreneurship in the tech sector. Hence, the author were able to gather participants with diverse backgrounds. The use of pseudonyms ensured the participants' anonymity and confidentiality in this research, and the participating businesses represent a variety of technological areas, as shown in Table 4.1. Their ages ranged from 20 to 50 years.

Pseudonym	Mari	Lise	Mona	Ingrid	Anna
Education	School of entrepreneurship NTNU	School of entrepreneurship NTNU	Economy and Leadership	Movie production and other studies abroad	School of entrepreneurship NTNU
Tech experience	Worked in different tech companies	Master of Science NTNU	Worked in different tech companies	Worked with IT at university and in different tech companies	Worked with marketing in different tech companies
Startup type	NPL and AI	AI	Security	Cloud and support	Sustainability and fashion
Position	Founder and CEO	Founder and CEO	Owner, founder and CEO	Owner, founder and CEO	Co-founder and CEO

Table 4.1: Description of the participants to the semi-structured interviews in Chapter 5

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[1]https://www.microsoft.com/en/microsoft-teams/group-chat-software/
[2]https://www.linkedin.com/
[3]https://www.instagram.com/

4.3.2   Data Collection Procedure

Semi-structured interviews was chosen as data generating method because it is very appropriate for qualitative data analysis [51]. It also gives the participants room to express themselves freely with minimal disruptions, which can positively influence the quality, validity and relevance of the data [53]. The semi-structured approach usually starts with a couple of general question or topics which are formulated ahead of the interview, and works as the base for new additional questions that come naturally later in the interview [47]. According to Smith and Shinebourne [54] the aim is to elicit detailed stories, thoughts and the feelings. This approach allows both the person interviewing and the participant the flexibility to be detailed in their answers or discuss issues if needed.

Regarding the interviews conducted for this thesis, a pre-set of questions was sent out to the participants prior to the interview, giving them time to think about their views around the topic. It also help the author establish credibility as a serious researcher [51]. When the interviews were held, the author asked open questions rather than closed questions, as suggested in the work of Oates [51]. Appendix C contains the predetermined questions that was given to the participants.

All of the interviews were conducted in Norwegian, since it tends to make respondents more at ease and forthcoming when asked to answer in-depth questions. The automated transcription program that transforms mp4 audio files to text did not perform well with Norwegian pronunciation, thus all interviews were hand transcribed. This implies that not all parts of the interviews were translated verbatim from the audio.

4.3.3   Analysis Procedure

When analysing data in qualitative research, one of the key attributes is the sheer amount of data that needs to be analysed, usually without a clear understanding of which parts are relevant or not to the final outcome, or why [47]. Rajasinghe *et al.* [53] present that since entrepreneurship is a complex social activity, knowledge production in this field requires inclusivity and diversity within research approaches and perspectives to appreciate the richness of the phenomenon. The analysis procedure in this thesis will follow a step by step guide of the method called Interpretative Phenomenological Analysis (IPA) proposed by the same authors. The method was chosen because it is discussed as an innovative qualitative research methodology that facilitates a fuller appreciation of the richness and diversity of entrepreneurship [53]. This phenomenological approach was also used in the study of Kubberød *et al.* [4], which inspired the author of this thesis to use the same approach. The guidelines that was followed through the analysis procedure of this thesis will now be presented based on the research of Rajasinghe *et al.* [53] with theory from Smith and Shinebourne [54]. The results of the process can be found in Chapter 5.

Step 1: Reading and re-reading

The first step consists of reading and rereading the interview text while listening to each participant's recorded voice [54]. Therefore, analysis begins during transcribing and continues until writing is complete. Continuous listening alongside reading the transcript brings the researcher closer to the experience of the subject, resulting in a deeper understanding [55].

Step 2: Initial noting

Next, the analyst is urged to record anything of interest regarding the phenomena, thereby fostering a deeper understanding of the individual's experience [53]. In this instance, the phenomena will be the participants' experiences, ranging from positive to negative, with starting a venture in an industry dominated by men. The purpose of initial noting is to make a collection of thorough notes and comments on the transcript so that data immersion and comprehension may commence [54]. The author employed Excel[4] columns and color coding to identify units of meaning by arranging them into clusters with shared characteristics.

Step 3: Developing emergent themes

The initial notations from the preceding stage were now utilized to build emerging themes, which helps to construct a more interpretive account of the participant's experience by shifting the attention from the actual transcript to the initial remarks [56] [57]. However, it is permissible to shift between interview transcripts and emerging ideas in order to comprehend the participants' sense-making [53].

Step 4: Searching for connections across emergent themes

During this phase, it was advised to move emerging topics to a new document and group them with relevant themes [53]. Techniques such as abstraction (placing like with like and coming up with a new name for the cluster), submission (an emerging theme that claims to be a superordinate theme), and contextualization (attempting to find contextual and narrative components) were used. Traceability and transparency of the data analysis are guaranteed by the iterative nature of the process and the author's revisiting of developing themes and the previous stages [58].

Step 5: Moving to the next interview

According to the idiographic commitments of the IPA, it is important to avoid being too influenced by a prior interview analysis [54]. The first four procedures are repeated independently for each interview. Each interview should be analyzed in its own sense, with concepts derived from prior interviews placed on hold. It is accepted that the researcher would be influenced by what has already been discovered [59], but it is necessary to mention the value of distancing from the previous case. The goal is to provide the fullest possible acknowledgement of each individual's experience with the topic [58].

Step 6: Looking for patterns across the interviews

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[4]https://www.microsoft.com/nb-no/microsoft-365/excel

After completing the first four phases for each interview, it was time to check for patterns across the themes and clusters that emerged from each interview [53]. During this phase, the superordinate themes were determined by reconfiguring and relabeling similar themes; this process continued until the results were complete. This led to a thorough analysis of meaning patterns and thoughts on shared experience. It was crucial that the analyst and participants had a shared knowledge of the research's background, since this helps a broader audience interpret the results [54].

4.4   Design and Creation

The design and creation research strategy retrieved from Oates [46] focuses on developing new technologies to contribute to knowledge by explore and exhibit the possibilities of digital technology. This strategy ensures that academic qualities such as analysis, explanation, argument, justification, and critical evaluation are demonstrated. According to Oates [46], the technology can have one of three roles in the research project: the main focus of the research, a vehicle for something else or a tangible end-product of a project where the focus is on the development process. The process of how the design and creation strategy was conducted in this thesis can be seen in Figure 4.2.

Awareness
Systematic Mapping Study + Interviews

Suggestion
Guidelines + paper prototype

Development
Prototype in Figma

Evaluation
User testing + Interviews

Conclusion
Suggestion of further development
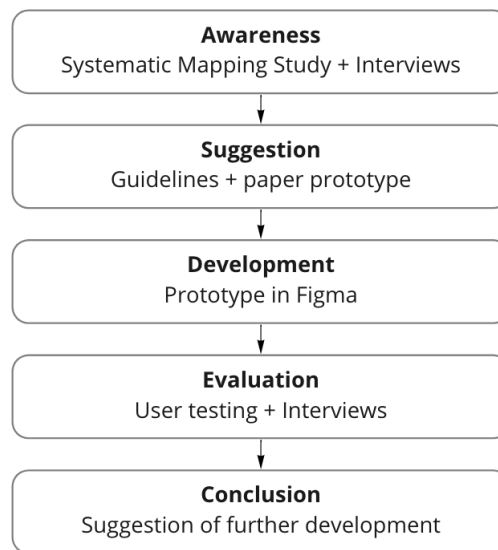
Figure 4.2: The Design and Creation strategy process.

In this section, it will be described how a technology can be developed to encourage more women interested in tech to found their own tech startup, based on the findings from the SMS [5] in Chapter 3, and the findings from the IPA analyse of the interviews in Chapter 5. This technology rules as the main focus of this research, where a design prototype of the technology

was made and user-tested to provide knowledge if a technical service could help answering RQ2: How to design software to decrease the gender gap in Norwegian tech entrepreneurship?

4.4.1 Planning Phase

The design and creation methodology is typically seen as a problem-solving approach which uses an iterative process involving five steps retrieved from Kuechler and Vaishnavi [60]. The steps do not have to be followed linear, they work more as a fluid, iterative cycle [46]. The steps were undertaken in the process, and the result will be presented in Chapter 6. Each stage will now be introduced with its description and how it was implemented within the context of this thesis:

1: Awareness

The identification and articulation of an issue, which may be attained by reading new results in another subject or by examining the literature in which writers indicate opportunities for additional investigation. It may also result from practitioners or customers stating a need for something, field research, or new technological breakthroughs [51].

Based on the findings from the SMS [5] in Chapter 3 and the interviews in Chapter 5, the problem in this context is how to inspire more women to enter tech entrepreneurship in Norway.

2: Suggestion

This stage involves a creative jump from problem-related curiosity to the provision of a very preliminary solution concept [46].

The preliminary concept was created on paper after the completion of the interviews, drawing inspiration from the data acquired from the SMS [5] and the interview analysis. The author additionally scoured the Internet for comparable items currently on the market for inspiration and to establish that the service did not already exist. The methodology is described in further detail in Section 4.4.2.

3: Development

The preliminary design concept will now be realized. How this is accomplished depends on the suggested Information Technology (IT) solution [51].

Due of time constraints, the author elected to adapt the design concept into a more sophisticated *Figma*[5] *prototype*. This implies that no software was created throughout the process. However, since Figma allows the prototype to be functional under the same conditions as a coded prototype, the author considers it to be a part of the development phase, not the suggestion phase. Section 4.4.2 explain the theory behind the prototype approach utilizing a design

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[5]https://figma.com/

tool.

4: Evaluation

In this stage, the produced artifact is evaluated in terms of its value and departures from expectations [46].

The prototype was user-tested with relevant stakeholders, followed by an evaluation to collect data on how the intended service may function in relation to its purpose. In Section 4.4.3, it is described how the user testing served as an examination method.

5: Conclusion

In the final stage, the findings of the design process are consolidated and documented, and the acquired knowledge is identified [46]

In Chapter 6, the collected data from the user testing will be analysed and presented. The evaluation will be discussed towards the research objective of this thesis in Chapter 7.

4.4.2 Development Methodology

The purpose of the prototype is to show that the researcher's design solution has certain attributes or behaves in a particular manner under specified circumstances [46]. For this design and creation, it was not previously known how a technology might inspire more women to participate or remain in the profession of tech entrepreneurship; a prototype will show that it is possible.

The author sketched the early ideas for the technology as a service on its iPad. Due to the time constraint and the author's decision not to program the technology, it was deemed unnecessary to follow any previously documented system development techniques. Prototype implementation in Figma was chosen as the development strategy in this instance, which, according to Oates *et al.* [46], is advantageous because you do not need to fully comprehend a problem before exploring potential solutions. The strategy is also appropriate if your research is time-constrained. Only one iteration was undertaken due to the deadline of the project.

After completing the iPad sketches, the author chose to create more sophisticated prototypes using the digital interface design tool Figma[6]. Figma facilitates the transformation of static design files into interactive experiences without the need for programming. It connects User Interface (UI) components and allows the user to apply various interactions and animations by setting subtle interactions such as on click, while hovering, while pushing a button, as well as other capabilities often seen in a fully developed technology. During user testing, these features provide users with a realistic representation of how the technology will function. Figure 4.3 displays an overview of Figma being used as a tool.

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[6]https://www.figma.com/ui-design-tool/
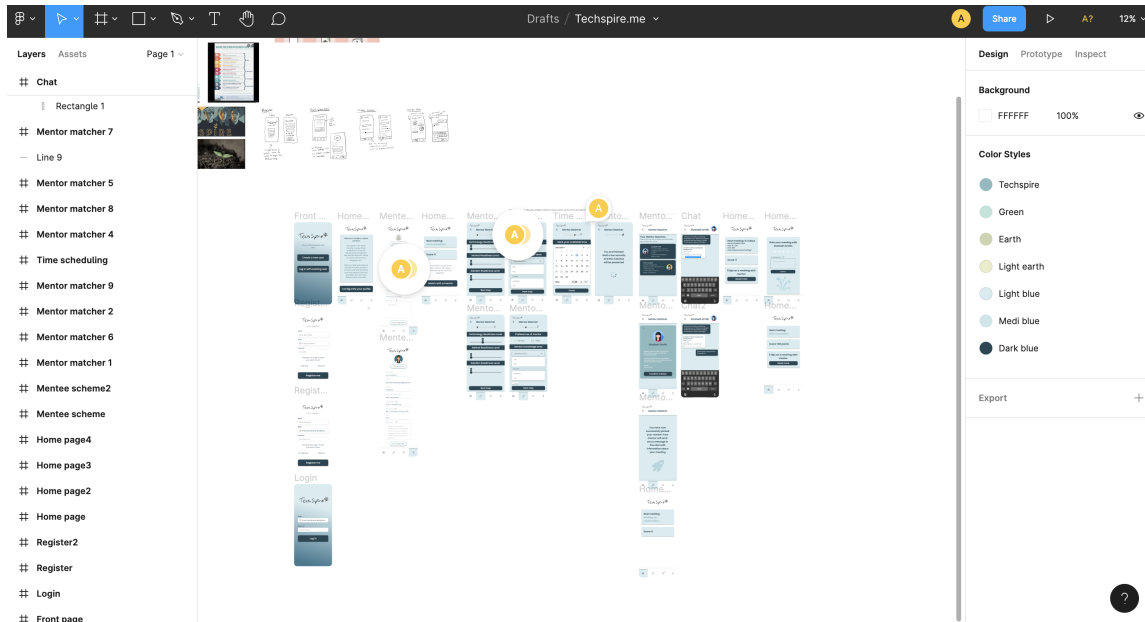
Figure 4.3: Overview of Figma Design Tool.

