Bachelor thesis

Artificial Intelligence

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AI, The SDGs, and Gender Equality

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Abstract

This study analyzes whether AI is capable of assisting the United Nations (UN) in achieving the Sustainable Development Goals (SDGs) related to gender equality. The increasing popularity of AI has caused the UN to consider using it as a tool to achieve the SDGs. However, a lack of research into the intersection of gender, AI and sustainability highlights the need for a deeper understanding of AI's impact before such solutions are implemented. The study explores some examples of AI solutions and their effects on women. These examples include Information Technology (IT), job automation and decision-making software in hiring processes. Through these examples it identifies the most prevalent risks AI poses to be bias in algorithms, inequalities in the tech industry and its inability to solve societal issues. These issues can cause solutions to have unwanted and unexpected consequences that perpetuate gender inequality. This means that AI in its current form is unable to benefit gender inequality and is more likely to form a risk rather than a solution. This means that the UN will have to address these pressing issues concerning AI before implementing solutions that rely on it. In addressing these issues the UN must spread awareness on the dangers that AI poses to gender inequality. Additionally, it is important to focus on rules and regulations that ensure that AI systems that are implemented do not promote gender inequalities.

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Chapter 1

Introduction

The United Nations agenda for Sustainable Development was adopted in 2015 by all member states of the UN. It is a plan of action on how the UN aims to achieve global peace and prosperity by 2030 through 169 Sustainable Development Goals (SDGs). One of the issues the agenda addresses is gender inequality which is a persistent global issue. It does so through goal 5: "Achieve gender equality and empower all women and girls" (United Nations, 2015). This goals has multiple subgoals and targets aimed at addressing various forms of gender inequality. This thesis focusses on subgoal 5B: "Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women" (United Nations, 2015). This thesis will explore the role that Artificial Intelligence (AI) can play to achieve gender equality. With AI's increasing popularity, the UN too is keen on using it to assist in achieving its goals. But what are the positive influences of AI on gender equality? And more importantly, what are the pitfalls?

The intersection between AI and gender equality is complex and remains largely unexplored, making it important to delve into this topic. The UN's seeming commitment to using such technologies highlights the need for a deeper understanding. This is because current AI solutions might not consider all factors, potentially leading to unintended consequences. Before such technologies are implemented, we need to fully understand what the outcomes and possible pitfalls are.

The first chapter of the thesis will introduce the concept of sustainable development and the Sustainable Development Goals. It also includes a critical evaluation of the SDGs as this is necessary for a full understanding of the topic. Chapter two reviews (the limited) existing research on the connection between the SDGs and AI. Notably, none of the studies focus on the exact intersection between gender, AI and the SDGs which is the research gap this thesis aims to fill. The third chapter investigates the impact of AI on women, including the effects of information technology (IT), job automation and decision making software in job hiring processes. The chapter also highlights local solutions aimed at promoting gender equality. Chapter four will set out the most important challenges that AI poses to gender equality. Topics such as bias in data and applications, inequalities in the tech industry, and societal inequalities will be discussed. The fifth and final chapter is a concluding one. It functions as a recommendation for the UN on addressing the intersection of AI, sustainability, and gender.

Chapter 2

Sustainability

2.1 Sustainable Development

Sustainable development has become quite the buzzword among development discourse . This is likely due to the fact that sustainable development captures the issues that are most pressing to humankind these days. The most pressing issues that are coincidentally at the core of sustainable development are climate change and poverty. Mensah (2019) wrote an extensive literature review on the discourse around sustainable development. They found that the concept of sustainable development is often unclear as scholars differ in how they define it and what its implications are for development theory as well as practice. This section will capture the most important discourse around sustainable development in order to familiarize the reader with the topic.

2.1.1 Meaning and History

The term sustainable development exists of two terms.

Sustainability

In development theory sustainability is often referred to as the concept of sustaining or improving an existing (healthy) economic, ecological and social system for human development (Mensah, 2019). It is most often understood as creating systems that satisfy human needs without exhausting ecological resources to ensure that future generations can also live a comfortable life without having to worry about satisfying their needs due to exhaustion caused by previous generations.

Development

Development in turn is associated with many different interpretations. In the sustainable development discourse, specifically by the UN, it is understood as a process that aims to a higher quality of life for all people. Their understanding of development includes economic growth as they believe it will allow countries to improve living standards by the eradication of issues such as poverty and hunger (United Nations, 1997).

The term sustainable development was coined in 1987 in the Brundtland report by the United Nations. This report set out targets in search for a strategy toward sustainable development by discussing environmental issues and economic development as one. Their definition is the one that is most commonly used and cited (Mensah, 2019). In the

Brundtland report, sustainable development is defined as "Development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs" (Brundtland, 1987). The commission responsible for the report shifted to this new discourse as they found it impossible to separate issues of (economic) development and environmental issues as a lot of development erode environmental resources and environmental degradation can in turn undermine economic development (Brundtland, 1987). Even though the Brundtland definition sounds clear, there is still uncertainty in the discourse around the topic. Mensah (2019) concludes that there are three main pillars that sustainable development relies on.

