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The rise of femtech

Navigating the opportunities and challenges in the women's health technology landscape

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Abstract

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This thesis aims to explore femtech as a phenomenon, analyse its market dynamics, and investigate opportunities, challenges, and future prospects in the women's health technology landscape. By delving into these questions, this research contributes to a deeper understanding of femtech's significance and role in shaping the future of technology, innovation, and healthcare.

The digital health industry, specifically femtech, has grown remarkably over the last few years. Femtech provides solutions for various health aspects concerning women, including but not limited to those who identify as cisgender women and gender or sexual minority women. It has expanded its scope beyond menstruation and fertility to encompass fitness, mental health, and sexual wellness.

This explorative research employs mixed methods, utilising an induction-based, problem-centred approach and a structured analytical framework to provide a comprehensive analysis of the subject.

Results of this study show that the key challenges for the femtech ecosystem are gender disparities in tech, funding, and medical data. Furthermore, the key opportunities are greater demand for women's health solutions, technological advancements, and increasing awareness. Although femtech solutions accommodate the needs of about half of the world's population, research shows it is often still considered a niche market. Therefore, there is a large untapped potential market, and the industry may continue growing and innovating to address various health needs.

Keywords: femtech, health tech, gender bias, funding, diversity

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List of abbreviations

AI Artificial Intelligence

B2B Business-to-Business

B2C Business-to-Customer

CAGR Compound Annual Growth Rate

D2C Direct-to-Consumer

EU European Union

GDPR EU's General Data Protection Regulation

HCI Human-Computer Interaction

ICO Information Commissioner's Office

ICT Information and Communications Technology

LGBTQ Lesbian, Gay, Bisexual, Transgender, and Queer

M Million

NIH National Institutes of Health

OECD Organization for Economic Co-operation and Development

PCOS Polycystic Ovary Syndrome

R&D Research & Development

STEM Science, Technology, Engineering, and Mathematics

Tech Technology

VC Venture Capital

VCs Venture Capitalists

1 Introduction

The purpose of the following chapter is to introduce the research topic of the thesis. This section will describe the background of the subject and the author's motivation to undertake the research. It also presents the research objective and questions. Finally, it will explain the structure of this paper.

1.1 Background and context

During the past few years, capital investment and consumer market size have brought rapid growth in the digital health industry and, more specifically, the femtech industry, which works at the intersection of technology and women's health. Femtech is an umbrella term for companies within the health technology landscape dedicated to solutions catering to but not limited to women's health needs, providing solutions for various health aspects, including but not limited to those who are cisgender, gender or sexual minority women. The solutions provide for health needs such as maternal health, menstrual health, fertility, menopause, contraception, and other health conditions affecting women disproportionately. In the early stages, the focus was mainly on menstruation and fertility, but the industry has since expanded into new streams such as fitness, mental health and sex tech. (Woetzel et al., 2015)

While multiplying its funding and tractioning much interest in the past years, femtech could revolutionise healthcare. However, the emerging field faces a few obstacles, such as accessibility barriers and inadequate representation. Its fast growth emphasises the urgent need for inclusivity and equitable representation in technological advancements. (Kemble et al., 2022) Although the industry could potentially fill the critical health research gaps by collecting additional data, some

resources argue that the industry needs to be regulated better, and there is a strong need for legal protection of personal data. (Scatterday, 2022)

Femtech is an interesting and unique lens through which we can examine essential themes and topics regarding the broader technology and innovation landscape. Through this lens, we can see a variety of cross-industrial factors affecting femtech startups. On the other hand, it is an exciting chance to look into the future and analyse the opportunities and industry trends ahead for the broad audience of half the world's population.

1.2 Research problem and significance

“Communities and countries and ultimately the world are only as strong as the health of their women” – Michelle Obama at Elizabeth Garrett Anderson School in Islington, London, 3 April 2009

Women comprise 50% of the world's population and 40% of the global workforce in 2019 (FemTech Live, 2021). Moreover, many societal factors have led to a skewed gender divide in the technology sector: jobs and funding. While women account for less than 25% of tech jobs globally (Stewart, 2022), the small but growing number of women entrepreneurs face more significant challenges in obtaining funding. There is also a historical healthcare data gap. In the US, women did not need to be part of clinical research and trials by law before the NIH Revitalization Act of 1993, which requires clinical studies they fund to include men and women as well as people from ethnic minorities in their study populations. Even today, only 4% of global medical research spending goes toward specifically women's health (Smith, 2023).

Nevertheless, women's health has been considered a niche market and a mere subset of healthcare. With this realisation in mind, it is good to be mindful of the following factors: who are those developing and investing in tech products, what problems are they solving, and what gets left out? (Tikkanen, 2021)

The underrepresentation of women in entrepreneurial activities and leadership positions across economies and societies has severe adverse moral, social and economic impacts (Thomas et al., 2020). Increasing inclusion among researchers, inventors, investors, and founders can create more consumer-centric products and solutions that recognise and target specific healthcare needs. (Kemble et al., 2022) Therefore, the significance of studying the femtech industry lies in its opportunity to reshape healthcare, promote gender equity, drive technological innovation, stimulate economic growth, and improve overall societal well-being. Understanding these implications allows us to harness the benefits of femtech while addressing its challenges, ultimately contributing to a healthier, more inclusive future of tech.

1.3 Research questions and objectives

This bachelor's thesis aims to develop an understanding of femtech as a phenomenon, study its market dynamics and explore the opportunities, challenges and future prospects for startups in the field. Furthermore, the author aimed to study how the status quo in the technology industry might affect the success of femtech companies, subsequently questioning and researching the transformation and growth in the femtech era. Accordingly, the researcher is seeking answers to these questions to investigate if femtech has the potential to impact the technology and innovation sector, providing a more equitable future.

The thesis is based on two main research questions:

1. What is femtech and what are the key factors contributing to its growth?
2. What are the opportunities, challenges and future prospects for femtech startups?

1.4 Structure of the thesis

This paper starts with an introduction providing an outlook on the thesis topic, the statistics proving the significance, and briefly describing the purpose of the research. The author seeks to inform and contextualise our exploration of the femtech industry through a systematic literature review. Consequently, the chapter about methodology describes the research methods and research process.

After the basic knowledge about this thesis, the following chapters are part of the literature review. This literature review is a comprehensive summary of the previous research and theories related to the femtech industry. The review thoroughly examines existing research, theories, and discussions relevant to the femtech industry. This literature review serves as a groundwork for comprehending the key themes, debates, and perspectives that shape the industry landscape.

The review starts with a brief market analysis of femtech, providing context for our subsequent analysis. Furthermore, the literature delves into the biases and barriers that impact the femtech sector. This segment draws upon previous research to shed light on gender biases, historical factors, data gaps and other industry challenges, offering insights into how the industry's development intersects with various demographic factors. At the end of the literature review, our research extends to case studies of prominent femtech companies to illustrate the industry's impact and innovation, grounding theoretical concepts in practical applications.

Once the theory is covered, the analysis of findings and their interpretation is presented. This chapter provides a comprehensive foundation for discussing opportunities and challenges femtech startups face. Finally, concluding the thesis, the final chapter summarises the findings, proposes practical implications of the results and stipulates the limitations and recommendations for future research.

2 Methodology

Guiding the reader through the actual research process, this chapter reveals the theory behind the research and the methods used for data collection and analysis. It describes the research methodology on which all the research methods were chosen and discloses the whole process of data collection and analysis. Finally, it also considers the ethical aspects and limitations of the research.

2.1 Research methodology

Research is a systematic process that begins with identifying a problem and formulating research objectives. Subsequently, data is collected, analysed, and interpreted, and findings are reported. Research can be categorised into three primary types based on the problem definition and objectives. Exploratory research aims to define problems and suggest hypotheses by collecting preliminary information. Descriptive research aims at describing things, for example, describing a market potential or consumers' attitudes. Thirdly, causal research aims to learn about cause-and-effect relationships by testing hypotheses. (Kotler et al., 2013, p. 114)

The chosen research method for this paper is exploratory research. This method is employed to map the development of the femtech field, define industry-related problems, and suggest hypotheses by collecting preliminary information. Through exploratory research, the study aims to identify opportunities, problems, and challenges within the femtech industry.

The primary research approach in this study is induction. Induction involves deriving generalisations or theories from empirical observations. It is the most suitable method for this research as it seeks to generate broader insights and theories based on observed patterns and trends in the literature. Induction

focuses on identifying patterns and generating new theories, emphasising the development of generalisations and theories from specific observations. Additionally, the study follows a problem-centered and structured approach. This approach ensures that the research process is guided by well-defined problems, allowing for systematically exploring issues within the femtech industry. This structured approach aids in the comprehensive examination of challenges, opportunities, and developments in the field.

2.2 Research process and data collection

The research process in this study starts with a thorough literature search, exploring the existing resources related to the research topic. The thesis will primarily rely on secondary data, including academic literature, industry reports, case studies, and publicly available documents. The academic inclusion/exclusion criteria of factors, such as credibility, relevance, and appropriateness, evaluate the sources. Once we have selected the literature, we move on to the data extraction phase. This data is subjected to a systematic content analysis, where we extract key information, themes, and findings from the chosen sources. Following that, we employ thematic analysis to analyse the extracted data. Thematic analysis helps us identify recurring themes and patterns related to the growth of the femtech industry in the literature. By triangulating information from various sources, we aim to construct a comprehensive understanding of the topic, and the analysis will enable us to draw meaningful insights and conclusions while addressing the research questions posed in this study.