4.4.3   Evaluation through User Testing

After developing the final prototype of the technology, it had to be evaluated. According to Oates [46], the evaluation can lead to conclusions about the design process and the design product, and may suggest that further modifications to either or both are needed. In the case of this study, the prototype was evaluated through user testing with participants that fulfilled several criteria. User testing typically seeks to validate the need for a product and to find out if the product solves an actual problem[7].

The participant had to be a woman either studying or interested in tech, and had to have a connection to entrepreneurship, either through a course, working in a startup, or personal interest. The participants were found through the authors network at Norwegian University of Science and Technology (NTNU), and every user test happened physical. A total of 5 participants user tested the prototype, which is a optimal amount to fully test the functionalities of a prototype according to Nielsen and Landauer [61].

Each participant was requested to complete various tasks[8] related to entering registration details, filling out the mentor scheme, and providing feedback to the system in order to test the technology's user interface. A detailed task guide is shown in Chapter 6. The participants were instructed to conduct a concurrent think-aloud while completing these tasks, which is a strategy in which users voice their thoughts while they execute the tasks [62]. This strategy is advantageous since it enables researchers to learn why and where novice users struggle, as

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[7]https://uxplanet.org/the-value-of-user-testing-with-prototypes-522596052ff9
[8]https://www.nngroup.com/articles/task-scenarios-usability-testing/

well as how expert users accomplish specific tasks.

Design and creation research typically makes use of data generation methods, like semi-structured interviews, to obtain from intended end-user the requirements specification or design brief [46]. Hence, to gain more complete thoughts and knowledge about the intended technology developed in this thesis and its purpose towards solving the research objective of this thesis, the author followed the think-aloud method with a semi-structured interview. An explanation of semi-structured interview as a methodology was explained earlier in Section 4.3.

4.5 Ethics

When planning and conducting empirical research, ethical issues must be taken into account [46]. Two separate consent forms were made following the template provided from Norwegian Centre for Research Data (NSD)[9] to ensure this research was in line with Norwegian law and the policy for the protection and management of intellectual property rights and physical material at NTNU.

The first form were given to the participants of the interviews, and the other one to the participants of the prototype user tests. All of the participants were informed that the participation in this study is voluntary and they have every right to withdraw from the study without further notice. The approval of the NSD application is shown in Appendix A and the two separate consent forms in Appendixes B and D.

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[9]https://www.nsd.no/

Chapter 5

Interviews

5.1   Data analysis

The author read and analysed each of the five transcripts after the steps presented in the analysis procedure method in Section 4.3.3, inspired by Rajasinghe *et al.* [53] and Smith and Shinebourne [54]. As mentioned in the Chapter 4, the transcription of the audio files was conducted manually. While listening to the audio recordings, the author took preliminary notes on sections that were more pertinent than others, some of which were based on the initial interview questions.

After the transcription was finished, the author re-read the text and added more initial notes that could be relevant for the research, with colour-coding highlighting what was seemingly the most relevant ones. Further, the author moved away from the original transcript and focused on the initial notes to develop a more interpretative account of the participant experience [56]. While analyzing, the initial notes evolved into emergent themes. The emergent themes were then moved over to an excel sheet to cluster them with first-order codes. The author decided on the themes' first order codes by contextualizing the phrases and putting similar citations with similar or submission through realizing that an emergent theme could work as first order code.

Upon analyzing each transcript individually, the list of first-order codes for each interview was complete. The last procedure was to search for patterns across the various interviews. Figure 5.1 depicts the author's visualization of each first-order code in Miro[1], in which each color represents the interview where the codes originated.

Furthermore, the codes were grouped into themes, yielding second-order categories. The author gained a greater and deeper understanding of the intricacy of the participant's conveyed experiences. Three second-order categories were identified, as shown in Figure 5.2. From the

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[1]https://miro.com/

Figure 5.1: Visualisation of every first order codes.

second-order categories, three superordinate themes were conceived and related to applicable theory in the results (Section 5.2).
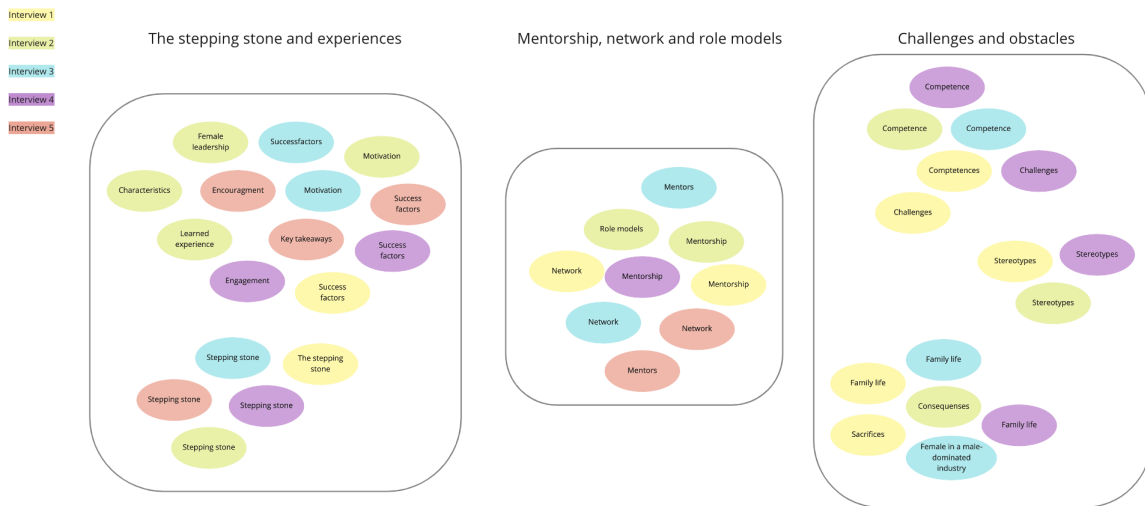
Figure 5.2: Looking for patterns across interviews and creating second-order categories.

During the development of the data analysis the theory from Stead [48] of women entrepreneurs employing various practices to counter negative gender perceptions to achieve belonging was identified in the context of the participants answers. According to Marlow and McAdam

[10], future conceptualizations of entrepreneurial legitimacy must understand how ascribed characterizations, such as gender, differently position the credibility potential of the person as the future company's substantive representation. This theory was also identified in the emerging themes of the transcripts.

At the end of each interview, all participants were asked how technology could help increase the number of female tech entrepreneurs in Norway based on their experiences with already existing initiatives, programs, and technology. The findings were analyzed externally from the themes that evolved into the three super-ordinate themes and will be presented in the next section as a separate theme. The findings from this question are especially relevant for the design and creation process described in Chapter 6.

5.2 Findings

Since the transcription was done in Norwegian, the author translated the primary data into English. The three key dimensions, 1) road to success, 2) bumps on the road, and 3) help on the road, represent underlying patterns of the interplay between gender equity, entrepreneurial experiences and belonging in the tech industry context. The participants were also asked the same concluding question at the end of each interview to get valuable input on this thesis's design and creation part, which will be presented in the last section. The following sections outline the participant's experiences through selected quotes, supplemented with relevant theory.

5.2.1 The Road to Success

Every participant described their "stepping stone" into tech entrepreneurship, and some entrepreneurs in this study sample lacked a technical academic background. As shown in Figure 4.1, three out of five (Mari, Lise, and Anna) had completed a master's degree at the NTNU School of Entrepreneurship. This master program was cited as a significant push towards creating a startup, as several of them had already created one during their study period. Since technology is an integral part of NTNU, Lise stated that it felt natural to combine entrepreneurship and technology. Before becoming entrepreneurs, Mona and Ingrid, who did not attend the NTNU School of Entrepreneurship, worked with and gained expertise in several tech companies. This encounter inspired them to establish a technology-based business. Mari and Anna worked for various tech companies before launching their own startup, which increased their enthusiasm in the field. Mona elaborated on encouragement by stating that she was inspired to launch her own technology company since an idea combined with technology can make a difference:

> "*I have read that one of the pillars for women to become founders is to pursue activities that are not only meaningful to themselves but also to others. And I believe that applies to my own journey.*" *(Mona)*

Regarding the above phrase, this may be a motivating factor for female entrepreneurs to start their own businesses. Entrepreneurship in the technology industry is essential for developing sustainable solutions for the remainder of society. Ingrid emphasized that the most fascinating aspect of technology was not the technology itself, but how people utilize it.

A number of significant insights and success criteria came from the participants' perspectives on the experiences of entrepreneurs following the launch of their startup. The entrepreneurial lifestyle is thought to be significantly more demanding than the 8-hour work that is more prevalent among female technologists. Anna stated that it is tough to compete in this industry as a woman due to the fact that you are in the minority, which makes you feel marginalized. This reinforces the concept of belonging of Stead [48] to illustrate what it feels like to feel at home or out of place. Anna also emphasized the importance of recognizing that the entrepreneurial journey is not about your gender but rather about your ability to achieve something. It will be a learning experience regardless, and that is a success.

There were also some disputes over the distinctions between the leadership styles of women and men and why the rise of female founders is significant. Lise noted that over her journey as a founder, she shifted away from the belief that a leader should adhere to a specific formula or template. Instead she came to believe that it is acceptable to display emotions at work and make team members feel seen. Changing the priority to ensure the comfort of team members appears to run counter to the conservative leaders' traditional principles. Possibility of a new conception of what a "good" leader should be as a result of the participation of women in leadership positions that are traditionally reserved for men.

> *"In this scenario, female leaders may have an advantage because people are made up of a variety of emotions; therefore, if everyone feels visible and safe and can express how they feel to their coworkers, it promotes workplace safety." (Lise)*

The leadership style can vary regardless of gender, however there are biological elements that can contend with the stereotypically masculinized leadership style for which many people are recognized today. As Marlow and McAdam [10] stated, the notion of the entrepreneur as an assertive change agent whose legitimacy is based on novelty conflicts with the ability to signal competency based on traditionally expected skills and accomplishments. Possibly, if the number of female founders rises, the number of female leaders will also rise and alter the conventional leadership style.

Mona emphasized the significance of trust, stating that it is essential to have faith in one's surroundings and resources towards success. Mari also learned the importance of a trustworthy workforce to an organization's growth.

> *"I realised that the team is more vital to the development of a company than having the correct idea and the appropriate product." (Mari)*

A different view was presented by Ingrid, who emphasized the significance of believing in the

idea you are attempting to promote. It shines through you if you do not believe it, so you must know you are sufficient. Anna stated that the most important component of an entrepreneur's journey is not necessarily the idea, but rather the passion, problem, and solution, which makes the journey easier to endure. Based on the comments of the participants, the idea that the company wants to develop is central. Nonetheless, it appears that all partners within the firm will grow if the emphasis is placed on building an internal drive and atmosphere, rather than focusing solely on the idea or product. Simultaneously, you demonstrate to customers and investors that they can support a company with total sincerity and group solidarity.

5.2.2 Bumps in the Road

As the story of the founder's journey progressed, it was revealed that the process of founding was sometimes fraught with difficulties and obstacles. A reoccurring theme among the participants was their dearth of confidence in their ability to carry out their responsibilities. Mona opined that it is nearly impossible to always feel competent as the Chief Executive Officer (CEO) of a newly founded technology company. You do not have the same ability to request assistance as you would in a large, established organization. Ingrid also mentioned the imposter syndrome[2], the feeling of inadequacy in comparison to others. These sentiments correlate with Marlow and McAdam [10]´s discovery of obstacles women face while entering a social environment that is fundamentally unsympathetic to their gendered identity. Female entrepreneurs who enter the male-dominated tech business are likely to encounter exacerbated gender dissonance, which adds another dimension to the identity work necessary to seek and claim entrepreneurial legitimacy [10].

> *"I have never felt that I had educated myself as a leader, and as a result, I have sometimes felt bad. However, you can then enhance your talents in tandem with the growth of the company. Thus, the evolution occurred along the route." (Lise)*

It appears that required competences and experience could be a hindrance for women who created their own businesses, and it could be difficult to locate the proper resources for the correct tasks within the tiny team you have at the outset. Mona underlined the need to seek out people in one's network to spar with when difficulties arise for a small startup. Lise also noted that during her journey, she realized that having management abilities from previously was less significant than recognizing that you evolve as a leader and establish your own leadership techniques. The participants' perceptions of their lack of competence appeared to be rather contradictory. It was essential and helpful to obtain support and fresh perspectives from your network, but it is essential to utilize the internal resources available to you.