- Economic sustainability, referring to a system that satisfies the needs of consumption today without compromising the needs of future generations. This means that we have to take into account the limited natural resources when making decisions on growth and consumption.
- Social sustainability, referring to a societal system that reduces poverty. It also entails that the alleviation of poverty does not cause harm to the environment or destabilize the economy.
- Environmental sustainability, referring to sustaining the natural environment in a way that it remains productive and resilient to support human life. That is to say that ecosystem integrity and safeguarding the carrying capacity of the earth should be a priority.

2.2 The Sustainable Development Goals

The United Nations (UN) is an international organization founded in 1945. With 193 Member States, it is the largest intergovernmental organization. It aims to form a place where the world's nations can come together to discuss common problems and find solutions (Mingst, Fomerand, & Lynch, 2022).

The Sustainable Development Goals are at the core 17 goals adopted by all United Nations (UN) member states in 2015. These goals lie at the core of the 2030 agenda which is a plan of action on how the UN aims to achieve global peace and prosperity for people and the planet by the year 2030 (United Nations, 2015). The SDGs were established as a continuation of the development agenda of the UN (Mensah, 2019).

The SDGs cover a range of areas that relate to social, economic and environmental sustainability. In order to achieve the broad goal of peace and prosperity, the SDGs are divided over 17 different goals and 169 targets (see 2.1). These goals address poverty, inequality, climate change, environmental degradation, peace and justice (United Nations, 2015).

Figure 2.1: The 17 SDGs (United Nations, 2015)

As mentioned before, the inclusion of big, influential players such as the UN is important as these goals are not stand-alone issues but are intertwined and interact on many different levels. For example, gaining progress in the area of climate change might influence other issues such as health and environmental degradation positively. On the other hand, progress in one area might lead to regression in other areas. Keeping the balance between achieving goals while negatively impacting others is a tricky objective which requires cooperation of many stakeholders. Successful implementation of the SDGs will rely on untangling these complex interactions (Mensah, 2019). This is why the UN aims to reach these goals by encouraging partnership among governments, private sector, research, academia and civil society organizations (UNCG-CSO, 2017).

The sustainable development goals are more than just goals set by the UN as they are prevalent throughout society. Many companies and organizations use the SDGs as pillars to show their contribution to achieving them. For example the Rabobank published a report in 2017 reflecting on how they contribute to the SDGs (Rabobank Sustainability, 2017). Even big companies that arguably actively contribute to the deterioration of the planet such as Shell and Tata Steel, often have webpages on how they addressing the SDGs (Shell, n.d.; Tata Steel, n.d.). For an example closer to home we can look at Radboud University. They have a Centre for Sustainability Challenges which functions as a hub that brings together research and education related to the sustainability and the SDGs in order to enhance the connection of different research (Radboud, n.d.). Furthermore, in 2021 Radboud announced that sustainability will become a mandatory subject for every student (Noij, 2022). These initiatives show that the SDGs are more than pillars for the UN and are present in many layers of society.

2.2.1 Sub-goal 5B

In this thesis I will focus on subgoal 5B: "Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women" (United Nations, 2015). Subgoal 5b is one of ten subgoals of goal 5 of the SDGs. Goal 5 is to achieve gender equality and empower all women and girls. The UN states that this goal matters as gender inequality is persistent throughout the world and stagnates social progress (United Nations, 2015). Researchers in gender theory argue that the goal and its subgoals are based on strong gender analysis that covers the interconnection of gender issues relating to economic, political and social aspects (Esquivel & Sweetman, 2016).

Sub-goal 5B has one indicator which is: "Proportion of individuals who own a mobile telephone, by sex". Increasing the number of women that have access to mobile phones has shown to accelerate both economic and social development (United Nations, 2015). However, women, especially those in developing countries, face challenges in accessing ICT and therefor miss out on opportunities related to for example education and employment (UNCG-CSO, 2017). It also inhibits them from participating in the democratic public debate in an accessible way which can be a cause to reinforce existing gender inequalities (Igelsias, 2020).

Enhancing technology is defined as technology that enables the user to perform a task or to improve his or her overall performance (Collins, 2014). This definition shows that enabling technology can have a very broad interpretation. The UN however, focusses solely on mobile telephones as becomes clear from the indicator of the subgoal. Even though the access to mobile phones is can contribute to the reduction of gender inequalities, I will look at the subgoal through a different lens by broadening the scope. I will do so by extending the goal to look at other (AI driven) technologies which the sub-goal fails to do. I am by no means saying that AI driven technologies can only bring about positive change in gender inequalities. But as the effects of such technologies in relation to the SDGs, specifically subgoal 5B, remains unexplored by the UN, the potential impact that AI may have needs to be investigated. The topic of the SDGs and AI and the research that has been done on the intersection of these topics will be explored in the next chapter.