The analytical approach for this study is mixed methods, which involves examining existing qualitative and quantitative data sources. Qualitative data are conceptual and descriptive. On the contrary, quantitative data can be measured and expressed in numbers. These two types of data are required for further analysis to develop arguments. (Saunders, Lewis, & Thornhill, 2009, p. 151-153)

Integrating quantitative and qualitative data enriches the analysis, providing a well-rounded understanding of the femtech landscape. Quantitative data, such as industry analytics and annual investment figures, is employed to quantify factors like growth trends, market size, and financial aspects. These datasets provide numerical insights into the industry's dynamics. In contrast, qualitative sources discuss industry biases, ethical perspectives, and detailed case examples. They help capture the qualitative aspects of femtech, presenting concepts, business models, and the industry's development.

2.3 Limitations

One mentionable limitation of this study is the need for more literature and scientific articles on this subject. The chosen subject is relatively new and has received limited academic attention. Academic research on femtech has primarily fallen outside of traditional management scholarship and has been dominated by those in the human-computer interaction (HCI) field. (Menking, 2020) In addition, the study's analysis and findings may be constrained by the limited number of well-established startups and historical cases available for examination. The relatively small sample size may impact the generalizability of the findings.

Consequently, relevant data and scholarly resources specifically focused on the industry were challenging to obtain due to the ongoing nature of research in this area. These limitations are essential to consider when interpreting the findings of this thesis and provide valuable insights into potential areas for future research and exploration.

3 Femtech industry

This chapter is the first part of the literature review and explores the dynamic landscape of femtech from its definition and terminology to market analysis. This chapter provides a comprehensive overview of femtech's evolving landscape. Finally, we conclude this chapter with a comprehensive strengths, weaknesses, opportunities, and threats (SWOT) analysis, identifying the industry's strengths, weaknesses, opportunities, and threats.

3.1 Definition of femtech

Femtech is an umbrella term for companies within the health technology landscape dedicated to solutions catering to women's health needs, providing solutions for various health aspects concerning women, including but not limited to those who identify as cisgender women and gender or sexual minority women. The solutions provide for health needs such as maternal health, menstrual health, fertility, menopause, contraception, and other health conditions affecting women disproportionately. In the early stages, the focus was mainly on menstruation and fertility, but the industry has since expanded into new streams such as fitness, mental health, and sex tech. (Woetzel et al., 2015)

The term was founded in 2016 by Danish entrepreneur Ida Tin, the founder of the Clue app, a period-tracking app currently used by millions of women worldwide. According to Tin, the term was initially brought up as a way of helping to validate the female health tech market, thus driving forward innovation, attracting investment, and helping to normalise conversations about female health. (Menking, 2020)

3.2 Critique towards the term: femtech vs. “mentech”

Various critics have raised concerns about the "femtech" term. Some have questioned the absence of a corresponding "men tech" category. The feedback evolves around creating a separate category for women's health within the health tech vertical. It alienates women and positions them as "the other" and men as the norm since no equivalent term like "men tech" exists for male-specific health products and services. There is also a worry that femtech could become exclusive to female investors, entrepreneurs, and consumers. (Kleinman, 2019)

Other authors suggest the term might oversimplify women's health, essentialising women to reproductive biological functions while excluding non-binary and transgender individuals. Goldhill (2019) argues that designating a narrow group of products for “females” implies that half the population is a niche sub-category with a series of body-specific needs.

3.3 Market size and growth trends

The femtech industry has witnessed significant growth in recent years, driven by a convergence of factors that underscore its importance in the healthcare and technology sectors. Understanding the current market size, historical growth patterns, compound annual growth rate (CAGR), and future projections is vital in comprehending the industry's trajectory.

While precise market size figures vary, the global femtech market has grown substantially. Depending on the scope, estimates for the current market size range from \$500 million to \$1 billion. Forecasts suggest opportunities for double-digit revenue growth. As of 2019, the global femtech market generated \$820.6 million in global revenue and \$592 million in total venture capital investment according to PitchBook data (Nayeri, 2021), signifying its place within the health

technology landscape. Recent projections suggest the market may reach \$1.1 billion by 2024 (Frost & Sullivan, 2020).

Furthermore, the market potential is much higher. According to Frost & Sullivan, the estimated potential might exceed \$50 billion by 2025. Emergen Research (2020) values it at \$60 billion by 2027. Overall, this indicates that market penetration of the femtech industry is still low, and there is enough room for growth.

Several key factors contribute to the growth of the femtech sector. These include increasing awareness of women's health issues, a growing emphasis on preventive healthcare, shifting cultural attitudes, and women's rising participation in the workforce. Additionally, advancements in digital health technologies, such as wearable devices and mobile apps, have empowered women to take charge of their health, further propelling the industry's expansion.

3.4 Key players and market segmentation

The femtech industry is a dynamic ecosystem of companies, ranging from well-established giants to noble startups. Women's health needs concern various life stages and wellness goals. As such, the versatile femtech market segments offer tailored solutions to women across the spectrum. For example, one firm has developed a urine test that detects sexually transmitted infections (STIs), another has designed a new cervical stabiliser to alleviate pain and bleeding, and a third has devised a smart bracelet that tells wearers when they are ovulating to help them conceive (Geneux, Brouet and Barraud, 2022). Helping to visualise the femtech products and services, the table below is a collection of a few example companies and their respective segments.

Company name	Founded by	Founded in	Funding by 2019	Segment
Ava	Lea von Bidder, Pascal Koenig, Peter Stein, and Philipp Tholen	2014	\$42.4M	A wearable and mobile app for fertility
Bloomlife	Eric Dy and Julien Penders	2014	\$14.4M	A wearable device monitoring contractions, displaying real-time data via a mobile app
Clue	Ida Tin	2013	\$29.7M	A mobile menstrual health app
Elvie	Alexander Asseily and Tania Boler	2013	\$53.8M	Kegel trainer and breast pump
Glow	Max Levchin	2013	\$23M	A mobile fertility app
Lia	Bethany Edwards and Sarah Rottenberg	2015	\$2.6M	Biodegradable and flushable at-home pregnancy test
Lola	Alexandra Friedman and Jordana Kier	2014	\$35.2M	A subscription service for menstrual and sexual health products
NaturalCycles	Dr Elina Berglund and Dr Raoul Scherwitzl	2013	\$37.5M	The first FDA-approved fertility tracking app

Table 1: Examples of femtech products and services. (Ava; Bloomlife; Clue; Elvie; Glow; Lia; Lola; NaturalCycles, 2023)

The vast majority of femtech addresses issues like contraception and assisted fertility, such as in vitro fertilisation (IVF), pregnancy and post-pregnancy, breastfeeding, menstruation and period care, pelvic health, menopause,

hormonal disorders like polycystic ovary syndrome, health and fitness, and sexual wellness (Menking, 2020). The product types range from various product types within diagnostics to telehealth, and the top 3 femtech product types are consumer products (19%), devices and wearables (17%) and apps (16%) (Femtech Analytics, 2023). Moreover, the table below breaks down the market size and growth trends by different segments within the femtech industry.

Share of femtech companies by subsector

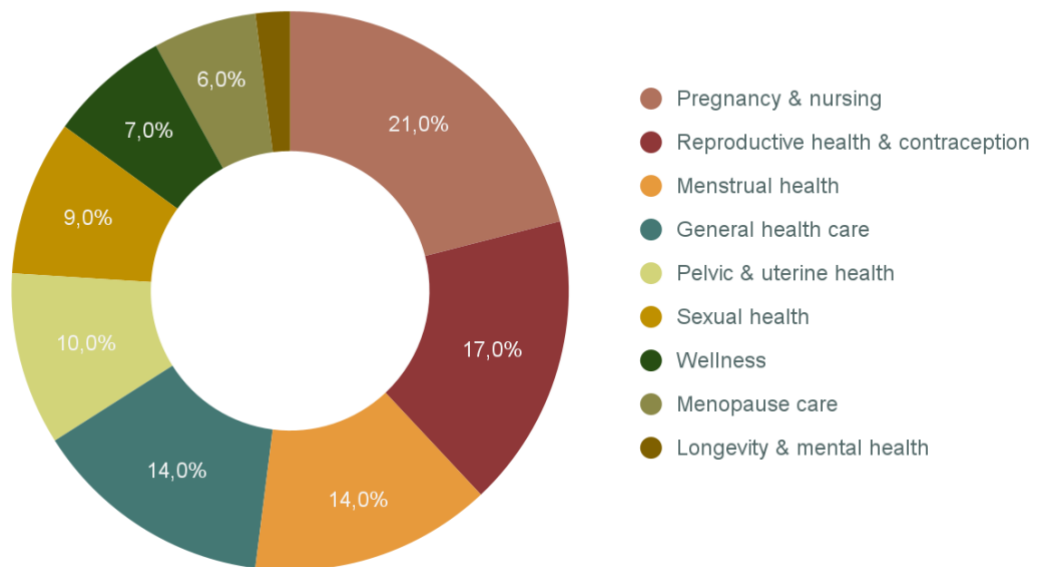


Figure 1: Share of femtech companies by subsector (Femtech Analysis, 2023)

The pregnancy and nursing subsector is the largest within the sector regarding the number of companies, accounting for 21% of the total market. The following subsector is the reproductive health and contraception subsector, representing 17% of the market. In the third position, both the menstrual health and general health care subsectors hold 14% of the market. Collectively, these top subsectors contribute to a substantial 65% of the entire market.