Moving on to other challenges that could arise throughout the process of founding a tech startup, several participants noted that the first phases were difficult. The actual entrepreneurial experience was at times more challenging than anticipated. Mari figuratively remarked that,

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[2]https://hbr.org/2021/02/stop-telling-women-they-have-imposter-syndrome

as a tech entrepreneur, you arrive to work every day to encounter multiple fires. You cannot put out all fires at once; you must select.

> *"You may live every day with the risk you feel on your body; there are always insufficient resources and more work to be done. You also fill multiple responsibilities within the company." (Mari)*

It appears that regardless of the type of entrepreneur you are, you must accept the concept of limited resources and the necessity to prioritize. Some of the participants observed that it is essential to be emotionally resilient and confident in one's ability to succeed. Mari remarked that other women may notice this and conclude that it is not for them.

Apparently, the longstanding history of male dominance in the technology sector has produced a work environment whose practices, beliefs, and culture exclude and marginalize women according to Marlow and McAdam [10]. The majority of the participants answered that they had not experienced any direct form of discrimination for being a female tech entrepreneur. Lise stated that she considers unconscious bias to be the greatest issue, as it leads to the occurrence of unpleasant situations. Because the other party is likely unaware that they are engaging in unconscious prejudice, it may be difficult to intervene in these instances. This could be a result of the historical assumption of a CEO in a male-dominated sector.

> *"When a female enters a sector where many people have strong beliefs about what to say and how to behave, it may be shocking to some. You no longer feel protected by your position in a larger organization; you are suddenly on your own and more exposed. (Mona)"*

Marlow and McAdam [10] suggested that women are obligated to engage in specific forms of identity construction in order to attain visibility and entrepreneurial legitimacy, especially when launching new ventures in traditionally male-dominated sectors. In accordance with this theory, the participant's experiences suggest that women may encounter more difficulties than men during their tech entrepreneurship journey. Several of the interviewees cited family life as a challenge that is clearly more difficult for women than for males, given that having children during their working years might diminishes their productivity. Creating a family in parallel to a business can be resource-intensive and challenge entrepreneurs to prioritize new situations. Compared to working for a larger corporation, entrepreneurship provides a more unpredictable lifestyle. Founders cannot always anticipate if their salary will be sent into their bank account the following month, and you may be required to do a great deal of traveling. These factors, among others, make it difficult to maintain the average level of stability.

> *"If you are going to operate a business, you will have to deny several requests. You should not anticipate having the ideal work-life balance." (Lise)*

Entrepreneurship, particularly in the field of technology, can result in sacrifices on personal level. Mari stated how important it was for her to have great communication with her partner and friends. Their support encouraged her to continue as a tech entrepreneur. Even if the path is difficult and arduous, external assistance can be provided through networks and mentors. The relationship between the participants and their experience with networks and mentorship will be discussed in the following section.

5.2.3   Support on the road

Mentoring is identified as a primary means to resolve career challenges, but the absence of female mentors and the perception that the tech industry is male-dominated are consistently identified as barriers to women [63][5]. Mona highlighted networks and people who believed in her as the primary factors that aided her during her founder journey. All of the participants acknowledged the significance of having a network and a mentor. According to Orser *et al.* [63], the low number of women in upper management roles and the limited number of senior female managers and executives in advanced technology sectors indicate that women are less likely to find female mentors. Particularly at the senior level. Anna opined that women tend to be less innovative due to lack of networks with like-minded people. She followed up with that as a woman, you can frequently feel alone on this journey, which can be difficult and demoralizing. Even if this path is the entrepreneur's choice and desire, it is good to converse with someone who is or has been in a similar situation.

> *"I can call other female managers and CEOs who have faced adversity and discuss difficulties with them." (Mari)*

Mari also stated that sharing experiences from a variety of industries, not only the technology industry, is a leadership hack, as innovation can only be generated by transferring knowledge from one subject area to another. Regarding mentorship, the participants highlighted the importance of discussing your ideas, difficulties, and opinions with an experienced in the same profession. Some participants remarked that the experience is not always beneficial due to the lack of gender diversity among the mentors, who are predominantly male. According to the research of Orser *et al.* [63], female founders in tech industries may face unique challenges in establishing and sustaining an effective mentoring relationship due to a lack of female mentors, sexual tensions in mixed-gender dyads, and compromised outcomes associated with mixed-gender dyads. However, it was discussed that the gender of the mentor does not have to be the primary reason why a mentorship is not as beneficial as anticipated.

> *"There will always be a variety of mentors with various backgrounds, points of view, and answers regarding how to operate your business." (Mari)*

As a founder, you must determine what is most important to you. A mentor from the outside might provide valuable insight, but you ultimately know what is best for your company. As

stated in the SMS [5] in Chapter 3, there is no manual or predetermined path for a founder to follow. Creativity and an innovative mindset are the foundations of innovation. Therefore the capacity for self-assurance and self-efficacy is essential to driving your business forward.

In context with the lack of female mentors with tech entrepreneurial experience, there is a lack of role models. Lise realized there are quite few women in the tech startup environment based on her observations on LinedIn, which makes it even more crucial to highlight those who exist. When participants were asked how they might help increase the number of female tech entrepreneurs, their responses varied. Mari stated that she had understood her duty should be to encourage other women to take risks and go into entrepreneurship without all the necessary experience. Fascinatingly, the majority of interviewees did not know how or where they would help to solving this problem. Lise acknowledged that she could have published and written more on social media. She also noted that it is rather paradoxical because individuals who write the most about female founders are frequently not founders themselves.

Regarding the theory of Stead [48], in order to combat gendered assumptions that act as barriers to entrepreneurial action, women in more advanced stages of their careers may serve as useful mentors in terms of fostering socio-cultural and political intelligence in those with less experience. Lise had observed a disparity between how others perceive her and how she perceives herself, which may explain why she has not focused more on contributing as a role model.

> *"You see me as having reached the mountaintop, but I feel like I'm at the bottom. It is an usual thought that I will become a role model when I reach the top of my profession." (Lise)*

This implies that female tech entrepreneurs should be encouraged to become visible as role models and mentors and ignore that there exists a threshold you have to reach before contributing. Like Kuratko *et al.* [49] mentions, the importance of mentoring for entrepreneurs should never be overlooked, as some of the most successful entrepreneurs often recall the special help they receive from a mentor early in the development of their ventures. Anna also mentioned that new networks, platforms and measures with the female in focus are the way to get more women involved in tech entrepreneurship and entrepreneurship in general.

5.2.4 The way Forward

In Norway, several organizations, incubators and communities offer help and support to newly established entrepreneurs through different technical platforms, events and programs. According to Marlow and McAdam [10] there is a lack of acknowledgement of the gendered presumptions and environment shaping the entrepreneurial support that is provided by incubators and organizations. At the end of each interview, every participant was asked if they felt a service, platform, or technology was missing during their journey that could have helped them on

their way. Several participants could not address that they missed something concrete since every entrepreneurial journey is different. Hence they reflected on what they thought could be helpful based on their journey.

Regarding the technical platforms provided by various entrepreneurial organizations and incubators, Lise expressed that she had read about such things everywhere but never used any of them. Other participants argued why such platforms do not apply to them and that creating a platform that helps every entrepreneur is almost impossible.

> "*None of the platforms is good enough or tailored to each individual or meets all your needs, so you end up not using them.*" *(Mari)*

Following Mona's reflection on platforms, they were often too generalising in addition to existing initiatives. From previous experience with such things, several participants concluded that you could not get the primary journey of an entrepreneur down to a fixed path. To succeed as a tech founder, you must combine different methods and be flexible enough to try out new and other ways of building the business and learn from your mistakes.

Even though the participants' experience with platforms and initiatives had not been a success, some suggested what would work, especially for early female tech entrepreneurs that often lack a wide network they can get help from. One suggestion was to provide frameworks and the usual features that cost a lot for newly established tech companies. It was noticed that when you build a company from scratch, it is costly to put all the necessary legal agreements and contracts. Ingrid said she missed a tech innovation network that does not cost a fortune founders can not afford. She was inspired by the US, where business development centres are sponsored by the state and various organizations and collaborate with universities. There you can get advice and help from nearly finished law students with legal issues, which usually will cost a lot here in Norway. Going back to the principle of having a network, Anna suggested a digital platform with access to a community where one can spar with other like-minded tech entrepreneurs. A more innovative mentoring scheme was also mentioned as a valuable service to have as an early established tech entrepreneur. Reflecting on the participants' answers, it is visible that the value lies a lot in the network and successful mentor guidance, not necessary in the available platforms or initiatives.

Chapter 6

Proposed Solution

In this chapter, the proposed solution which resulted from the research methodology (4.1) will be presented in detail from the idea face (Section 6.1), to the developing of the prototype (Section 6.1.4), and the results from the user testings (Section 6.3).

6.1 Idea

Looking at the results from the SMS [5] and interviews, it was noticed common denominator that the lack of networking opportunities among female tech entrepreneurs, and female entrepreneurs in general, is a big problem. Smaller networks mean lower opportunities for reaching out to a mentor when help or advice is needed to continue the entrepreneurial journey of turning an idea into a startup. From the interviews in Chapter 5, there was observed an assumption of dissatisfaction with the mentor opportunities provided through entrepreneurial organizations since they risked being provided with not like-minded mentors that were given through a manual mentor scheme. The interview participants also mentioned uncertainty about how they could contribute to encouraging more women towards their field, which this idea will help solve.

The author decided to develop a mobile application prototype that could connect mentees with mentors more efficiently than the mentor programs existing in Norway today. The application is based on a technology that matches the mentee with a mentor on a series of criteria connected through an algorithm. The author chose to name the application *TechSpire*, which is a combination of the term *technology* and *inspire*. TechSpire also contains other innovative features that make the user experience of the mentor matcher more efficient for every user, which will be further explained in the guidelines.

6.1.1 Guidelines

After the data was gathered from the SMS [5] and interviews (Chapter 5), the author proposed the following guidelines for an application that connects female early-stage entrepreneurs or women in tech with an idea with mentors through an algorithm. Table 6.1 shows the guidelines, segmented into category, as well as their rationale.

Goal	Guideline
The mentee will be able to register a profile and configure it with necessary information.	The registration of a new user should be intuitive and recognizable.
	Field for personal information like name, mail and phone number. Profile picture can be uploaded.
	The user should be able to provide information about background, stage of entrepreneur, interests and location.
	As a newly registered user, information about the application should be presented.
	The user should be able to edit the configured information.

Table 6.0 – continued from previous page

Goal	Guideline
Design a mentor scheme where the user have the ability to select preferences and status of situation.	The users level of process with the idea or startup should be measured.
	The user should be able to choose the gender of the mentor.
	The user should be able to select preferred experience from possible mentors.
	The user will be matched with one or more mentor candidates depending on the information provided in the scheme.
	The user selects a mentor and waits on response.
Providing a effective feature for time of meetup decision.	The user should be able to select which time and dates the person is available.
	The user will receive a suggestion of meeting time based on the persons provided information.
	The user has the option to accept the meeting time and send it to its personal calendar.
	The user should be able to change the provided information in the calendar system.
Low treshold communication opportunities between mentee and mentor.	The user should be able to communicate with the selected mentor though chat.

Table 6.0 – continued from previous page

Goal	Guideline
Providing a feedback system with scores.	The user should be able to score the value of the mentormeeting.
	The user should be able to write feedback to the mentor.
	A score should be provided to the user after the meeting has happened.
	The score system should encourage the user to apply for a new mentor meeting.

Table 6.1: Guidelines for designing an application to motivate women to become or continue as tech entrepreneurs.

6.1.2 Overview of Existing Products

Before defining guidelines for the application, the author searched the market for similar existing solutions to ensure the originality and novelty of this application. In Norway, several organizations working with entrepreneurship offer mentor schemes and programs, but they are done manually, not by an algorithm. The author could not find any similar solution targeting female tech entrepreneurs or entrepreneurs in general.

The closest technology discovered was the Mentorloop[1], a technology platform that provides an equitable matching algorithm to match mentees with mentors. The Mentorloop's mission is to help organisations and their people to achieve better results in life and work through their accessible approach to mentoring. Hence, their targeted user group is much broader than the users of TechSpire, since it focuses on already established companies rather than entrepreneurs.

Another technology found was the Stack.by.me[2] application to encourage more women to invest through digital courses and features. It does not contain any intelligent algorithm with the same purpose as TechSpire. Still, the application shares the same vision of increasing the number of females in male-dominated industries and solving SDG 5. Stack.by.me was included in the idea face of TechSpire as an inspiration.

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[1] https://mentorloop.com/
[2] https://stackby.me/

6.1.3 Targeted User

Regarding the purpose of the application to decrease the gender gap in Norwegian tech entrepreneurship, the main user is female early stage entrepreneurs or women in tech with an idea. This user goes also under the name *mentee*, which means "one who is being mentored[3]". The most crucial criterion is that the user must be familiar with the startup subject and seeks help to continue or discuss their ideas or challenges.

Since the application depends on mentors, the second user target is relevant people who maintain knowledge about the domain that the first user group seek for guidance. Examples of a mentor's experience and required acquaintance could be founding a tech startup, legal rights connected to founding and entrepreneurship, investment, technical skills related to entrepreneurship etc. These examples are based on the data from the interviews (Chapter 5) and the SMS [5]). This user group goes under the term *mentor*, which means "a trusted counsellor or guide[4]".

Due to the time constraint of this project, the prototype design was only developed and tested for the mentee user group. Since the purpose of the research is to design software to reduce the gender gap in Norwegian tech entrepreneurship, it was deemed sufficient to prioritize the mentee's application experience.

6.1.4 Sketches

To better visualise the idea and concept provided by the guidelines, the author drew initial sketches of the application on an iPad (Figure 6.1). Together with the guidelines, the sketches were used as a suggestion for the implementation of a prototype in Figma. The concept of sketching helped the author realise which features should be on what page of the application, making prototyping in Figma easier and less time-consuming.

6.2 Prototype in Figma

The development phase of the design and creation strategy was completed by applying the previous section's guidelines and sketches into a more advanced Figma prototype. This section will discuss the design of TechSpire in relation to the intended functionality.

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[3]https://www.merriam-webster.com/dictionary/mentee
[4]https://www.merriam-webster.com/dictionary/mentor
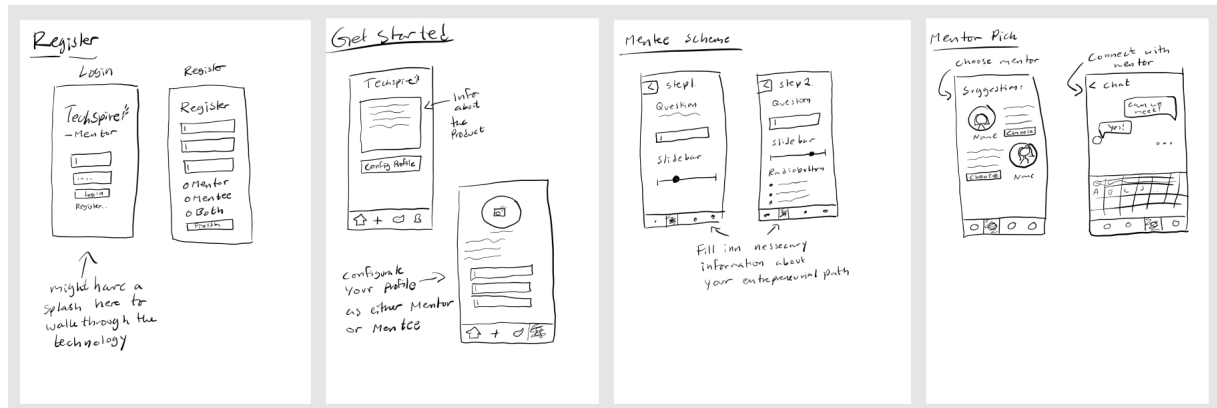
Figure 6.1: Sketches of prototype.

6.2.1 Design

To ensure a user-friendly design of the application, the six design principles of Don Norman [64] were conducted in the prototype development process in Figma. The application should be functional, easy to use, and intuitive to obtain a user-friendly design. The design principles are as follows:

Visibility: The greater the visibility of functions, the more probable it is that users will know what to do next. When functionalities are "hidden," it is more difficult to locate and understand how to use them.

Feedback: Feedback entails providing back information on what action has been taken and what has been accomplished, enabling the individual to continue the activity.

Constrains: The design concept of constraining relates to discovering strategies to restrict the type of user interaction that can occur at a given time.

Mapping: This relates to the connection between controls and their global effects. Almost all artifacts require a mapping between their controls and their effects, whether it is a flashlight, automobile, power plant, or cockpit. On a computer keyboard, the up and down arrows represent the up and down movement of the pointer, respectively. This is an example of a good mapping between control and effect.

Consistency: When designing interfaces with similar functions and elements for accomplishing similar tasks, consistency is achieved. Specifically, a consistent interface adheres to norms, such as selecting all objects with the same operation. Using the same input action to highlight any graphical object on the interface, such as always clicking the left mouse button, is an example of a consistent operation. Contrarily, inconsistent interfaces permit exceptions to the rule.

Affordance: A phrase used to describe a characteristic of an object that enables others to understand how to use it. By the way it is physically restricted in its plastic shell, a mouse button, for

example, encourages pressing (and hence clicking). At its most fundamental level, to afford implies "to provide a hint" [65]. When the affordances of a physical thing are perceptually evident, interacting with it is straightforward.

Figures are provided in this section to present the result of the prototype design. Figure 6.2, 6.3 and 6.4 visualise the first pages of the application TechSpire, where it can be seen the author implemented buttons that invited to be clicked with an informational purpose and therefore fulfilled the principle of Affordance. The principle of Visibility is also contained through the choice of colors and contrasts of the different features, and the the size of the elements makes it easier for the user to know how to use the application.
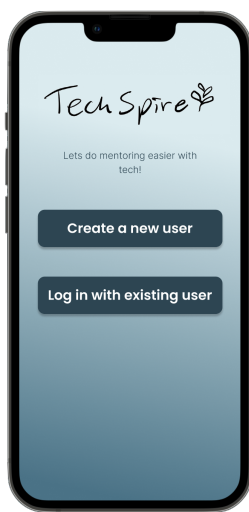
Figure 6.2: Login Screen in the TechSpire Prototype
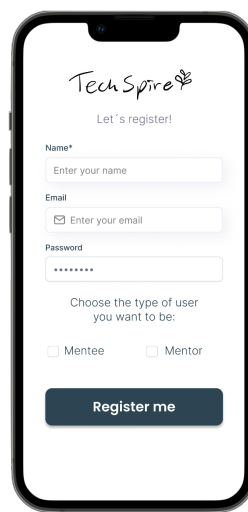
Figure 6.3: Register New User Screen in the TechSpire Prototype

Figure 6.4: Homepage with informal text Screen in the TechSpire Prototype

6.2.2   Mentor Scheme Feature

The mentor scheme functionality can be seen in figure 6.7 to 6.10, and consist of four main parts. The first one (6.7) measures how far the entrepreneur has come with their idea or startup. The measure is done through slide-bars, where the user must define the Technology Readiness Level (TRL)[5], Market Readiness Level (MRL)[6] and Solution Readiness Level (SRL)[7]. On the next part of the scheme, the user have the option to select the gender of the desired mentor and choose between preferred experiences (Figure 6.8). This selection helps the mentee to be matched with a mentor who can answer questions about the expected domain easier. The third part (Figure 6.9) is a time management feature where the user has to define available time slots. One the last part of the mentor scheme, the user is provided with either one or more choices of mentors (Figure 6.9). Key information about the mentor is provided with a profile picture, and more information will be provided when the user clicks on the mentor. Continuously when a part is finished, a progress bar on the top of the screen visualises the implementation process progress. This feature is intended to ensure the user that it will not take long to fill out the mentor scheme feature.

6.2.3   The Algorithm

The concept of making it easier and more innovative for mentees to access mentors is based on an algorithm that matches several user-provided elements and generates one or more suggestions of mentors the mentee can select to meet with. The entities are defined when the user configured the profile (Figure 6.5) and through the mentor scheme feature (Figure 6.7 and 6.8). Here the design principle "affordance" is central to making the entity decision intuitive for the user. After the entities are matched through the algorithm, the mentee will be provided with one or more suggestions of a mentor (Figure 6.10). The user selects its mentor and gets provided with a chat feature that is intended for communication between the mentor and mentee.

6.2.4   Meeting Time Management

The author developed a feature to manage the decision of meeting time as efficient as possible. The idea is that the mentee enters every hour available for the next couple of weeks, so the mentor can get an overview and suggest a suitable meeting time. This feature is intended to avoid unnecessary communication that usually happens when two people with different schedules try to find a meeting time that suits them both. The author suggests that it is relevant that the mentor receives an overview of the mentee's available time slots rather than

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[5]https://www.mentorworks.ca/blog/business-strategy/technology-readiness-levels/

[6]https://www.starbridgevc.com/market-readiness-levels

[7]https://www.canada.ca/en/department-national-defence/programs/defence-ideas/solution-readiness-level.html
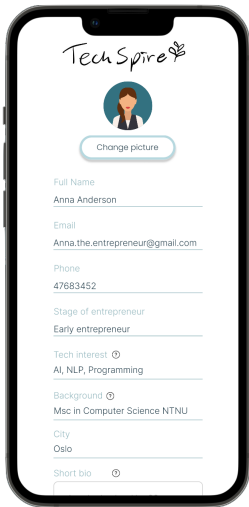
Figure 6.5: Configuration of Profile Screen in the TechSpire Prototype
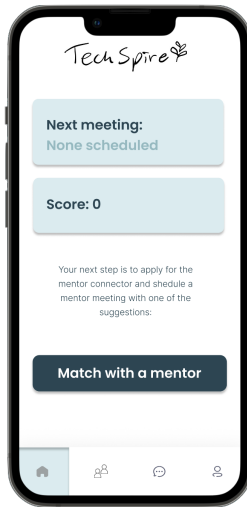
Figure 6.6: Homepage Screen in the TechSpire Prototype
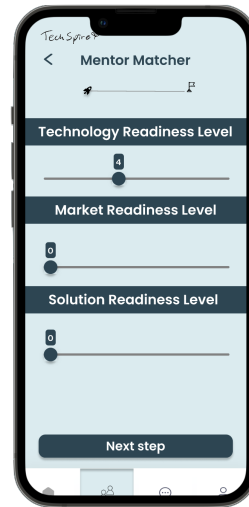
Figure 6.7: Mentor Scheme Step 1 Screen in the TechSpire Prototype

otherwise since the mentor is most likely in a higher position which indicates time constraints to availability. From the mentees' point of view, the application's time management system is presented in Figures 6.9 and 6.11.
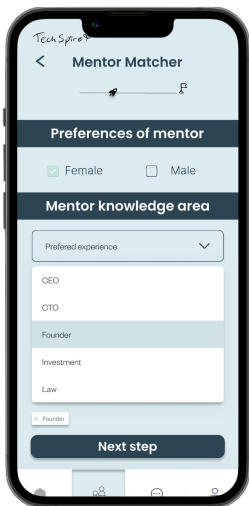
Figure 6.8: Mentor Scheme Step 2 Screen in the TechSpire Prototype
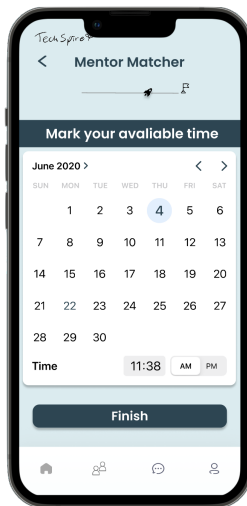
Figure 6.9: Mentor Scheme Step 3 Screen in the TechSpire Prototype
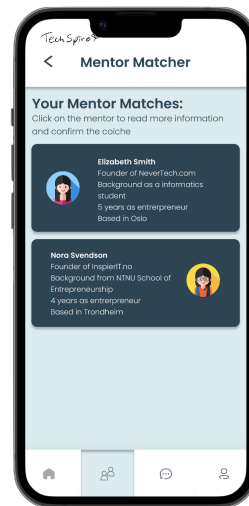
Figure 6.10: Mentor Scheme Step 4 Screen in the TechSpire Prototype

6.2.5   Feedback and Reward

It is evident that feedback allows for evaluating the mentor meeting, especially in the case of the mentor, who will be able to self-evaluate and grow from the process. Figure 6.13 shows how the feedback feature is visualised. The feedback system is also intended to provide the mentee with a score based on the number of stars received from the mentor. The mentee is encouraged to increase the score since a certain amount will result in a gift. The reward can vary depending on the score level and should be something related to the entrepreneurial field, like tickets to a conference. The reward system is an example of how gamification [66] is implemented to encourage the user to continue using the application. Figure 6.12 visualises the application's home screen where the users' score is presented.
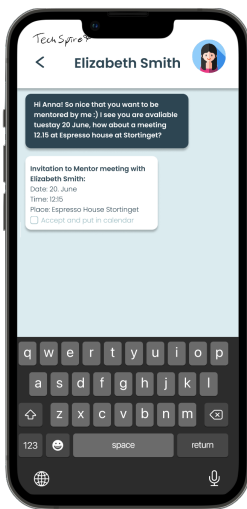
Figure 6.11: Chat Feature Screen in the Tech-Spire Prototype

Figure 6.12: Homepage with Score Feature in the TechSpire Prototype
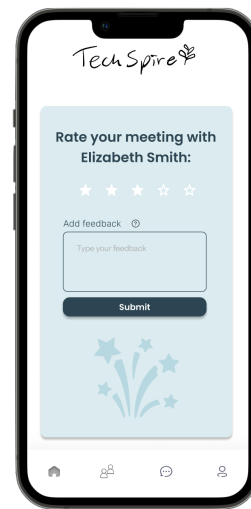
Figure 6.13: Feedback Feature in the TechSpire Prototype

6.3   User Testing

The author ran a total of 5 user tests on relevant female participants. The actual run-through of the prototype took about 15 minutes. This section presents the developed prototype's evaluation from the provided tasks given throughout the session, followed by the results and feedback on the application's design. When the participants were asked about what they thought was good with the application's design, all of them delivered positive and constructive feedback about improvements.