3.5 Regional analysis

As the table below shows, North America has the most extensive number of femtech companies by region, holding nearly 55%. Its dominance surpasses other regions by a wide margin. Europe secures the second position with 25%. This number demonstrates a significant presence in the industry. While relatively minor compared to North America and Europe, Asia, the Middle East, and North Africa (MENA) regions play a more minor role in the industry landscape, accounting for 8% and 7%, respectively. The lowest shares of the industry fall into South America, Africa, Australia and Oceania, accounting for the lower end with a combined 5% share.

Region	Share of femtech companies
North America	55%
Europe	25%
Asia	8%
Middle East & North Africa	7%
Africa	2%
Australia & Oceania	2%
South America	1%

Figure 2: Distribution of femtech companies by region, 2021 (Femtech Analytics, 2023)

On a country level, the United States and the United Kingdom stand out as the countries with the highest concentration of femtech companies (Femtech Analytics, 2023).

3.6 Consumer trends, demographics, and future prospects

Pauliina Martikainen, director of investment at Maki.vc, displays that there is room and need for information, services and products related to women's health throughout women's lifetime. The image below represents the perfectly healthy European woman's life cycle with vast opportunities for mainstream femtech products. In her article, Martikainen emphasises that this is an oversimplified picture that makes stereotypical assumptions.

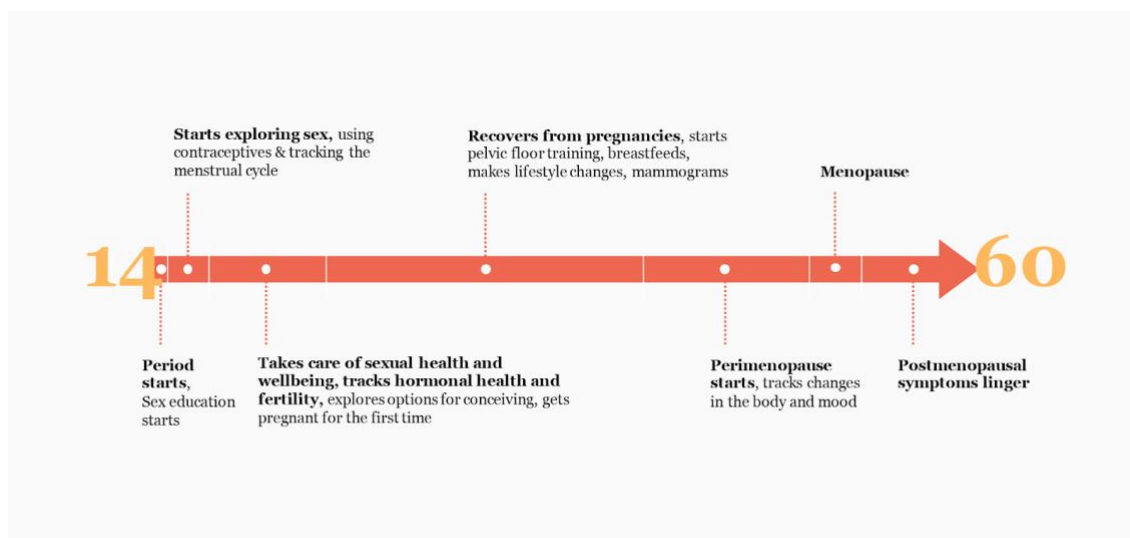


Figure 3: Lifecycle of possible femtech solutions (Martikainen, 2021)

According to Martikainen (2021), several notable trends support the rise of femtech in the modern day. Firstly, women of all ages are starting to take more control over their hormones and reproductive health, demanding safer, holistic, and personalised solutions. Along with that, the growing social acceptance of sexual pleasure and well-being will benefit the sex tech sector. Moreover, in 2025, over 1 billion people will be experiencing menopause worldwide, and the growing demand makes it one of the hot areas in the industry. The big data opportunity is evident. Martikainen proposes that companies could build feedback loops from symptoms to how treatments work, likely tapping into valuable data for research and for creating and validating new treatments. Finally, what has been overlooked in product development so far are specific conditions like endometriosis or

polycystic ovary syndrome (PCOS) affecting many women, and targeted femtech solutions for underrepresented groups, such as women of colour or sexual minorities.

Furthermore, companies and organisations operating in this sector could explore growth opportunities in the following areas, based on Frost & Sullivan's 2020 report: developing connected health solutions for pregnancy care with affordable pricing models and doctors' support, expanding reach to Africa and Asia, which are the locations with the highest female populations, reaching the previously inaccessible customers in rural areas with digital health technologies such as smartphone apps, and meeting the unmet needs of women with culturally appropriate solutions, such as wearable devices.

3.7 Strengths, Weaknesses, Opportunities and Threats (SWOT)

The SWOT analysis is a strategic tool designed to assess four critical elements that impact an organisation's performance. These elements encompass both internal and external factors. Strengths are the internal assets and competencies that set a company apart and qualities for building a competitive advantage. In contrast, weaknesses involve internal factors that challenge a company. Opportunities represent favourable external factors or trends in the business environment that can benefit the company in pursuing its objectives. Finally, threats are environmental factors and trends that may harm the organisation's performance. (Kotler et al., 2013)

While SWOT analysis is a technique developed for assessing the external and internal factors of a business, it can also be used to assess part of a business such as a product line or division, an industry, or another entity. Below, it is applied to an entire industry.

<p><u>Strengths</u></p> <ul style="list-style-type: none"> • Growing demand • Technological innovations • Diverse product offerings • Growing investment and funding • Growing awareness 	<p><u>Weaknesses</u></p> <ul style="list-style-type: none"> • Lack of data • Lack of diversity • Regulatory challenges • Limited awareness • Market saturation
<p><u>Opportunities</u></p> <ul style="list-style-type: none"> • Global expansion • Diversification • Enhancing healthcare quality and accessibility • Legislative advancement • Research and development 	<p><u>Threats</u></p> <ul style="list-style-type: none"> • Increasing competition • Cybersecurity • Funding disparities • Taboos and stigmatisation

Figure 4: SWOT analysis of the femtech market

The SWOT analysis above covers the strengths, weaknesses, opportunities, and threats of the femtech industry. The advantages of conducting the analysis are understanding its environment, such as competition and state regulation, and knowing how favourable the external environment is for the business (Kotler et al., 2013).

4 Gender disparities in the technology and innovation landscape

As we examined the market landscape in the previous chapter, the femtech market's immense potential became evident. However, the technology and innovation landscape have a persistent gender gap with far-reaching implications.

This chapter is the second part of our literature review, providing information regarding gender diversity within the technology and innovation sector. As we explore this multifaceted terrain, we seek answers to vital questions: Who drives innovation in this landscape? What opportunities and challenges do they face? How does gender diversity, or the lack thereof, influence the direction and impact of technological progress?

4.1 Gender disparities in the tech sector

The tech industry has long been marked by a notable underrepresentation of women. Women's underrepresentation in tech not only reflects broader gender inequalities but also worsens these disparities, which might further hinder innovation and reinforce harmful stereotypes.

Considering that women comprise about half of the world's population and nearly 40% of the global workforce in 2019 (FemTech Live, 2021), their significant absence in tech leadership and entrepreneurial roles has important moral, social, and economic consequences (Thomas et al., 2020). In addition, women must also be encouraged to develop technology. Men and women use technology, and therefore, both must be developing it. (Rusanen, 2021)

Regarding education, women are proportionately half as likely to major in science, technology, engineering, and mathematics (STEM) as men. Despite the percentage of women still being low, female representation has been growing, leading to a higher recognition of women in the tech domain (Kantrowitz, 2022). However, women only represent about 27% of the STEM workforce today (Martinez and Christnacht, 2021). The statistics on women in the technology industry show that women are underrepresented in tech-related jobs, especially in technical roles, in the five largest American technology companies also known as the “tech giants” or “big tech”. The term refers to Google (Alphabet), Amazon, Apple, Meta, and Microsoft. While women employees comprise between 29 per cent (Microsoft) and 45 per cent (Amazon) of the total workforce, they take up fewer than 25% of technical roles at each company reporting such a figure. (Richter, 2021)

This gender gap highlights the need to remove obstacles that prevent women from fully participating and leading in tech and innovation. It is essential to promote diversity and inclusion, recognising that empowering women in these fields benefits both fairness and progress in society.

Sheryl Sandberg's book "Lean In" (2013) sheds light on several key points that offer valuable insights into this complex issue. She discusses how one of the most prominent factors affecting the gender disparities in the tech sector is gender stereotypes. These stereotypes can lead to biases in hiring, further limiting the career opportunities available to women in the tech sector. In addition, the stereotypes often cast women as less capable of excelling in technical roles.

To advance women's presence in the tech industry, Sandberg also introduces the concept of "Lean in Circles," small groups of women who come together to support each other in their career development. These circles help overcoming gender disparities through networking, mentorship, and mutual support. By sharing experiences and insights, women in the tech sector can navigate the unique challenges they face and work collectively to break down barriers.

In summary, addressing stereotypes, supporting women in their career development, enhancing negotiation skills, promoting work-life balance, fostering female leadership, and working together to overcome both social and internal barriers are all essential elements in the ongoing efforts to create a more inclusive and equitable tech industry. (Sandberg, 2013)

4.2 Women entrepreneurship

In Europe, there is a notable gender gap in entrepreneurship, with women comprising just 29% (approximately 11.6 million) of entrepreneurs (European Commission, 2014). Based on the same report, a higher proportion of women than men entrepreneurs were active in sector groups such as education, human health and social work. In addition, the European Parliament (2015) conducted a study where all case studies suggested that women set up businesses that are predominantly in women-dominated sectors.