6.3.1   Tasks and Scenario

The author started the user test session with an informal introduction of the applications purpose. The participant were then introduced to a scenario that built up to the tasks. For each of the tasks (table 6.2) the participant navigated through the automated prototype demonstration provided by Figma. The author took notes on of the participants loud thinking and eventual struggles and hinders in the prototype. After completing the activities, users were requested to provide comments on what was excellent and what could be improved about the application. The user test guide, including scenario, is available in Appendix E Section E.2.

Task	Description
1	Register as a user on the application and fill out necessary information to configure your profile.
2	User the mentor-scheme to select a mentor and wait for acceptance.
3	Accept the mentors request of meeting and go back to the home screen.
4	Evaluate the meeting by rating the meeting and give feedback to the mentor.

Table 6.2: User test of prototype tasks.

6.3.2   Observations

Overall, the tasks went quite well for every participant. Considering the observations made throughout the process observation, each participant's performance on the offered tasks was satisfactory and intuitive. There were no outstanding concerns with any of the stages, only a couple of cases where the participant had to think for a couple of seconds before continuing. In the first step, some of the participants were not known the term mentee before. An introduction to the difference between mentee and mentor could be implemented in future

development. Regarding step 2, most participants experienced missing some explanation on the meaning of the terms used to measure the mentee's level of entrepreneurship (Figure 6.7). The icon of the mentor scheme in the menu-bar was also experienced as misleading by some. The author noticed that one of the participants struggled with finding the chat notification and missed a decline button of the proposed meeting time in the request from the mentor. Several participants struggled to understand the concept of the score feature when they tested step 4 (Figure 6.12). All notes from the task observation and the complete feedback from the participants can be found in Appendix F.

6.3.3 Positive Feedback

After the tasks were finished, every participant commented that the design was nice and clear. With the use of contrasts and intuitive functions, it felt easy to navigate through the service. It helped that the buttons were visible and indicative. It was also simple to implement the correct information where it was required, and several participants felt the requirements were thorough and made sense of how the mentor scheme works. One participant mentioned that it could often be challenging and confusing when an application provides too many different steps and features, but TechSpire felt more straightforward.

The meeting time management tool was also well welcomed by all participants. The participants appreciated the chat feature, which made interacting with the mentor simpler than if they had to use an external communication system in addition to this application. Several participants indicated that the scoring mechanism could encourage application usage. Regarding mentor selection, it was considered beneficial to gather information on the mentor or mentors with whom one was paired. The mentor is responsible for contacting the mentee, which makes the entire process of choosing a mentor more comfortable. The participants enjoyed the progress bar since it gives the user an estimate of how long it will take to finish the scheme. It was stated that such forms typically take a while to complete, therefore a visible speed indication is motivational.

6.3.4 Suggestion of Improvements

Moving on to the more constructive feedback, which works as suggestions for improvement, all participants missed more explanations on the first step of the mentor scheme. It should not be expected that early entrepreneurs are familiar with the definition and meaning of terms such as TRL, MRL and SRL. The user should also be informed that it is acceptable to measure the level of entrepreneurship at zero for those who are very new to the field and do not have something particular developed according to the terms.

Several participants commented that the score feature should be explained since it was somewhat hard to understand what they could gain from it and what the score was based on. It was also mentioned that the user should be able to clarify if there exists a team with the mentee

working on the startup or if the user is working alone, which could be valuable for the mentor to be aware of before the meeting. An additional suggestion of improvement was the users' possibility to add the expected goal of the meeting and maybe a sentence about a particular problem, if there exists one, to inform the mentor prior. The categories could also be expanded regarding the selection of preferred experiences expected from the mentor. It should also be possible to select more than one qualification. Some reacted with dissatisfaction that you were obligated to choose either a male or female mentor when it should be possible to select both since some users might not have a preference about the mentor's gender.

One of the participants highlighted that the reward and feedback system should be improved to prevent users from misusing the application only to increase their score amount. The scoring system could also be based on specific indicators calculated on the feedback from both parts of the meeting. When the user received the mentor's meetup request, several participants missed a decline feature in case something came up during the available time. One suggestion was to make the time management system editable subsequently. Another suggestion was to make it possible to synchronize the service with the user's personal calendar to make it even more effective.

6.4   Evaluation through Semi-Structured Interviews

To evaluate the participants' experience of the application's potential, each participant was asked four questions after the prototype run-through. The semi-structured interview lasted about 15 minutes, and the questions can be seen in Appendix E Section E.4. After the data was collected from every interview, the author analyzed the answers and implemented them into an Excel sheet to get a better overview of the data belonging to each question. The participants' responses are listed according to the respective question in Appendix G. Three themes based on the first three questions emerged in the analysis containing the most relevant findings from the interviews and will be presented in the following subsections. The last question was not considered valuable to contribute to the findings because it mainly provided suggestions unrelated to the scope of this research.

6.4.1   Towards a Better Way

The participants were asked to reflect around the following question in the beginning of the semi-structured interview:

> *How do you feel this application is a better or worse way to get in touch with a mentor?*

One participant reflected that if you are a student at NTNU, you can relatively easily be

provided with a mentor through Spark*[8], an initiative helping students with entrepreneurial activities. Hence, she thought this application benefits those who are finished with their studies or students from other universities without access to organizations like Spark*. Her impression was that after you have completed your studies and have an idea you want to develop, you can feel lost and struggle with finding the correct information you seek as an entrepreneur. In this scenario, TechSpire was deemed very useful.

Another participant who had received a couple of mentors from different programs earlier expressed that TechSpire proved like a more low-key method to obtain a mentor than she previously had experienced. One also reflected that this service provides an easy and efficient way to find a meeting time that suits both the mentee and mentor, which is very good compared to her previous experiences with mentor meeting setups. It was also mentioned that the service is experienced as beneficial because of its low-key way of getting in touch with mentors and role models. The same participant usually had to call around and build a certain legitimacy that made her appealing to the mentors, which could be a demanding process. She also stated that this technology would be preferred by female entrepreneurs since, in many cases, the males are more likely not to feel the same struggle when calling and reaching out to mentors.

In the research done by Kuratko *et al.* [49], it was found that when entrepreneurs are aligned with similar-thinking mentors, they are more likely to view their mentorship experience as successful and surpassing their expectations. Several participants mentioned the value of connecting with a female mentor and a role model through the application was very accessible and valuable because of the mentor scheme technology. One said that it seems that this application will increase the chance to be provided with a mentor that you can build a friendship with, which could be very beneficial if you want to reach them more often to ask questions and help on a more friendly basis. Several participants highlighted the ease of getting in touch with a person who is interested in you as an entrepreneur and your ambitions, which is provided through the application. The process becomes more comfortable when you know you will be in contact with someone who wants to meet you and help you and knows some information about you before the meeting. That prevents the uncertainty that could arise when you have to contact a mentor on its initiative on other platforms, and you are not sure if the person will respond yes or no to meet.

6.4.2 Motivation Boost

The second question of the semi-structured interview was:

> *Do you feel the service provided by the application increases your motivation and interest in tech entrepreneurship, and how?*

All five participants responded with positive reflections that they believed the service had a great potential to reach its goal, and several of them also brought up some constructive opin-

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[8]https://www.sparkntnu.no/

ions the author had not thought through before developing the application. One of the participants expressed that the fact that you can easily connect with a role model within tech would be inspiring and encourage her to continue with the process of founding a tech startup. Another stated that the motivation increases after having a mentor who fits the entrepreneur's expectations. It was also mentioned that since there are many things you have to think about in the beginning phases of the founding process, you might not dare to continue without the right help. Further, it was noted that TechSpire is a service where the mentors provide their time to help early entrepreneurs, making it much less scary to ask them for help through the mentor scheme in the application.

One of the participants answered that she felt it depends on what the entrepreneurs get out of the meeting with the mentor. But at the same time, it is an excellent chance that an appointment with a mentor will be helpful and likely to encourage you to take the next step since you can share your idea and vision with someone more experienced and like-minded. Other participants reflected that in itself, it is essential to see others who are inside the environment. As a student with access to NTNU School of Entrepreneurship, you constantly see others doing the same thing as yourself. So when you do not have this environment, TechSpire would work as a channel to get in touch with other women who have their own startups and have been in the same situation, making it more casual to be a female entrepreneur. According to the research of Elliott *et al.* [50] female tech entrepreneurs develop an awareness of their entrepreneurial identity when they have access to a group of entrepreneurial women and role models in STEM, which compliments the participants' reflections on TechSpire's goals. Elliott *et al.* [50] also stated that having access to other female tech entrepreneurs enables them to decrease any apparent contradiction between themselves as an entrepreneur, the prevailing discourse of gender, and the entrepreneurial "norm" such as masculine preconceptions.

6.4.3 Potential of the Service

The third question of the semi-structured interview was as followed:

> *What do you feel about this technology's potential to encourage more women into tech entrepreneurship and founding of a tech startup?*

Several participants answered that the features provided through TechSpire could potentially encourage more women into tech entrepreneurship, at least if it is marketed to women. It was appreciated that the design was feminine and light, but at the same time, not exclusive to another gender. One expressed that this service will not necessarily work better for women than men, but because of the feature that allows you to choose the gender of the mentor was nice to have. She reflected that it makes it easier to reach out with a problem since she would prefer to meet a woman rather than a man in a vulnerable situation. One of the other participants highlighted that it is encouraging not to get a random mentor but rather one you have background information on and are closer to what you expect.

One participant felt that TechSpire as a service would at least get more women to consider it. Being able to talk with someone who has the experience and provides real insight into how things work with women, technology and entrepreneurship will work as encouraging and make it easier to assess whether the entrepreneurial path is right for you or not. Another stated that this application could mainly be beneficial for those in a very early stage of tech entrepreneurship or those who are hesitant and unsure of what they need help with. They could benefit and be encouraged after a meeting with a mentor through TechSpire. At the same time, it was mentioned that the service is also suitable for those motivated to start up anyway, who want to take a step back and get the help they need to get started properly, which could prevent an eventual failure later in the process. One expressed that she believed this application would motivate more girls to start up since this helps you take the next step after you have found an idea.

Another participant felt TechSpire had the potential to encourage women into founding a tech startup because of the easiness of using the user interface and features compared to contacting people on your own initiative. The application feels low threshold since you get rid of the small talk that often comes at the beginning because by using TechSpire the mentor and mentee are provided background information about each party in advance. It was highlighted that since the mentors are in charge of contacting the mentees, you feel they are interested in hearing about your ideas and ambitions. One expressed that the application makes the mentor experience much freer without many strict requirements compared to other organizations where others evaluate your vision, and you have to reach out to them actively.

Regarding the score feature that motivates the user to use the application, one of the participants specified that you have to make sure that the scoring system does not scare the users in fear of getting a bad result. She suggested that the user could be provided with certain tryouts before the scores are set so you do not risk getting a bad score the first time you use the service. Another participant also suggested some scaling potential to increase the purpose of the application, with functions that provide opportunities for newly established startups to find co-workers. A meetup function with an overview of different events with the same purpose hosted by other organizations was also mentioned as a suggestion for scaling.

Chapter 7

Discussion

In this chapter, the findings from the interviews presented in Chapter 5 and the proposed prototype of a solution developed and tested in Chapter 6 will be discussed in response to the research objective of this thesis and relevant theory. The most crucial experience-based characteristics retrieved from the interviews will be discussed in Section 7.1. How the findings from the interviews relate to the guidelines in the TechSpire prototype will be discussed in Section 7.2. In Section 7.3 the potential of the proposed solution will be discussed towards its purpose and the evaluation from the user tests. Limitations and implications are further explained at the end of this chapter.

7.1 Essential Experiences from Female Tech Entrepreneurs

The female tech entrepreneurs that participated in this research for the interview section outlined their learning experiences from positive to negative reflections on their founding journey in a highly masculine sector. Even though the network of female tech entrepreneurs is small in Norway, they seem able to mobilize their situation and create changes and new rules on their terms that challenge the typical norms and stereotypes connected to founding and running a tech startup. This aligns with the research of Kubberød *et al.* [4] where it was discussed that successful entrepreneurship is about *not* belonging and the opportunities this brings to subvert gender norms within the tech sector.

Regarding typical norms and stereotypes expected from tech entrepreneurs, it seemed that the female tech entrepreneurs found a way to appreciate their "differentials" related to perceived competencies and leadership styles. Some of them appeared encouraged to challenge the norms instead of adapting them to "fit in", which could be an ideal way to make the whole tech startup environment more applicable for women that want to join the field. There were also found advantages of the female leadership style that could help make the workplaces more diverse and suitable for every kind of employee. A founder mostly chooses the path and

competencies they desire to build into their business. By challenging the narrative that exists today in entrepreneurship, which is mainly dominated by men, new entrepreneurs can have the chance to combine elements seen by both genders' characteristics.

Founding a tech startup is known to be more exhausting and complex than a regular 8 hours job in an established tech company. The participants expressed their different thoughts on existing programs and organizations created to help entrepreneurs on their founder journey. A common dissatisfaction was noticed with the initiatives provided, and very few initiatives are aimed directly at female entrepreneurs, especially in the tech sector. This case might be connected to the fact that few female tech entrepreneurs are operating in Norway today. The initiatives could even negatively affect the tech entrepreneurs since the lack of diversity focus made them feel excluded from the environment. The participants did not express that they wanted to change this at first. Instead, they managed to continue their journey without participating in events and programs.

Several participants highlighted how they managed their own network of external sources to help them in their startup process, seemingly an essential factor of success for the entrepreneurs. Some expressed the importance of sparing with like-minded and experienced people who sympathize with the female journey in a male-dominated field. This emphasizes the work of Kuratko *et al.* [49] where they suggest that the similarity between newly established founders and more experienced mentors is a crucial factor influencing entrepreneurs' positive mentorship experiences and increasing their entrepreneurial motivation. On the other side, it was also specified from the interview analysis that if you have a mentor, the gender of the mentor does not necessarily make a big difference since each entrepreneurial journey comes with different viewpoints, experiences, and backgrounds. Still, the participants seemed to agree that there is a need for more diverse network opportunities, which could help female tech entrepreneurs to reach out a hand and feel included. Overall the value of mentorship and inspiration from role models were seen as an essential success factor in a male-dominated industry.

7.2   Guidelines Based on Success Factors and Challenges

Analyzing the success factors experienced by successful participants from the field was presumed necessary to develop software to increase the number of female tech entrepreneurs in Norway. The lack of network among female tech entrepreneurs and female entrepreneurs in general in Norway was a common struggle among all participants. One of the interviews' most interesting findings was that most participants were unsure how to contribute to helping solve the gender gap. According to the tech entrepreneurs that participated in the interviews, they all wanted to contribute to support and encourage other women in earlier founding stages. Still, they expressed a struggle with where to engage. It seemed that because of their common complaints against the many existing platforms and the overflow of information, a new platform was not the right way to go with developing software to solve the problem. Another surprising finding was noted when one of the entrepreneurs did not feel ready to be a mentor because she felt she had not reached the "top" yet. This was an unforeseen barrier that could explain

why several of the entrepreneurs was not sure how to contribute with their expertise. Stead [48] expressed that women at more advanced stages of their career may be helpful mentors in terms of developing socio-cultural and political intelligence in the tech industry for those with less experience. It seems that some of the female tech entrepreneurs could be hindered by mentoring other women because they feel they have not reached a certain advanced stage of their career. Observing the lack of female mentors and role models, it occurred a need for guidance on how they could provide their knowledge and experiences to motivate less experienced tech entrepreneurs.

Therefore, an application to simplify and streamline the connection between newly established entrepreneurs and more experienced founders and startup-related sources is proposed. The idea and guidelines of the prototype were mainly developed based on success factors and challenges retrieved from the interview data analysis but also influenced by the findings from the preparatory project [5]. From the interview analysis it was expressed that there exist no standardised path to entrepreneurship and is mainly formed by the individual self, which was crucial to keep in mind during the development. The author was also influenced by the entrepreneurs' disbelief towards platforms and mentor programs and tried to make the application as simple and intuitive as possible. An important key was to make the application aim at women and include features that differentiate the application from other redundant solutions and programs. When developing an idea of a technology marketed to women in a male-dominated sector, the user group size could be quite small. In addition, TechSpire will not work if the mentor part of the application is engaged through experienced founders and other startup-related stakeholders like investors, lawyers, leaders, etc. But disregarding the potential risks, the few female tech entrepreneurs in Norway would have a platform where they know their contribution will be valuable and gain something in return for themselves. According to Kuratko *et al.* [49], a founder's ability to be coached is essential for acquiring startup capital and increasing business development. Investors within the startup community view coachability as a crucial and one of the most significant criteria.

7.3 Encouraging Norwegian Female Tech Entrepreneurs with Technology

The evaluation of the prototype through user testing followed by semi-structured interviews provided helpful insight into the potential of the service towards solving "RQ2: How to design software to decrease the gender gap in Norwegian tech entrepreneurship?". According to the data collected from the prototype evaluation in Chapter 6, all participants noted a shared appreciation of the application. The concept of TechSpire as a service was perceived as original and unique compared to already existing solutions recognized by the participants. It was not just the aim toward female tech entrepreneurs that made the application original. The algorithm behind the mentor scheme was commented as an innovative streamlining of something usually done manually through different organizations and entrepreneurship programs. Several of the test participants highlighted how the application encourages female tech en-

trepreneurs since they can manage a meeting with a mentor selected by themselves through pre-selected preferences and criteria. This evaluation compliments some of the citations from the interview data collection (Chapter 5), and indicates that TechSpire has the potential to motivate more women with background from or interest in technology to enter the entrepreneur industry with their startup ideas.

Even though the prototype and its features were seen as promising, certain pitfalls were noticed that could affect the purpose of the application. The score and reward feature was implemented intended to motivate the users to use the application. From the data collected from the evaluation, it was discovered that the scoring system could work as a barrier to first-time users in fear of getting a bad score or reward that could result in a demotivating experience of the technology. Another interesting observation of a potential pitfall was the selection of gender preference in the mentor scheme. Based on the opinions of the test participants, you should be able to select not only one of the gender but both of them if you do not have any preferences. This aligns with one of the reflections from the interviews in Chapter 5 where the mentors' gender did not necessarily make a big difference for all women. It could indicate the importance of not providing an application that becomes biased towards the users who do not mind the gender of the mentor but perhaps instead value the mentor's area of competencies and experience. The pitfalls noticed through the evaluation are important to address regarding further development so that the software could reach its goal of a diverse tech entrepreneurs environment in Norway. This also shows the importance of running user tests during the development of a product.

In the data retrieved from the interviews in Chapter 5, it was expressed uncertainty of how the female tech entrepreneurs could contribute and engage in decreasing the gender gap in tech entrepreneurship. After realizing that the application was encouraging and appreciated by the test participants, this application is suitable for those who want to contribute to solving the problem and, at the same time, have the potential to receive something valuable in return. As mentioned in the last section, TechSpire, as a developed software, depends on people who register as mentors on the application. Then the mentees get a more comprehensive selection of desired criteria in the mentor scheme. Therefore it is vital to promote the application where the relevant stakeholders are to increase the usage and efficiency of the algorithm. There could also be a potential to provide the technology through organizations in the Norwegian entrepreneurship environment like StartupLab, Innovation Norway, and other incubators.

7.4   Future Development of the Application

The application was deemed viable for future development based on the positive responses of the user test participants. Since the application was not finished, the user tests also collected the necessary information about changes and suggestions for new features that should be implemented in the next iteration of the development. Primarily, the mentor user part of the application should be developed in Figma and tested the same way as the mentee part presented as a solution in this study. After the evaluation from the mentor perspective is retrieved, the

algorithm can be developed with code. Continuously if the algorithm work toward its purpose, the interface can be created and result in an Minimum Viable Product (MVP). Further, there should be a new iteration of user testing with the MVP to collect new feedback and suggestion for changes to achieve the potential of the application as presented in this study.

7.5   Implications

The research of this study highlights several implications for practice. The mentor programs and solutions in the Norwegian entrepreneurial society present barriers to early-stage female tech entrepreneurs due to confusing platforms and miss-matches between provided mentors and the mentee. The respondent of the prototype user test addressed their belief and appreciation of a technology that could streamline obtaining successful guidance and inspiration through a mentor. To attract a new generation of women into the tech founding sector, Tech-Spire has a great potential to distribute mentor meetings for women in tech entrepreneurship that will decrease the gender gap in Norwegian tech entrepreneurship. Additionally, studying female entrepreneurs in the technology sector contributes to the limited number of empirical studies on the intersection of technology entrepreneurship and gender equity.

7.6   Limitations

The sample size of the interviews in this study was affected due to the limited number of female tech entrepreneurs available to participate in this Norwegian study context. The author contacted several relevant contributors through e-mail and LinkedIn, but receiving answers was difficult and time-consuming, even though it was sent multiple requests. However, transcribing and analysis in line with idiographic commitments like the IPA is time-consuming, so the author was satisfied with having at least five participants. It is also worth mentioning that the theory used to complement this research was often based on gender and entrepreneurship without the technology part, which is a critical element in the research of this study. However, since there was a lack of theory covering all of the details in the same research context, general insight about gender equity and entrepreneurship was valuable to include in this research.

Due to the time constrain of this research period, only the mentees' perspective of the Tech-Spire application was developed in Figma and evaluated through user tests on relevant participants. To achieve a total evaluation of the potential of TechSpire, the full application should be developed in Figma and user-tested on every perceived group of users. However, since the research objective of this study was to propose a design of software to encourage early-stage entrepreneurs to continue establishing a tech startup, it was considered sufficient to prioritize the mentee part of the application.

Chapter 8

Conclusion

This study extends entrepreneurial learning and gender equity research by providing an understanding of Norwegian female tech entrepreneurs' experiences in a male-dominated tech industry. The study suggests a solution on how technology could help encourage more women to found tech startups, based on the learned experiences women tech entrepreneurs.

The research signifies that women with tech entrepreneurial interests struggle due to a lack of including networks, like-minded mentors, and inspirational role models. Female tech entrepreneurs appear to have learned to deal with and manage these disadvantages and other problems and subvert the conventional culture of entrepreneurship in technology. However, there was uncertainty about how they could contribute with their knowledge and experience to encourage more women to choose the same path. This research contributes to developing insight on how technology can streamline the mentorship process by designing a mentor scheme software based on an algorithm.

Likewise, the evaluation of the application proposed in this study clarifies that the application has the potential to enable women entrepreneurs motivation, inspiration, and guidance through a mentor with expected qualifications and experience. Additional features that streamline the user experience of the mentor scheme process raise the users' interest in using the technology. TechSpire also makes it easier for Norwegian tech entrepreneurs to engage in the shared responsibility of achieving gender equality in the tech startup industry.

8.1   Future Work

The prototype design of TechSpire should be developed further in new iterations based on the evaluation from the user tests. A suggestion for future work also includes a further addressing gender diversity and tech entrepreneurship topics which were not included in this proposed solution of a prototype. An empirical investigation of the factors found in the SMS [5] that were

not covered in the research of this thesis, could provide new guidelines for future technologies and software designs intended to decrease the gender gap in tech entrepreneurship. In the same way, since the scope of this research is based on the experiences of Norwegian female tech entrepreneurs, further research could extend the study to other countries in new contexts.

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Appendix

1. Appendix A: Application to NSD

2. Appendix B: Consent Form for the Interviews

3. Appendix C: Semi-Structured Interview Questions

4. Appendix D: Consent Form for User Tests

5. Appendix E: User Test Guide

6. Appendix F: Feedback from the User Test

7. Appendix G: User Test Evaluation - Answers from Semi-structured Interview Answers

Appendix A

Application to NSD

Contains the assessed application from the Norwegian centre for research data (NSD) which states that the author can carry out the research.

(Starts on the next page)

NSD NORSK SENTER FOR FORSKNINGSDATA

Meldeskjema

Referansenummer

947244

Hvilke personopplysninger skal du behandle?

- Navn (også ved signatur/samtykke)
- Fødselsdato
- E-postadresse, IP-adresse eller annen nettidentifikator
- Bilder eller videoopptak av personer
- Lydopptak av personer
- Bakgrunnsopplysninger som vil kunne identifisere en person

Beskriv hvilke bakgrunnsopplysninger du skal behandle

Personens kjønn, alder, yrke og utdanning.

Prosjektinformasjon

Prosjekttittel

IT3920 - Master Thesis for MSIT - Gender diversity in tech entrepreneurship

Prosjektbeskrivelse

IT3920 - Master Thesis for MSIT - spring semester 2022 at NTNU

Begrunn behovet for å behandle personopplysningene

Jeg ønsker å vite mer om hvordan det er å være kvinnelig tech entreprenør og være med å starte en tech startup. Derfor er enkelte personopplysninger som kjønn, alder, yrke og utdanning relevant informasjon. For å samle informasjonen vil jeg gjennomføre intervjuer. Intervjuene vil skje fysisk eller digitalt over videosamtale avhengig av hvor de relevante intervjuobjektene holder til.