The gender disparity becomes even more pronounced in high-growth sectors such as Information and Communication Technology (ICT) (Grünfeld, Hernes and Karttinen, 2020). Despite the increasing significance and expansion of the ICT industry, gender imbalances persist, particularly in tech entrepreneurship (BarNir, 2021). According to the European Working Conditions Survey facilitated in 2015, woman entrepreneurs in the ICT sector represent 23.4% of the European labour market. Before, the figure was slightly below 20%. This figure indicates progress, but it has a slow pace. (European Commission, 2018)

The Global Startup Ecosystem report underscores this discrepancy, revealing that a mere 14.1% of tech entrepreneurs worldwide are women (Startup Genome LLC, 2020). In Europe, the representation of women among tech founders is notably low, standing at only 5% (Atomico et al., 2020). This underrepresentation extends across various levels of the digital sector, as highlighted by the European Commission (2018).

Even in Nordic countries, often lauded for their advancements in gender equality and the inclusion of women in the workforce, the share of women engaged in entrepreneurship remains modest. These figures range from 23% in Sweden to 34% in Finland, indicating that despite progress, challenges persist in achieving gender parity in European entrepreneurship. (Grünfeld, Hernes and Karttinen, 2020)

The European Parliament (2015) report lists some barriers that all case studies presented to women setting up and running businesses. These were socially constructed gender roles, a lack of angel investors, the size of their professional networks, and being predominantly responsible for the care of children or other dependents. These findings are supported by the study by Grünfeld, Hernes and Karttinen, where the authors list various reasons for the gender gap and suggest effective measures for increasing women's entrepreneurship. Firstly, as women have less access to role models and smaller networks, which makes them less likely to innovate, establishing women's mentoring schemes and networks might further encourage entrepreneurship. Secondly, expanding is difficult as women entrepreneurs have less access to external funding than male entrepreneurs. Their access to capital might improve by reviewing the investment guidelines in governmental investment companies and establishing a government-supported women's investment fund. Thirdly, framework conditions are essential for enabling female entrepreneurship. If the entrepreneurial culture is male-dominated, it is difficult for women to succeed. Studies show women do well as entrepreneurs in the industries where they are overrepresented, such as health care, care and nursing, and education. Their opportunities might expand by removing competitive disadvantages in industries where women often operate as entrepreneurs. Finally, entrepreneurship could also be included in university and college studies to promote entrepreneurial ideas early on.

Despite the industry disparities, data suggests that women deliver great economic returns. Research published in 2018 by Boston Consulting Group found that on average, although female business owners receive less than half the level of investment their male counterparts get, they produce more than twice

the revenue. In fact, for every dollar of funding female-owned start-ups generate 78 cents, compared to male-owned start-ups which generate 31 cents. They also generate 10% more in cumulative revenue over a five-year period, which means they perform better over time. (Abouzahr et al., 2018)

4.3 Women in the femtech field

Interestingly, the gender landscape in the femtech sector notably differs from the patterns observed in other industries, as seen above. A comprehensive study conducted by McKinsey examined over 700 femtech companies and discovered a striking difference. More than 70% of these femtech companies boasted at least one female founder, a substantial contrast to the 20% average among new companies (Kemble et al., 2022). Moreover, early statistics on femtech entrepreneurship consistently indicate a significant presence of women as business leaders and founders, with at least 50% representation in 2019 (Frost & Sullivan, 2020). To provide context, the average proportion of women entrepreneurs across the Organization for Economic Co-operation and Development (OECD) countries stood at just 9.2% in 2020 (Szmigiera, 2021). This substantial overrepresentation of women in the femtech sector highlights a distinctive and promising trend in terms of gender diversity and leadership within this particular industry.

4.4 Gender bias in funding

Access to venture capital (VC) represents a significant and pressing challenge for entrepreneurs, playing a pivotal role in securing early-stage financing and fueling the growth of ventures (Balachandra et al., 2020). However, the global landscape reveals a substantial gender disparity, with a mere 2.3% of VC funding directed toward women-led ventures (Teare, 2020), while on the other hand,

women comprise less than 15% of venture investors (PitchBook, 2023). In the US, businesses founded exclusively by women accounted for 2.1% of venture capital investments in venture-backed startups in 2022. In Europe, companies established solely by women received 0.9% of the total capital invested in European venture-backed startups. However, VC funding for female-founded or co-founded enterprises has shown upward trends (PitchBook, 2023).

Many hypotheses exist regarding women's business funding disparities, especially concerning equity financing. The topic began to gain attention and the subsequent research has continued to investigate the topic after the 2000s. According to Brush et al. (2018), the success in securing funding could be due to the three theoretical frameworks: social networks, structural obstacles, and stereotypes. Success in raising capital is often linked to the strength of one's network. In addition, the predominance of men in the venture capital industry has led to a male-influenced environment, shaping the industry's rules and practices and presenting hurdles for women entrepreneurs. Finally, stereotypes and the homophily theory could reason that investors tend to favour male-led ventures or management teams over female-led enterprises.

These findings are partially aligned with the 2015 report by the European Parliament, where the results showed that women-dominated sectors appear less attractive to investors and lenders. The study found that women entrepreneurs tend to seek lower loan or investment amounts, eventually making them less attractive to equity and debt financiers who will achieve lower returns due to lower debt amounts.

Research indicates a probable bias, where VCs may prefer investments aligned with their personal experiences, leading to a higher likelihood of funding startups led by men (Solal and Snellman, 2023). Finally, the research in early-stage VC funding shows that women face several gender-based biases during the pitch process. Brush et al. (2018) present that the pitching process is often described as "confrontational, competitive, and judgmental", characteristics typically associated with a male-oriented approach. A study by Kanze et al. (2017)

proposes both men and women who evaluate startups appear to display the same bias in their questioning, inadvertently favouring male entrepreneurs over female ones. Whether it is for these possible reasons or some others, the research has been consistent in the fact that VCs are biased against women (Balachandra, 2020).

4.5 Lack of funding in femtech

Femtech faces numerous challenges in securing the financial support necessary to drive progress. A recent article suggests that raising capital for femtech presents significant challenges for entrepreneurs. According to Forbes, predominantly male investors sometimes lack interest or engagement with femtech ideas. Reiterating this view, Balachandra (2020) frames that many women pursuing growth-oriented ventures may never even obtain an opportunity to pitch for VC funding and, thus, may never obtain growth capital, enabling them to develop their ventures. How men and women evaluate opportunities may be based on gender biases as well. The first decision VCs make is on which companies they will invite to pitch, based purely on the company's market and industry. Also, venture capitalists tend to fund ventures with which they feel connected, most often in the form of expertise. Because almost 90% of investment decision-makers are male, unleashing the full potential of the femtech market is a big challenge.

The consensus is that the lack of investment in femtech is due to the difficulty in getting capital to female entrepreneurs who are often the drivers of femtech, and the need for more investments remains a critical barrier to femtech's development. Underdevelopment in femtech is also said to stem from the lack of research and development (R&D) dedicated to the area, insufficient R&D funding and limited public support. (Femtech Analytics, 2023)

4.6 Gender data gaps

The lack of gender-specific data in historical narratives, as well as the biases present in various technological applications, have significant real-world implications. These issues underscore the importance of addressing gender data gaps in both historical accounts and artificial intelligence (AI) development.

As Caroline Perez discusses in her book "Invisible Women: Exposing Data Bias in a World Designed for Men" (2019), historical narratives have often overlooked the role of women in the evolution of humanity, in cultural contexts, and within biological perspectives. This historical perspective has predominantly centred on the male experience, portraying men as the archetypal representation of all human experiences. The absence of gender-specific data is not just a matter of historical silence but has tangible, day-to-day consequences that impact women's lives. For instance, it results in workplace discomfort when office temperatures are more suitable for men. It also becomes evident in the design of smartphones, often too large for women's hands, as these devices typically fit the dimensions of men's hands. The absence of gender-specific data might stem from long-standing norms and an unconscious bias rather than driven by malice.

Regarding AI, gender data gaps become particularly critical. Blind spots and biases in AI can significantly affect the accuracy and relevance of insights generated, leading to flawed outcomes and decisions. As highlighted by researcher Anna-Mari Rusanen and TietoEvy's managing director, Satu Kiiskinen, in a Yle article (2021), when AI technology is developed primarily for men, it can perpetuate discrimination against women. Algorithms rely on historical data, which is often gendered, and this data frequently emphasizes male experiences. Consequently, AI algorithms tend to adopt the "male" perspective as the norm, potentially increasing gender inequality. However, Rusanen and Kiiskinen emphasise that involving women in product development can lead to more diverse and inclusive technology.

According to Rusanen, gendered power structures are visible in application development and algorithm usage, including speech recognition programs that prioritise male vocal characteristics as the norm, making it challenging for the technology to understand women's voices. Rusanen and Kiiskinen stress the urgency of addressing these distortions and biases to create more equitable and inclusive technology in the future.