Ekstern finansiering

Type prosjekt

Studentprosjekt, masterstudium

Kontaktinformasjon, student

Alis Wiken Wilson, alis.w.wilson@ntnu.no, tlf: 99242826

Behandlingsansvar

Behandlingsansvarlig institusjon

Norges teknisk-naturvitenskapelige universitet / Fakultet for informasjonsteknologi og elektroteknikk (IE) / Institutt for datateknologi og informatikk

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Letizia Jaccheri, letizia.jaccheri@ntnu.no, tlf: 73593469

Skal behandlingsansvaret deles med andre institusjoner (felles behandlingsansvarlige)?

Nei

Utvalg 1

Beskriv utvalget

Kvinnelige tech entreprenører som har studert eller jobbet med teknologi før startupen ble opprettet.

Rekruttering eller trekking av utvalget

Jeg har samlet en liste over kvinnelige tech entreprenører gjennom mitt nettverk på NTNU og observasjoner på LinkedIN og i media.

Alder

20 - 60

Inngår det voksne (18 år +) i utvalget som ikke kan samtykke selv?

Nei

Personopplysninger for utvalg 1

- Navn (også ved signatur/samtykke)
- Fødselsdato
- E-postadresse, IP-adresse eller annen nettidentifikator
- Bilder eller videoopptak av personer
- Lydopptak av personer
- Bakgrunnsopplysninger som vil kunne identifisere en person

Hvordan samler du inn data fra utvalg 1?

Personlig intervju

Grunnlag for å behandle alminnelige kategorier av personopplysninger

Samtykke (art. 6 nr. 1 bokstav a)

Informasjon for utvalg 1

Informerer du utvalget om behandlingen av opplysningene?

Ja

Hvordan?

Skriftlig informasjon (papir eller elektronisk)

Utvalg 2

Beskriv utvalget

Personer som er grundere av en nyopprettet startup eller studenter som vurderer å bli grundere etter studiet.

Rekruttering eller trekking av utvalget

Jeg har samlet en liste over relevante interessenter gjennom mitt nettverk på NTNU

Alder

18 - 40

Inngår det voksne (18 år +) i utvalget som ikke kan samtykke selv?

Nei

Personopplysninger for utvalg 2

- Navn (også ved signatur/samtykke)

Hvordan samler du inn data fra utvalg 2?

Personlig intervju

Grunnlag for å behandle alminnelige kategorier av personopplysninger

Samtykke (art. 6 nr. 1 bokstav a)

Annet

Beskriv

Brukertest av prototype. Målgruppen (utvalget) vil teste funksjonalitet, interaksjon og forståelse av innhold, og testannsvarlig vil inneha en observerende/veiledende rolle. Resultatene fra hver deltaker i brukertesten vil bli registrert og og beskrevet i oppgaven. Hver deltaker vil være anonymisert.

Grunnlag for å behandle alminnelige kategorier av personopplysninger

Samtykke (art. 6 nr. 1 bokstav a)

Informasjon for utvalg 2

Informerer du utvalget om behandlingen av opplysningene?

Ja

Hvordan?

Skriftlig informasjon (papir eller elektronisk)

Tredjepersoner

Skal du behandle personopplysninger om tredjepersoner?

Nei

Dokumentasjon

Hvordan dokumenteres samtykkene?

- Elektronisk (e-post, e-skjema, digital signatur)

Hvordan kan samtykket trekkes tilbake?

Ta kontakt med letizia.jaccheri@ntnu.no

Hvordan kan de registrerte få innsyn, rettet eller slettet opplysninger om seg selv?

Ta kontakt med letizia.jaccheri@ntnu.no

Totalt antall registrerte i prosjektet

1-99

Tillatelser

Skal du innhente følgende godkjenninger eller tillatelser for prosjektet?

Behandling

Hvor behandles opplysningene?

- Ekstern tjeneste eller nettverk (databehandler)

Hvem behandler/har tilgang til opplysningene?

- Student (studentprosjekt)
- Databehandler
- Prosjektansvarlig

Hvilken databehandler har tilgang til opplysningene?

Microsoft Teams vil benyttes til lagring av intervjuene i en privat kanal der bare jeg og veileder vil ha tilgang til dataene. NTNU har en databehandleravtale med Microsoft, og alle tjenestene er beskyttet med passord.

Tilgjengeliggjøres opplysningene utenfor EU/EØS til en tredjestat eller internasjonal organisasjon?

Nei

Sikkerhet

Oppbevares personopplysningene atskilt fra øvrige data (koblingsnøkkel)?

Ja

Hvilke tekniske og fysiske tiltak sikrer personopplysningene?

- Opplysningene anonymiseres fortløpende
- Adgangsbegrensning

Varighet

Prosjektperiode

14.01.2022 - 31.12.2022

Skal data med personopplysninger oppbevares utover prosjektperioden?

Nei, data vil bli oppbevart uten personopplysninger (anonymisering)

Hvilke anonymiseringstiltak vil bli foretatt?

- Personidentifiserbare opplysninger fjernes, omskrives eller grovkategoriseres
- Koblingsnøkkelen slettes
- Lyd- eller bildeopptak slettes

Vil de registrerte kunne identifiseres (direkte eller indirekte) i oppgave/avhandling/øvrige publikasjoner fra prosjektet?

Nei

Tilleggsopplysninger

Appendix B

Consent Form for the Interviews

The consent form gives potential research participants sufficient written information to determine whether or not to join in a research study, based on a description of the planned research and the nature of the requested participation.

(Starts on the next page)

Vil du delta i forskningsprosjektet

"Gender equality and tech entrepreneurship in Norway"?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å undersøke grunner til at kjønnsgapet i startup-miljøet for teknologibedrifter eksisterer, og hvilke tiltak som kan gjøres for å oppnå kjønnsbalanse i norsk entreprenørskap innenfor teknologi. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål

Forskningsprosjektet er et masterprosjekt ved Institutt for datateknologi og informatikk (IDI) ved Norges teknisk-naturvitenskapelige universitet (NTNU). Masterprosjektet er en del av NTNU-prosjektet

Software For A Better Society, ledet av professor Letizia Jaccheri, som handler om hvordan man kan bruke IT til å bidra mot FNs bærekraftsmål. Dette masterprosjektet fokuserer på FNs bærekraftmål 5 om likestilling mellom kjønnene, spesielt delmål 5.5. Målet med prosjektet er å samle relevante erfaringer fra kvinner som har startet en teknologibedrift og hvordan vi kan bruke IT til å minske kjønnsgapet i det norske teknologi-entreprenørskaps miljøet.

Hvem er ansvarlig for forskningsprosjektet?

Masterprosjektet utføres av Informatikkstudent Alis Wiken Wilson og veiledes av professor Letizia Jaccheri ved IDI NTNU.

Hvorfor får du spørsmål om å delta?

Du får spørsmål om å delta på grunn av din rolle som entreprenør og gründer av et teknologi-selskap. Vi har fått kontaktinformasjonen din etter å ha kontaktet deg på LinkedIn. Din deltakelse vil bidra til å gi innsikt i hvordan det er å starte en teknologi-bedrift i en mannsdominert sektor, som videre vil brukes til å utvikle IT løsninger til å motivere flere kvinner til å delta i entreprenørskap innen teknologi.

Hva innebærer det for deg å delta?

Om du velger å delta, vil du bli med på et semistrukturert intervju for å innhente informasjon om dine erfaringer som entreprenør i en mannsdominert sektor. Dette intervjuet vil ta deg ca. 45 minutter å gjennomføre. Det blir tatt lydopptak av intervjuet som skal brukes til å transkribere og analysere den innhentede dataen i ettertid.

Det er frivillig å delta

Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket. Det vil kun være studenten og veileder, som nevnt tidligere, som har tilgang til opplysningene.

Navn og kontaktopplysninger om deg vil bli erstattet med en kode som lagres på en egen navneliste adskilt fra øvrige data. Datamaterialet blir lagret på Microsoft Teams. NTNU har en databehandlingsavtale med Microsoft, og alle tjenestene er beskyttet med passord og tofaktorautorisering. Stipendiaten som gjennomfører og transkriber intervjuene blir eneste med tilgang til lydopptakene fra intervjuene.

Intervjudeltakere vil ikke kunne gjenkjennes i publikasjon.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?
Opplysningene anonymiseres når prosjektet avsluttes/oppgaven er godkjent, noe som etter planen er 31.12.2022. Etter dette vil datamaterialet bli anonymisert. Alle lydopptak vil da bli slettet.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra NTNU har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:
- innsyn i hvilke opplysninger vi behandler om deg, og å få utlevert en kopi av opplysningene
- å få rettet opplysninger om deg som er feil eller misvisende
- å få slettet personopplysninger om deg
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger

Hvis du har spørsmål til studien, eller ønsker å vite mer om eller benytte deg av dine rettigheter, ta kontakt med:
- NTNU - Norges teknisk-naturvitenskapelige universitet ved student Alis Wiken Wilson på epost (alis.w.wilson@ntnu.no) eller telefon: 992 42 826
- NTNU - Norges teknisk-naturvitenskapelige universitet ved hovedveileder Letizia Jaccheri på epost (letizia.jaccheri@ntnu.no) eller telefon: 918 97 028
- NTNUs personvernombud ved Thomas Helgesen på thomas.helgesen@ntnu.no

Hvis du har spørsmål knyttet til Personverntjenester sin vurdering av prosjektet, kan du ta kontakt med:
- Personverntjenester på epost (personverntjenester@sikt.no) eller på telefon: 53 21 15 00.

Med vennlig hilsen

Alis Wiken Wilson
Prosjektansvarlig
(Student)

27.01.2022

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet "Gender equality and tech entrepreneurship in Norway" og har fått anledning til å stille spørsmål. Jeg samtykker til å delta i semistrukturert intervju der det blir tatt lydopptak, og at mine opplysninger behandles frem til prosjektet er avsluttet ca. 31.12.2022.

(Signert av prosjektdeltaker, dato)

Appendix C

Semi-Structured Interview Questions Guide

C.1 Norwegian Guide

1. Hvordan vil du beskrive reisen din som gründer av en tech startup?
2. Hva oppmuntret deg til å bli tech gründer?
3. Hvordan var de forskjellige fasene av oppstarten?
4. Har du noen gang opplevd utfordringer med tanke på følgende faktorer: Familieliv, Mangel på kompetanse, Stereotypier?
5. Kan du nevne noen suksessfaktorer som har hatt positiv innvirkning på gründer-reisen din?
6. Har du et nettverk/mentorer/støtte som har hjulpet deg?
7. Føler du at det manglet et initiativ/en plattform som kunne gjort entreprenørskapet enklere å jobbe med?
8. Hvordan kan du bidra til å oppmuntre flere kvinner til å bli teknologientreprenører?

C.2 English Guide Translation

1. How will you describe your journey as a tech entrepreneur/founder/co-founder?
2. What encouraged you to start this journey with founding a tech company?
3. How were the different phases of the startup founding?
4. Have you ever experienced any of these challenges/obstacles: Family life, Lack of competences, Stereotypes?
5. Can you mention some success factors that have had an impact on your work?
6. Do you have a network/mentor/support that have helped your journey?
7. Do you feel an initiative/platform were missing that could have made the early stages easier?

8. How can you contribute to encourage more women to become tech entrepreneurs?

Appendix D

Consent Form for the User Test

The consent form gives potential research participants sufficient written information to determine whether or not to join in a research study, based on a description of the planned research and the nature of the requested participation.

(Starts on the next page)

Vil du delta i forskningsprosjektet

"Gender equality and tech entrepreneurship in Norway"?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å undersøke grunner til at kjønnsgapet i startup-miljøet for teknologibedrifter eksisterer, og hvilke tiltak som kan gjøres for å oppnå kjønnsbalanse i norsk entreprenørskap innenfor teknologi. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål
Forskningsprosjektet er et masterprosjekt ved Institutt for datateknologi og informatikk (IDI) ved Norges teknisk-naturvitenskapelige universitet (NTNU). Masterprosjektet er en del av NTNU-prosjektet

Software For A Better Society, ledet av professor Letizia Jaccheri, som handler om hvordan man kan bruke IT til å bidra mot FNs bærekraftsmål. Dette masterprosjektet fokuserer på FNs bærekraftmål 5 om likestilling mellom kjønnene, spesielt delmål 5.5. Målet med prosjektet er å samle relevante erfaringer fra kvinner som har startet en teknologibedrift og hvordan vi kan bruke IT til å minske kjønnsgapet i det norske teknologi-entreprenørskaps miljøet.

Hvem er ansvarlig for forskningsprosjektet?
Masterprosjektet utføres av Informatikkstudent Alis Wiken Wilson og veiledes av professor Letizia Jaccheri ved IDI NTNU.

Hvorfor får du spørsmål om å delta?
Du får spørsmål om å delta på grunn av din tilhørighet til teknologibransen. Vi har fått kontaktinformasjonen din etter å ha kontaktet deg via mail. Din deltakelse vil bidra til å gi innsikt i hvordan vi kan motivere flere kvinner til å delta i entreprenørskap innen teknologi.

Hva innebærer det for deg å delta?
Om du velger å delta, vil du bli med på en brukertest etterfulgt av et intervju for å innhente informasjon om hvordan prototypen av teknologien fungerer opp mot å motivere flere kvinner til å bli entreprenører innenfor tech. Brukertesten og intervjuet vil ta 45-60 minutter å gjennomføre. Det vil bli tatt notater av observatør underveis som brukes til å analysere den innhentede dataen i ettertid.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger
Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket. Det vil kun være studenten og veileder, som nevnt tidligere, som har tilgang til opplysningene.

Navn og kontaktopplysninger om deg vil bli erstattet med en kode som lagres på en egen navneliste adskilt fra øvrige data. Datamaterialet blir lagret på Microsoft Teams. NTNU har en databehandlingsavtale med Microsoft, og alle tjenestene er beskyttet med passord og tofaktorautorisering. Stipendiaten som gjennomfører og transkriber intervjuene blir eneste med tilgang til lydopptakene fra intervjuene.

Deltakerne vil ikke kunne gjenkjennes i publikasjon.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?
Opplysningene anonymiseres når prosjektet avsluttes/oppgaven er godkjent, noe som etter planen er 31.12.2022. Etter dette vil datamaterialet bli anonymisert. Alle lydopptak vil da bli slettet.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra NTNU har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:
- innsyn i hvilke opplysninger vi behandler om deg, og å få utlevert en kopi av opplysningene
- å få rettet opplysninger om deg som er feil eller misvisende
- å få slettet personopplysninger om deg
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger

Hvis du har spørsmål til studien, eller ønsker å vite mer om eller benytte deg av dine rettigheter, ta kontakt med:
- NTNU - Norges teknisk-naturvitenskapelige universitet ved student Alis Wiken Wilson på epost (alis.w.wilson@ntnu.no) eller telefon: 992 42 826
- NTNU - Norges teknisk-naturvitenskapelige universitet ved hovedveileder Letizia Jaccheri på epost (letizia.jaccheri@ntnu.no) eller telefon: 918 97 028
- NTNUs personvernombud ved Thomas Helgesen på thomas.helgesen@ntnu.no

Hvis du har spørsmål knyttet til Personverntjenester sin vurdering av prosjektet, kan du ta kontakt med:
- Personverntjenester på epost (personverntjenester@sikt.no) eller på telefon: 53 21 15 00.

Med vennlig hilsen

Alis Wiken Wilson
Prosjektansvarlig
(Student)

19.05.2022

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet "Gender equality and tech entrepreneurship in Norway" og har fått anledning til å stille spørsmål. Jeg samtykker til å delta i en brukertest der det blir tatt notater, og at mine opplysninger behandles frem til prosjektet er avsluttet ca. 31.12.2022.

(Signert av prosjektdeltaker, dato)

Appendix E

User Test Guide

E.1 Norwegian Tasks and Scenario

Scenario: Du har interesse for entreprenørskap og har en ide som du har begynt å drodle på som du gjerne har lyst til at skal bli en Startup. Du ønsker gjerne å få til et møte med en mer erfaren grunder/mentor som allerede har etablert en tech bedrift, og vil benytte deg av appen "TechSpire" for å få til dette møtet.

Oppgaver:

1. Du skal nå registrere deg som bruker på appen og fylle ut nødvendig informasjon til profilen din.
2. Du skal nå skaffe deg en mentor ved å finne en match.
3. Du skal nå godkjenne forespørsel fra valgt mentor.

   Scenario: Nå går vi 9 dager frem i tid, og møtet med mentor har akkurat blitt ferdig.

4. Du skal nå rate hvordan mentor-møtet gikk og gi feedback.

Spørsmål til evaluering etter oppgavene er fullført:

Hva synes du er positivt med denne applikasjonen etter bruker-testen? Og føler du det er noe som kunne blitt gjort anderledes med denne prototypen, konstruktive tilbakemeldinger?

E.2   English Tasks and Scenario Translation

Scenario: You are interested in entrepreneurship and have an idea you have developed and want to result in a startup. You wish to have a meeting with a more experienced founder who has already established a tech startup. To organize the meeting you will use the application "Techspire".

Tasks:

1. Register as a user on the application and fill out necessary information to configure your profile.
2. User the mentor-scheme to select a mentor and wait for acceptance.
3. Accept the mentors request of meeting and go back to the home screen.

   Scenario: We now go 9 days forward in time, and the mentor meeting has just finished.

4. Evaluate the meeting by rating the meeting and give feedback to the mentor.

Questions for evaluation after the tasks are finished:

What did you feel was positive with the interface and features of this application after the completing the tasks? Do you feel there are something that could be done differently with this prototype, any constructive feedback?

E.3   Norwegian Semi-Structured Interview Questions for Prototype Evaluation

1. Føler du dette er en bedre eller verre måte å komme i kontakt med en mentor på fra ingen eller tidligere erfaringer (hvorfor/hvorfor ikke)?
2. Føler du deg mer motivert til å bli entreprenør innenfor tech etter å ha brukertestet denne teknologien? (Hvorfor/hvorfor ikke)
3. Føler du denne teknologien har potensiale til å motivere flere kvinner til å starte opp sitt eget tech selskap?
4. Har du noen andre kommentarer eller innspill du vil legge til?

E.4   English Semi-Structured Interview Questions Translation for Prototype Evaluation

1. How do you feel this application is a better or worse way to get in touch with a mentor?

2. Do you feel the service provided by the application increases your motivation and interest in tech entrepreneurship, and how?
3. What do you feel about this technologys potential to encourage more women into tech entrepreneurship and founding of a tech startup?
4. Any other comments or feedback you want to add?

Appendix F

Feedback from User Test

Positive feedback

It was simple to implement the correct information, and it makes sense why you have to provide it.

Its nice that you receive a response when you execute a functionality.

Its valuable to receive information about the mentor you are matched with, to make the choice easier if you match with multiple.

Its very positive that the mentor is in charge of contacting the mentee, and not the opposite, since then you don't feel needy. It makes the whole process of finding a mentor more comfortable.

Simple, intuitive and clear, with not to many details. It was easy to navigate through the application. It can be challenging and confusing when a application provides many different steps and features, but Techspire felt more straight forward.

The application had a nice look and design, good use of contrasts.

The buttons were very visible and indicative.

The progress bar was very smart since it indicates how long the scheme will take to complete. Such forms can take a while, so its nice to have a indicator on how fast it goes, which in this case felt quick.

The scores motivates me more to use the app.

Very good with the time selection feature, it makes the process easier.

Very nice that you have to be thorough with the configuration of profile to be matched with a

like-minded mentor.

Very nice with a built-in chat feature.

Constructive feedback

The step where you measure TRL, MRL and SRL should provide a button for explanation if you are not familiar with the terms before.

It should be explained how the score system works, and what the user gain from it.

The user should be informed that its okay to have TRL, MRL and SRL (measures of entrepreneurship level) at zero, if you are very new to the field.

The user should be able to clarify if there are more people on the team, which it usually are if you are building a startup with a team or other co-founders. It would be valuable for the mentor to know that before the meeting.

You should be able to choose more than one preferred experience of the mentor. The categories of experience can also be expanded.

It should not be limited to choose either a female or male mentor, it would be nice to have the option of choosing both in case of the users who don't mind the gender of the mentor.

It would have been nice to have linked to the mentors linked-in profile if the user wants to do more research.

An overview of when mentors are available or not would have been valuable, similar to the features that exists on Slack and Teams.

The reward and feedback system should be improved to prevent users from using the mentor service only to increase the score, not for its actual purpose.

The score system could be based on certain indicators like the value of the meeting, how it went, etc.

The icon of the mentor scheme was confusing and not intuitive to its purpose, it should be changed.

A decline button was missing from the chat when the user receive a meeting invitation from the mentor. The calendar availability should be editable if something comes up.

The calendar feature could be synchronised with the users personal calendar.

A feature where the mentee can add the expected goal and a sentence if the mentee have a specific problem with the idéa/startup before the mentor meeting would be valuable.

Appendix G

User Test Evaluation - Answers from Semi-structured Interview Answers

How do you feel this application is a better or worse way to get in touch with a mentor?

If you are a student here at NTNU, I have experience that you get easy access to a mentor though Spark*, so I think this application benefits those who are finished their studies, or study at other universities where they do not have access to an organisation like Spark*.

After finishing your study you can feel lost and it can be hard to find the right information you seek as an entrepreneur. In that case I think this application could be valuable to try out.

I have received a couple of mentors from different programs, but this service seems like a more low-key way to receive a mentor compared to what I know exist.

Whats good about this technology and its provided service is the way that you find a time for meeting that suits both the mentee and mentor, which is a much more efficient way than what i have been used to.

It seems that this application will increase the chance to meet a mentor you can build a friendship with, which would be very valuable if you could call them and ask questions for help on a more friendly basis.

This application makes it much more easier to get in touch with people that's interested in you and your ambitions.

Its very comfortable that when you use this service, you know you will be put in contact with a person that wants to meet and help you, and know some information about you before the meeting. It prevents the uncertainty that could arise when the mentee contact someone on other platforms like LinkedIn and wonders if the mentor will answer yes or no.

I feel the service benefits me since its a low-key way to get in touch with mentors and role models. Usually I have to call around and build a certain legitimacy that makes me attractive, which can be time consuming and demanding. I think this technology would be preferred by female entrepreneurs, since the males are more likely to not feel the same struggle when calling and approaching people. There is a difference there.

Do you feel the service provided by the application increases your motivation and interest in tech entrepreneurship, and how?

Yes, especially since its a lot of things you have to think about in the beginning face of the founding process which you might not dare to start on without help.

The fact that you can easily connect with a role-model within tech would be inspiring and motivated me to continue with the process.

Yes, you become very motivated after having a mentor who fits your expectations.

I feel it depends on what you get out of the meeting with the mentor. But it would have been cool to meet a mentor anyway and will probably help to encourage me to continue with my idea and be inspired to take the next step.

Yes. This is a service where the mentors make time for it, which makes it less scary to ask for help.

I think in itself that it is very important to see others who are inside the environment, and being a student entrepreneur is very pleasant in a way. Because you constantly see others doing the same thing as you. I think if you go into this app and get in touch with others who have their own start-up, then it is more casual to be an entrepreneur. You can search for people who have done the same thing, and it affects me as a person. And having someone follow you up forces you to do something for the next meeting, you have a third party that you can show what you have said you should do. It's a motivator.

What do you feel about this technology s potential to encourage more women into tech entrepreneurship and founding of a tech startup?

I think this service will not necessarily work better for women than men, but the question the user gets about what gender they want to be on the mentor is very nice to have. It makes it easier for me to reach out, since if I feel vulnerable I would rather meet a woman than a man.

Very nice not to get a random mentor, but rather one you have background information on and are closer to what you want.

Absolutely, at least if you market it to women. One should market this service in typical places

where women gather.

Also feel there is a lot of scaling potential with the technology and service. You can add functionalities such as that startups can find Co-Workers, meetups functions with an overview of what happens to various events related to entrepreneurship. Student offers could also be obtained for those who are still studying.

But you have to make sure that that score makes you dare to get started, and is not afraid of getting a bad score. You could give, for example, x number of attempts before you get a score so that it becomes a kind of trial time without the risk of getting a bad score.

By being contacted by a mentor in the service, you can feel that they see your idea as exciting and valuable.

Here it is much freer without any very strict requirements, compared to other organisations where your idea are considered by others and you have to actively seek out to them.

I feel that this service will at least get more women to consider it. It will help to talk to someone who has experience and get a realistic insight into how things actually work with technology and entrepreneurship. It makes it easier to assess whether something is right for you or not.

The design is feminine and light, but at the same time not exclusive to other gender.

The service is also good for those who are motivated to start up anyway, who want to take a step back to get the help they need to get started properly.

This is very useful for those who are in a very early stage, or those who are hesitant and do not quite know what they need help with. They can become very motivated after such a meeting.

Yes actually. It is very easy to use the app, compared to contacting people on your own. Then you get rid of the small small talk that often comes at the beginning since in this context the mentor has information from you in advance. That makes it more low threshold.

Yes I absolutely believe so. I think it will motivate more girls to actually start up since this helps you take the next step after you have found an idea.

You can also meet everything from a student to a very experienced adult. Think it would have been easier for me if I had gone to a tech study outside of business school, take a short meeting, and tell about the idea to someone. It had possibly motivated me to take this further.

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Science and Technology