4.7 Data gaps in medical research

Aside from the funding challenges faced by femtech companies, there is a long-standing issue in medical research. The chronic underfunding of women's health studies has perpetuated gender disparities. Only 4% of global medical research funding is allocated to women's health initiatives (Smith, 2023). A study of funding by the NIH found that in nearly 75% of the cases where a disease afflicts primarily one gender, the funding pattern favours males. The study concluded a common paradox: either the disease affects more women and is underfunded (concerning burden), or the disease affects more men and is overfunded. (Mirin, 2021)

Furthermore, historically women have been limitedly represented in crucial phases of medical research, particularly clinical trials. Regarding drug trials, that means an enormous amount of lost data on how many common drugs and their dosing impact on women today. It was not until 1993 that women were mandated to participate in clinical studies. Based on the US National Institute of Health Report 2019, this issue persists even today, with nearly three-quarters of biomedical studies neglecting to report gender-specific outcomes.

The European Commission has recently reaffirmed its commitment to promoting gender equality in research and innovation through its latest framework program. This commitment includes specific provisions for research teams and a clear objective of achieving a 50% representation of women in European boards, expert groups, and evaluation committees. Furthermore, in 2020, the Royal Society of Medicine organised a three-part webinar series that delved into the

transformative role of digital technology in women's health, which promotes the representation even more (Wiederhold, 2021). These developments collectively demonstrate a dedication, in both public and private sectors, to fostering an environment conducive to developing evidence-based solutions to address women's distinct health challenges and unmet requirements, ultimately contributing to lasting and sustainable improvements in women's health globally.

Based on the arguments presented above, femtech not only responds to these gender inequalities but also reflects them. It could be the transformative power to bridge medical data gaps and gather real-world evidence at a significant scale. By spotlighting the neglect of women's health in the tech sphere, femtech simultaneously confronts the gender gap within the industry.

4.8 Taboos and stigma around women's health topics

Taboos around women's health have persisted throughout history and across cultures. According to the dictionary, a taboo is a social or religious custom prohibiting or restricting a particular practice or forbidding association with a particular person, place, or thing. Hence, taboo is a subject that is socially unacceptable or associated with intense feelings of shame and modesty in a given culture and, thus, intentionally avoided. The taboo around sexual and reproductive health and rights has historically left countless women uninformed about their bodies. This, in turn, results in a lack of control over their physical well-being and autonomy. Taboos appear especially prevalent in health conditions such as menstruation, maternity, and menopause (Grandey, Gabriel and King, 2020).

In the article "How did menstruation become taboo?" Druet (2019) argues that menstruation stigma is a form of misogyny. In many societies, negative taboos have conditioned people to understand menstrual function as something to hide, and not naming it reinforces the idea. Also, conversations around menopause are

often avoided due to a fear of making others uncomfortable with this taboo topic (Tin, 2015). The silence about the topic contributes to further misinformation and myths about it. In addition, the invisibility of menopause, in addition to low awareness of menopause, leaves too many unsupported during this transition (Tsang, 2023).

Startups might face barriers when advertising their products on social media. In some cases, social media platforms automatically block messages, posts and other content about women's sexual health because the moderators consider them inappropriate, which derives from the taboos. (Geneux, Brouet and Barraud, 2022) This can further make it more difficult to break the taboos.

5 Ethical perspectives on femtech

Although the rise of the industry indicates a shift to a better era for empowering women's health technology, the fast rise of femtech raises concerns surrounding accessibility and the need for such advancements with integrative and inclusive efforts to improve healthcare equity. Additionally, femtech products often face accessibility barriers due to the high development and production costs.

5.1 Data privacy and security concerns

In health technology, data privacy issues often arise in discussion. Protecting users' sensitive health data from unauthorised access and possible misuse is a critical challenge for developers and regulators. Regarding femtech, the nature of the data is also rather sensitive. Apps that track users' emotional and physical data must consider information and privacy concerns, particularly in countries with prohibitive laws surrounding women's health, such as fertility.

The applications rely on users' personal health information. The apps work so that the disclosure and use of personal health information meet with promises to provide users with more accurate personalised data. In effect, applications collect much of the personal health information stored on these devices freely and automatically because users are encouraged to disclose such information. (Rosas, 2019)

Many femtech apps regularly share users' personal and intimate data with third parties, such as Meta. Almost all femtech apps use a profit-making mechanism that relies on users entering personal and sensitive information into the app to characterise users and draw up user data, from where it gets sold to third parties, who use them for more precise targeting of their audiences with personalised advertisements. Given the sensitive nature of the personal data that femtech apps handle, privacy breaches could lead to various unwanted consequences for femtech users. (Jacob and Evers, 2023) Some authors argue that this problem is a systemic regulatory failure across the entire femtech industry while failing to understand the nature and extent of the threats that further assault women and other users of femtech's bodies, autonomies, and identities. (McMillan, 2021)

A recent article by Poli (2022) analysed the five most popular period-tracking apps in the US by data privacy, using the data privacy evaluation frameworks and analysing the apps through four core areas: local versus cloud storage, third-party sharing, data deletion, and location tracking. The mentionable areas where apps performed the worst were how the app lets the user store data and whether it tracks the device ID or IP address.

What strategies should femtech companies employ to be secure then? Lisa Falco, head of product at a company that develops AI-based tools, says: "It is easier to consider the privacy concerns from the beginning when you design a system than to change it later". The development principles of "Privacy by design" and "Privacy by default" should be used, ensuring that sensitive user data is stored in a non-traceable way back to the user's identity. For example, storing the user data and identifiers on different servers makes it easier to anonymise, and

potential hackers would need to hack several servers to get the data linked to a person. (Femtech Live, 2021)

When discussing safeguarding users' sensitive health information, we know there are several data protection laws in place around the world to regulate the ecosystem. Concerning the scope of the thesis, notable examples include the General Data Protection Regulation (GDPR) in the European Union, the Information Commissioner's Office (ICO) in the UK, and the Health Insurance Portability and Accountability Act (HIPAA) in the United States. These regulations are crucial in preserving user privacy, setting data collection, storage, and sharing standards, and holding femtech companies accountable for data security.

Within the EU, the reports by Privacy International have shown that many popular femtech apps do not comply with the GDPR despite the highly intimate nature of these personal data (Jacobs and Evers, 2023). Moreover, a recent empirical study by Almeida and Mehrnezhad (2021) revealed the privacy risks associated with 30 top fertility apps. The study found that many apps do not comply with the GDPR and ICO guidelines and continue to process personal information or track user data in ways that users may not be aware of. McMillan (2021) argues that the data collected by femtech products are susceptible and risk being shared with third parties, saying that the systemic problems are easier to identify than to remedy and femtech apps might not become as effective and reliable as users need them to be.

In America, a recent scholar Rosas (2019), presents that most emerging femtech companies do not fall under the Code of Federal Regulation's definition of a covered entity. Rosas suggests that the issue could be resolved by expanding HIPAA's covered entity definition. The definition of "covered entities" should include femtech applications and their biosensing devices. Expanding the definition and requiring encryption would ensure that HIPAA will better serve users of these mobile applications and ensure users receive the necessary protection for security and data privacy.

Furthermore, ongoing debates surrounding reproductive rights add another layer of complexity to the American healthcare landscape. In the United States, the Supreme Court overturned the legal right to abortion in 2022, returning the ability to regulate the procedure to the states. After the decision, legal experts have warned that people seeking abortion care have become critically vulnerable to privacy threats, especially those who reside in states where laws incentivise private citizens to file civil complaints against them. (Poli, 2022)

This is a significant point, especially within the context of the US, as employers are crucial in granting access to quality healthcare there. According to the 2020 Employer Health Benefits Survey facilitated by KFF, employer-sponsored insurance covers approximately 157 million people, nearly half the country's population. This responsibility involves handling sensitive health data and varies across different regions of the country, leading to complex nuances in healthcare discrimination. Consumers fear that femtech companies may disclose their reproductive health data to law enforcement officers, who could use that data to prosecute illegal abortions. Women's health data entered into a femtech app could prove that a woman sought an abortion in a state where such medical procedures are outlawed or criminalised.

5.2 Accessibility and inclusivity issues

Many authors voice that femtech will not make tech more equal until it is for everyone. For instance, in the World Economic Forum article, Alba-Gonzalez (2022) stresses that while the ecosystem is expanding rapidly, it must fully include black, indigenous, and people of colour (BIPOC) women. BIPOC women face particular challenges regarding their healthcare due to intersectional circumstances, such as race, ethnicity, income, and education. They are subject to health disparities and discrimination, which significantly hinders obtaining proper diagnoses, treatments, and adequate care experience. BIPOC women face particular discrimination in receiving equitable healthcare, and inadequate BIPOC health data is one particularly challenging area.

In the UN Women's article, "Expanding FemTech to advance sexual and reproductive health and rights" (2023), a tech and gender activist and social entrepreneur Ayesha Amin expresses her concern that the current femtech ecosystem tends to exclude those who most need it: "Most of the femtech applications that exist right now benefit women who are from socially and economically privileged groups". The accessibility affects women from rural communities, women who are not digitally literate, or women without sufficient income to pay for subscription-based apps.

Various authors have criticised the focus on stereotypical feminine cisgender heterosexuality in designing femtech apps. In a study with users of period-tracking apps, Epstein et al. (2017) found that the designs of apps can create feelings of exclusion for some users. The study showed that many users of femtech apps find the overly feminine design "insulting" or "condescending". In addition, the assumptions made by the apps about fertility and reproduction are heteronormative and, thus, do not apply to all users. People may have various reasons to track their menstrual cycles, such as LGBTQ women. Moreover, the authors suggest more representation and acknowledgement of all femtech users, accompanied by gender-neutral themes and language. (Jacobs and Evers, 2023) People who do not fit the common definition of "women" can become easily discriminated against, isolated, marginalised, or stigmatised. When diseases and healthcare issues are gendered, it becomes more difficult for trans and gender-nonconforming people to access healthcare. (Bell, 2017)

Krishnamurti et al. (2022) summarise the discussion by saying that femtech must adopt a race-, class-, and gender-conscious approach to advance the needs of populations whose reproductive health and well-being have been harmed or neglected by our current societal structures and reproductive health equity.

6 Industry examples

While previous chapters have established a theoretical foundation and examined the overarching dynamics of femtech, this chapter bridges the gap between theory and practice. By showcasing two prominent companies, Clue and Oura, we will understand how femtech functions in the real world and gain tangible insights into applying femtech concepts and theories. This chapter presents how the femtech concepts manifest in these companies' strategies, innovations, and operations.

6.1 Case Clue

Clue is a pioneer femtech company founded in Germany in 2012. The company primarily focuses on menstrual tracking and reproductive health. It provides an app that helps users track their menstrual cycles, ovulation, and other related health data. It collects data related to menstrual cycles, mood, and physical symptoms and provides insights and predictions about users' menstrual cycles and fertility windows. Clue aims to empower women with knowledge about their reproductive health.

Their business model is business-to-consumer (B2C) and fluctuates in offering a free basic app with premium features available through a subscription model. They generate revenue through premium subscriptions and partnerships. To access advanced features and additional services, users can subscribe to a monthly or yearly premium plan of Clue Plus. Premium subscriptions include features such as enhanced cycle predictions and tracking, full access to all pregnancy features, such as pregnancy planning and perimenopausal features and access to educational articles. (Clue, 2023)

According to the founder Ida Tin, when women track their period through Clue, they contribute an unprecedented data set essential for continuing our

understanding of female health. Clue's data has contributed to an academic understanding of menstrual health by providing a large database of user-tracked observations that can be analysed to identify patterns and trends. For example, a study published in the National Library of Medicine used Clue's data to characterise physiological and symptomatic variation in menstrual cycles (Li et al., 2020). Another study used Clue's data to investigate the impact of COVID-19 infections and vaccinations on the menstrual cycle (Femtech Insider, 2023). Clue is working to advance academic understanding of menstrual health, and their data has helped address several research questions regarding how menstrual cycle variation affects overall health. The company's scientific collaborations are exploring questions like what pain patterns are considered 'normal' in which populations? What mood patterns do we see around ovulation? How might our menstrual and symptom patterns help us spot disease and illness earlier? Clue is known for working with top research institutions and clinicians, including Columbia University, Stanford University, University of Oxford and Kinsey Institute (Clue, 2023).

Clue's response to data privacy issues has been clear to take security seriously. The company declares that they do not sell user data and only collects data necessary to provide its services and processes data for the purposes outlined in its privacy policy. With third-party sharing, only the needed data is shared with research groups and the data is anonymised. It is also worth noting that the data Clue shares with these institutions is always stripped of identifying factors and only aims to answer research questions of a non-commercial nature (Femtech Live, Tin, 2021). Also, Clue's co-CEOs, Audrey Tsang and Carrie Walter, have promised not to turn users' private health data over to any authority that could use it against them. In the analysis from Poli (2022), where the author compared five femtech apps by data privacy, Clue performed the best in comparison. One of the only issues Poli found was that while the app specifies which information is shared with third parties, Clue may send IP addresses to them. The company confirms this and states that IP addresses do not link to anything personally identifiable. They will exchange certain data with Google, such as device data, IP

address and information provided to Google when creating an account. Also, while the app allows deleting users' data, 30-day retention applies.

6.2 Case Oura

Conversely, Oura is a pioneer in health technology wearables. Oura, founded in Finland in 2013, focuses on sleep tracking and overall health monitoring. Its primary product is a smart ring that tracks sleep patterns, activity, heart rate, and temperature. Oura's audience includes individuals interested in improving their sleep quality, activity, and overall health. Moreover, Oura collects data on sleep duration, sleep stages, activity, and physiological markers. It gives users insights into their sleep quality, readiness, and recovery. Oura ring's key features include 24/7 heart rate monitoring, which can provide valuable insights into how the body responds during and after exercise and how physical activity impacts sleep. Besides its tracking features, the mobile app also offers heaps of content, including personalised and evidence-based guided meditation sessions for sleep and rest, as well as for focus and creativity. (Oura, 2023) Their business model combines direct-to-consumer (D2C) and B2B. Their primary source of revenue comes from a one-time purchase of the smart ring, and users can access the accompanying app for free. However, Oura has also launched Oura for Business, a B2B solution for organisations to improve employees' health.

What makes Oura's story interesting in the femtech field is that it failed to comply with its gender-inclusive needs on the initial launch of its popular device, Generation 2, in 2018. Since then, the company has remodelled its product to comply with hormonal aspects. Oura's latest ring model, Generation 3, was three years in the making and finally incorporated a period tracking beta feature at the end of 2021. Oura has since then prioritised investment in research and development in several areas, including women's health, illness detection, sleep, stress, and mental health. Femtech features include predicting labour onset and mapping hormone and creative cycles. As a new fertility awareness player, the company partnered with Natural Cycles, a temperature-only (with optional LH)

fertility tracking app. With the integration with Oura Ring, Natural Cycles provides women with a feature to plan or prevent pregnancy without hormones. (Oura, 2023) This collaboration might contribute to the femtech space as both companies are experts within the health technology landscape.

In response to the data privacy topic, Oura has implemented technical and organisational measures, such as anonymisation or pseudonymisation of personal data, strict access control, and encryption to protect the data to keep user data safe and secure. Stricter GDPR privacy laws govern it as the company is located in Finland. Like Clue, Oura collects only the data it needs to provide the service users pay. It does not share user data with third-party advertisers or for advertising or marketing purposes. (Oura, 2023)

6.3 Implications and insights

The analysis of Clue and Oura offers a comparative perspective, enabling us to draw insights from diverse femtech subsectors. These two companies offer different perspectives within the femtech industry. Clue focuses exclusively on women's health and reproductive tracking, and simultaneously, Oura provides a broader health tech solution with applications relevant to femtech. Examining their strategies and impact can uncover valuable lessons and principles applicable to various femtech subdomains. Experiences of Oura and Clue highlight the diverse pathways femtech companies can take to succeed. While Clue represents a quintessential company, focusing solely on women's health and reproductive tracking, Oura's journey underscores the possibility for health technology companies to adapt and cater to the market successfully. This diversity in approaches suggests there can be different models for femtech startups. Entrepreneurs in this space should consider the unique demands and opportunities within the ecosystem.

The cases of Clue and Oura indicate the intersection of health technology and femtech. Developed initially as a health monitoring device, Oura adapted its

product to cater to female users, acknowledging the importance of addressing women's health needs within the broader health technology landscape. This intersection emphasises the collaboration and innovation between the health tech and femtech sectors, encouraging a more holistic approach to women's health and well-being.

Oura's expansion into the femtech market signifies the opportunity for diversification and evolution for existing health technology companies. This strategic shift underscores the growing demand for solutions with woman-centric product development and encourages established players in the health technology space to explore opportunities in this sector. In terms of success, it might benefit companies to provide a product for all genders while truly accommodating different needs.

7 Analysis

To answer the research questions, it was crucial first to analyse and understand femtech as a phenomenon. In the first part of the literature review (chapter 3), market research, we learned that it falls into the digital health industry category that focuses on developing technology-driven solutions for, including but not limited to, women, supporting their needs with the main product types of consumer products, apps, devices and wearables. Recent reports (e.g. Frost & Sullivan, 2020; Emergen Research, 2020) estimate the market potential from \$50 to \$60 billion by 2027.

Although femtech solutions accommodate the needs of about half of the world's population, research shows it is often still considered a niche market. Therefore, there is a large untapped opportunity in the market, and it may continue growing and innovating to address various health needs. While the femtech companies have traditionally focused on fertility and menstruation, there is a large untapped potential market for menopause, fitness, mental health, sexual wellness, and

other conditions like PCOS and endometriosis (Martikainen, 2022; Femtech Analysis, 2023). Although femtech companies usually cater for these purposes, on the other hand, other health tech companies can be scaled into femtech, such as Oura (see 6.2).

Results of this study show that the key challenges for the femtech ecosystem are gender disparities in tech, funding, and data gaps (Balachandra et al., 2020; European Commission, 2018; Thomas et al., 2020). In fact, the lack of funding is the most notable key barrier, both in advancing the industry and for the success of companies. The underrepresentation of women in funding, specifically technology-related and VC investor roles, negatively affects the field. Femtech companies face a few obstacles, such as accessibility barriers and inadequate representation, and there is an urgent need for inclusivity and equitable representation in technological advancements (Kemble et al., 2022). Furthermore, the key opportunities are greater demand for women's health solutions, technological advancements, and increasing awareness (Martikainen, 2021; Geneux, Brouet and Barraud, 2022).

The statistics of femtech often reflect a broader gender gap in education and the workforce. The research shows that women's presence in technical, leadership and entrepreneurial roles remains limited. This gender gap is particularly within high-growth sectors such as ICT (Grünfeld, Hernes and Karttinen, 2020).

Interestingly, since the dominance of the femtech sector workforce and founders are clearly women, perhaps the health tech and femtech sectors could be where women will start companies in the future. Perhaps the female predominance of the social and health sector and the education sector could be turned into a positive thing in the business world if women start to found growth companies in these sectors.

Authors have suggested some interesting measures for increasing women's entrepreneurship that can also benefit the femtech field. The measures proposed to encourage women's entrepreneurship and promote the femtech industry include establishing women's mentoring schemes and networks, improving

women's access to capital, reviewing investment guidelines in investment companies, and establishing women's investment funds (e.g. Grünfeld, Hernes and Karttinen, 2020). In summary, having more women around might give women entrepreneurs more role models to look up to and support their networks, encouraging and inspiring other women entrepreneurs.

Unfortunately, there is a prominent healthcare data gap regarding studies with women. The historical data gaps in all research, especially health research, are dangerous. Once the algorithms are based on data which prefers men, it risks promoting injustice and inequality. (Yle Uutiset, 2021) Blind spots in the data sets may contribute to a perception of less unmet needs and less need for continued innovation. Therefore, the inconsistencies between the brand and roadmap come from investors, founders, and the board not realising the issue or not prioritising it.

Furthermore, while fixing these data gaps and gathering new data, it is crucial to consider the ethical considerations of femtech. Firstly, the research (e.g. Scatterday, 2022; Jacob and Evers, 2023; Rosas, 2019) argue that although the industry could potentially fill the critical health research gaps by collecting additional data, the industry needs to be regulated better, regulatory compliance is inconsistent, and there is a strong need for legal protection of personal data. As many femtech products rely on data collection, femtech users share sensitive health data. Thus, they might be prone to sharing intimate data with illicit third-party resources and, eventually, even data breaches. Secondly, another broadly discussed issue in femtech concerns accessibility and inclusivity. Femtech needs to address issues of inclusivity and accessibility, particularly for BIPOC women (Alba-Gonzalez, 2022), by adopting a race-, class- and gender-conscious approach (Krishnamurti et al., 2022). Additionally, addressing design stereotypes and heteronormativity in femtech apps, and promoting gender-neutral themes and representation, is essential to prevent discrimination, isolation, and stigmatisation of users, including those who are trans or gender-nonconforming (Bell, 2017; Jacobs and Evers, 2023; Epstein et al., 2017).

In conclusion, femtech emerges as a response to the disparities discussed in this thesis, offering a great opportunity to bridge the historical data gaps and gather evidence on women's health at a substantial scale. By addressing and improving within the limitations and considerations of the current femtech market discussed in this thesis, femtech could respond to its initial purpose even better. In conclusion, it could be crucial in reshaping the broader landscape of technology and innovation.

8 Conclusion

The main goal of this thesis was to research what femtech is and what the reasons affecting its growth are, and based on the answers, what opportunities and challenges arise for femtech companies. During the research process, the research questions complemented each other, as we needed first to define the industry and then investigate its finer nuances. The topic is important as the industry solutions accommodate about half of the world's population, but according to the conducted research, it is often still considered a niche market. While the term "femtech" may evolve or change, the industry may continue growing and innovating to address women's health needs.

Based on the research conducted in this paper, it is possible to draw a few conclusions regarding the femtech industry. The femtech market currently represents a small percentage in the health tech but has grown fast in recent years. In summary, the challenges affecting the startups in the femtech industry are affected by the cross-functional lack of inclusivity in tech, funding, and medical data. However, addressing these current challenges, along with future prospects and emerging trends, can lead to comprehensive economic and social advantages. These advantages include enhanced gender diversity in technology, increased investment opportunities, improved women's health outcomes, and the potential to create a more inclusive and equitable healthcare ecosystem.

Understanding the content represented in this research allows us to identify the systemic limitations in the broader landscape. Gender disparities, accessibility barriers and funding limitations within the technology and funding sector are undeniable and complex. Women must be represented in technical roles, leadership positions, and funding allocation to enable their full participation and influence in shaping technological advancements. The emergence of femtech highlights these issues, demonstrating the pressing need to address these issues.

While it can be argued that a contributing factor to industry disparities involves structural gender-based disadvantages, it is essential to note that the underdevelopment of femtech does not necessarily derive from intentional harm towards women. It may simply mirror the need for diversity since founders and investors are more likely to solve issues related to them and their surroundings. As Perez (2019, p.174) states, "It is not always easy to convince someone a need exists if they do not have that need themselves".

On that note, to eventually enable a safe space and success for all stakeholders in the industry, we need to address that systematic oppression towards women and minorities has affected and will affect the rise of femtech. The femtech startups should be designed to be more accessible and inclusive. The stakeholders in the development processes should acknowledge their unconscious biases and try to solve the issues outside their bubble. It is clear that most of the current femtech solutions are only touching the topics from their perspective, problems that they relate to, which are usually from the viewpoint of a healthy, white, cisgender woman.

In conclusion, the significance of this research lies in its ability to illustrate important matters. By examining femtech's evolution, we can better understand the various inequalities within the broader technology landscape. This exploration compels us to confront systemic biases, rethink traditional roles, and reimagine technology as a force for positive change. The story of femtech may inspire us to embrace a future where innovation, empowerment, and equality intersect, shaping the technology landscape for future generations.

References

Abouzahr, K., Krentz, M., Harthorne, J. and Brooks Taplett, F. (2018). *Why Women-Owned Startups Are a Better Bet*. BCG Global. Available at: <https://www.bcg.com/publications/2018/why-women-owned-startups-are-better-bet>.

Amin, A. (2023). *Expanding FemTech to advance sexual and reproductive health and rights*. UN Women. Available at: <https://www.unwomen.org/en/news-stories/feature-story/2023/03/expanding-femtech-to-advance-sexual-and-reproductive-health-and-rights>.

Alba-Gonzalez, M.D. (2023). *Femtech is transforming women's healthcare. But it must include everyone*. World Economic Forum. Available at: <https://www.weforum.org/agenda/2023/05/femtech-healthcare-bipoc/>.

Almeida, T., and Mehrnezhad, M. (2021). *Caring for Intimate Data in Fertility Technologies*. CHI Conference on Human Factors in Computing Systems. doi: 10.1145/3411764.3445132.

Ava. (2023). *Crunchbase*. Available at: <https://www.crunchbase.com/organization/ava-3>.

Balachandra, L. (2020). *How gender biases drive venture capital decision-making: Exploring the gender funding gap*. *Gender in Management*, 35(3), 261–273. doi:10.1108/GM-11-2019-0222.

BarNir, A. (2021). *To venture or not to venture? Gender stereotyping and women's entrepreneurial aspirations*. *Sex Roles*, 1–16. doi:10.1007/s11199-020-01204-3.

Bell, J. (2019). *What it's like to get your period when you're trans*. Available at: <https://helloclue.com/articles/cycle-a-z/what-it's-like-to-get-your-period-when-you're-trans>.

Bloomlife. (2023). *Crunchbase*. Available at:

<https://www.crunchbase.com/organization/bloom-technologies>.

Brush, C. G., & Greene, P. G. (2018). *A research agenda for women and entrepreneurship: Identity through aspirations, behaviors, and confidence*.

Edward Elgar Publishing.

Brush, C. G., Greene, P. G., Balachandra, L., & Davis, A. (2018). *The gender gap in venture capital - progress, problems, and perspectives*. *Venture Capital*, 20(2), 115–136.

Clue. (2023). *How tracking your period advances women's health*. Available at:

<https://helloclue.com/articles/about-clue/scientific-research-at-clue>.

Clue. (2023). *Crunchbase*. Available at:

<https://www.crunchbase.com/organization/clue>.

Druet, A. (2019). *How did menstruation become taboo?*. Helloclue.com.

Available at: <https://helloclue.com/articles/culture/how-did-menstruation-become-taboo>.

Elvie. (2023). *Crunchbase*. Available at:

<https://www.crunchbase.com/organization/chiaro-technology-ltd>.

Emergen Research. (2020). *Femtech Market By Type, By End-Use, By Application, By Region, Forecasts to 2027*. Available at:

<https://www.emergenresearch.com/industry-report/femtech-market>.

Epstein, D., Lee, N.B., Kang, J.H., Agapie, E., Schroeder, J., Pina, L.R., Fogarty, J., Kientz, J.A., and Munson, S. (2017). *Examining menstrual tracking to inform the design of personal informatics tools*. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. ACM, New York, NY, USA, 6876-6888. doi:10.1145/3025453.3025635.

European Commission. (2014). *Enterprise and Industry Statistical Data on Women Entrepreneurs in Europe*. Available at:

<https://ec.europa.eu/docsroom/documents/7481/attachments/1/translations/en/rendition/native>.

European Commission. (2018). *Increase in gender gap in the digital sector - Study on Women in the Digital Age*. Available at: <https://digital-strategy.ec.europa.eu/en/library/increase-gender-gap-digital-sector-study-women-digital-age>.

European Parliament (2015). *Women's Entrepreneurship: Closing the gender gap in access to financial and other services and in social entrepreneurship*.

Available at:

[https://www.europarl.europa.eu/RegData/etudes/STUD/2015/519230/IPOL_STU\(2015\)_519230_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2015/519230/IPOL_STU(2015)_519230_EN.pdf).

FemTech Analytics. (2023). *FemTech Market Overview*. Available at:

<https://www.femtech.health/femtech-market-overview>.

FemTech.Live. (2021). *Data privacy: How FemTech should be thinking*.

Available at: <https://femtech.live/data-privacy-how-femtech-should-be-thinking>.

Femtech.Live. (2021). *FemTech Founder: An Interview with Clue CEO, Ida Tin*.

Available at: <https://femtech.live/femtech-founder-an-interview-with-clue-ceo-ida-tin>.

FemTech.Live. (2021). *Unlocking the blue ocean: A guide to FemTech for*

investors. Available at: <https://femtech.live/unlocking-the-blue-ocean-a-guide-to-femtech-for-investors>.

Femtech Insider. (2023). *COVID-19 Infections and Vaccinations Temporarily Impact Menstrual Cycle, Clue Data Study Reveals*. Available at:

<https://femtechinsider.com/covid-19-menstrual-cycles-clue>.

FemTech Analytics. *FemTech Market Overview*. Available at:

<https://www.femtech.health/femtech-market-overview>.

Frost & Sullivan. (2020). *Growth Opportunities in the Global Femtech Market, Forecast to 2024*.

Geneux, V., Brouet A-M., and Barraud, E. (2022). *FEMTECH: Taboo-breaking innovations*. Dimensions - EPFL Magazine. longread.epfl.ch. Available at: <https://longread.epfl.ch/en/dossier/femtech-taboo-breaking-innovations/>.

Glow. (2023). *Crunchbase*. Available at: <https://www.crunchbase.com/organization/glow>.

Goldhill, O. (2019). *Why FemTech is a sexist category*. Quartz. Available at: <https://qz.com/1586815/why-femtech-is-a-sexist-category>.

Grandey, A. A., Gabriel, A. S., and King, E. B. (2020). *Tackling taboo topics: a review of the three Ms in working women's lives*. Journal of Management, 46(1), 7–35. doi:10.1177/0149206319857144.

Houston, M. (2021). *The challenges of raising capital for business owners in the femtech industry*. Available at: <https://www.forbes.com/sites/melissahouston/2021/09/29/the-challenges-of-raising-capital-for-business-owners-in-the-femtech-industry>.

Jacobs, N., and Evers, J. (2023). *Ethical perspectives on femtech: Moving from concerns to capability-sensitive designs*. Bioethics. doi: 10.1111/bioe.13148.

Kantrowitz, M. (n.d.). *Women Achieve Gains In STEM Fields*. Forbes. Available at: <https://www.forbes.com/sites/markkantrowitz/2022/04/07/women-achieve-gains-in-stem-fields/>.

Kanze, D., Huang, L., Conley, M. and Higgins, E.T. (2017). *Male and Female Entrepreneurs Get Asked Different Questions by VCs — and It Affects How Much Funding They Get*. Harvard Business Review. Available at: <https://hbr.org/2017/06/male-and-female-entrepreneurs-get-asked-different-questions-by-vcs-and-it-affects-how-much-funding-they-get>.

Kemble, E., Perez, L., Sartori, V., Tolub, G. (2022). *The dawn of the femtech revolution*. McKinsey. Available at: <https://www.mckinsey.com/industries/healthcare/our-insights/the-dawn-of-the-femtech-revolution>.

Kleinman, Z. (2019). *Femtech: Right time, wrong term?*. BBC News. Available at: <https://www.bbc.com/news/technology-49880017>.

Krishnamurti, T., Birru Talabi, M., Callegari, L.S., Kazmerski, T.M. and Borrero, S. (2022). *A Framework for Femtech: Guiding Principles for Developing Digital Reproductive Health Tools in the United States*. *Journal of Medical Internet Research*, 24(4), p.e36338. doi:10.2196/36338.

Kotler, P., Armstrong, G., Harris, L.C., Piercy, N. (2013). *Principles of Marketing*. 6th European Edition. Pearson.

Lia. (2023). *Crunchbase*. Available at: <https://www.crunchbase.com/organization/lia-diagnostics>.

Li, K., Urteaga, I., Wiggins, C.H., Druet, A., Shea, A., Vitzthum, V.J., and Elhadad, N. (2020). *Characterizing physiological and symptomatic variation in menstrual cycles using self-tracked mobile health data*. *Digital Medicine*, 3(1), 1–13. doi:10.1038/s41746-020-0269-8.

Lola. (2023). *Crunchbase*. Available at: <https://www.crunchbase.com/organization/lola>.

Martinez, A., & Christnacht, C. (2021). *Women Making Gains in STEM Occupations but Still Underrepresented*. The United States Census Bureau. Available at: <https://www.census.gov/library/stories/2021/01/women-making-gains-in-stem-occupations-but-still-underrepresented.html>.

McMillan, C. (2022). *Monitoring Female Fertility Through 'Femtech': The Need for a Whole-System Approach to Regulation*. *Medical Law Review*, Volume 30, Issue 3, Summer 2022, Pages 410–433. doi:10.1093/medlaw/fwac006.

Menking, A. (2020). *The Rise of Femtech*. Institute for Gender and the Economy. Available at: <https://www.gendereconomy.org/the-rise-of-femtech>.

Mirin, A.A. (2020). *Gender Disparity in the Funding of Diseases by the U.S. National Institutes of Health*. *Journal of Women's Health* (2002), [online] 30(7). doi:10.1089/jwh.2020.8682.

Natural Cycles. (2023). *Crunchbase*. Available at:
<https://www.crunchbase.com/organization/naturalcycles>.

Nayeri, F. (2021). *Is 'Femtech' the Next Big Thing in Health Care?*. The New York Times. Available at: <https://www.nytimes.com/2021/04/07/health/femtech-women-health-care.html>.

Oura (2022). *Oura Partners With FDA-Cleared Birth Control App, Natural Cycles*. The Pulse Blog. Available at: <https://ouraring.com/blog/oura-partners-with-fda-cleared-birth-control-app-natural-cycles/>.

Oura. (2023). *New to Oura: Cycle Insights*. The Pulse Blog. Available at: <https://ouraring.com/blog/oura-cycle-insights/>.

Oura. (2022). *Oura Ring: the most accurate sleep and activity tracker*. Oura Ring. Available at: <https://ouraring.com/>.

Perez, C.C. (2019). *Invisible Women: Exposing Data Bias in a World Designed by Men*. New York. ABRAMS.

Poli, K. (2022). *The Most Popular Period-Tracking Apps, Ranked by Data Privacy*. Wired. Available at: <https://www.wired.com/story/period-tracking-apps-flo-clue-stardust-ranked-data-privacy>.

Richter, F. (2021). *Infographic: The Tech World Is Still a Man's World*. Statista Infographics. Available at: <https://www.statista.com/chart/4467/female-employees-at-tech-companies/>.

Sandberg, S. (2013). *Lean In: Women, Work, and the Will to Lead*. Knopf.

Scatterday, A. (2022). *This is No Ovary-Action: Femtech Apps Need Stronger Regulations to Protect Data and Advance Public Health Goals*. North Carolina Journal of Law & Technology. Available at:
<https://scholarship.law.unc.edu/ncjolt/vol23/iss3/6/>.

Smith, K. (2023). *Women's health research lacks funding – these charts show how*. Nature.com. Available at: <https://www.nature.com/immersive/d41586-023-01475-2/index.html>.

Solal, I., & Snellman, K. (2023). *For Female Founders, Fundraising Only from Female VCs Comes at a Cost*. Harvard Business Review. Available at: <https://hbr.org/2023/02/for-female-founders-only-fundraising-from-female-vcs-comes-at-a-cost>.

Stewart, C. *Global femtech market size 2030*. Available at: <https://www.statista.com/statistics/1333181/global-femtech-market-size/>.

Szmigiera, M. (2021, March 12). *Share of female entrepreneurs in OECD countries*. Statista. Available at: <https://www-statista-com.esc-web.lib.cbs.dk:8443/statistics/1208492/share-of-female-entrepreneurs-in-oecd-countries/>.

Tikkanen, H. (2021). *The rise of Femtech in a gender-biased technology sector – cure or symptom?* Hanken. Available at: <https://www.hanken.fi/en/news/rise-femtech-gender-biased-technology-sector-cure-or-symptom>.

Thomas, R., Cooper, M., Cardazone, G., Urban, K., Bohrer, A., Long, M., Yee, L., Krivkovich, A., Huang, J., Prince, S., Kumar, A., & Coury, S. (2020). *Women in the Workplace*. Available at: https://wiw-report.s3.amazonaws.com/Women_in_the_Workplace_2020.pdf.

Tsang, A. (2023). *It's bloody time we got a clue about perimenopause*. helloclue.com. Available at: <https://helloclue.com/articles/menopause/it-s-bloody-time-we-got-a-clue-about-perimenopause>.

Tin, I. (2023). *8 reasons to talk openly about menopause*. helloclue.com. Available at: <https://helloclue.com/articles/life-stages/8-reasons-to-talk-openly-about-menopause>.

Wiederhold, B.K. (2021). *Femtech: Digital Help for Women's Health Care Across the Life Span*. *Cyberpsychology, Behavior, and Social Networking*, 24(11), pp.697–698. doi:10.1089/cyber.2021.29230.editorial.

Woetzel, J., Manyika, J., Dobbs, R., Madgavkar, A., Ellingrud, K., Labaye, E., Devillard, S., Kutcher, E., & Krishnan, M. (2015). *The power of parity: How advancing women's equality can add \$12 trillion to global growth*. Available at: [https://www.mckinsey.com/~media/McKinsey/Industries/Public and Social Sector/Our Insights/How advancing womens equality can add 12 trillion to global growth/MGI Power of parity_Full report_September 2015.pdf](https://www.mckinsey.com/~media/McKinsey/Industries/Public%20and%20Social%20Sector/Our%20Insights/How%20advancing%20womens%20equality%20can%20add%2012%20trillion%20to%20global%20growth/MGI%20Power%20of%20parity_Full%20report_September%202015.pdf).