2.3 Criticism of Sustainable Development

There is a lively discourse surrounding sustainable development. The concept of sustainable development does not come without critics. There are criticisms of the concept itself but also on how the UN presents and implements it.

2.3.1 Criticism of the concept

There are three main criticisms when it comes to the concept sustainable development. The most common criticism of sustainable development is that the term is too vague and many people seem to interpret the concept differently. This confusion is partly due to the fact that the concept is used in many different contexts and there is a lack of a strong framework (Dernbach & Cheever, 2015). A counter argument is that this vagueness is caused by the different ways that the concept is applied rather than the definition and framework as they are understood through history (Dernbach & Cheever, 2015).

An often reoccurring criticism of sustainable development is that it is impossible to use the root of a problem as part of its solution. The argument at hand is that economic development/growth is the cause of over consumption which in turn has caused poverty and environmental deterioration (Lippert, 2004). It is therefor not possible to use economic development as a solution to these issues. The core of the argument is that sustainability and development are incompatible as an increase of consumption will inevitable lead to further exploitation of natural resources.

Lastly, it is argued that sustainable development offers too little too late to achieve its goals. A well known scholar who argues that we should shift away from sustainable development is Dennis Meadows. In an interview with the Smithsonian he argues that it is not feasible for people to expect to keep what they have without causing more damage to the environment and using fewer natural resources (Gambino, 2012). A common proposal by scholars who follow this train of thought is that we need to shift to resilience.

2.3.2 Criticism of the SDGs

Next to the concept itself, the SDGs also face criticism. The three main criticism are a lack of responsibility of implementation, a lack of monitoring and evaluating, and inconsistencies between different goals.

One of the main criticisms of the SDGs is that the UN fails to provide who is responsible for the implementation (Esquivel & Sweetman, 2016) (Spahn, 2018). The UN mentions that this is an intentional approach as they use governance through goal-setting (United Nations, 2015). The SDGs are however in no way legally binding meaning that states are under no obligation to adopt the SDGs into their legislation. This means that the UN has to find a way to make sure its member states respect the SDGs and that they actually implement them.

There is no set way to monitor and evaluate progress on the SDGs, especially on the local/national level. Partly due to the issues mentioned in the previous paragraph, there is a lack of institutional oversight and a high level of national discretion when it comes to monitoring the SDGs (Biermann, Kanie, & Kim, 2017). Additionally, the goals set out by the UN are very abstract and broad but fail to mention how member states should go about achieving them (Swain, 2018). This means that it is challenging to measure if progress is being made.

Lastly, critics often mention contradictions between socio-economic development and environmental sustainability. The contradictions arise because achieving progress in one goal, might cause regression in another. Espey, for example, argues that deforestation in order to increase agricultural production can increase food security while also threatening biodiversity (Espey, Walecik, & Kühner, 2015). Keeping a balance between goals related to poverty reduction and the preservation of the environment is hard and creates issues in achieving progress.

Every year the UN conducts a review of where they stand regarding progress in the SDGs yearly called The Sustainable Development Goals Report. In the most recent report they stated that for the second year in a row, there is no progress on the SDGs. According to the UN, this is largely due to ongoing health and security crises such as COVID-19

(United Nations, 2022). However, research has shown that the lack of progress is also due to the criticisms expressed earlier. Allen (2018) used a systematic approach to analyze progress on the implementation of the SDGs. They found that some progress was made but found clear gaps in the assessment of trade-off between achieving different targets and in systematic approaches. Halkos (2021) conducted a similar analysis of global progress and found similar gaps. They emphasized that global collaboration on strategies and policies is needed in order to make headway in achieving the SDGs. These gaps might undermine the effective implementation of the SDGs and highlight the value of the previously mentioned criticisms.

An important criticism I want to address as this thesis discusses gender equality, is the lack of intersectionality in the SDGs. Even though gender equality is an important topic, equality related to other issues such as ethnicity and LGBTQ status are not addressed as thoroughly. This means that while the SDGs might benefit some people, other will be left out. In the section of the 2015 agenda that deals with gender equality for example, there is no talk of intersections between race and gender. This is harmful as not all women have equal opportunities and women of color face different and often more severe issues compared to white women. What good is a goal that strives for equality if not everyone can profit from it? An additional issue is that in the goals that address gender, women are addressed but the goals leave out other marginalized groups such as gender queer and trans people. This means that the goal of gender equality does not address all people who suffer gender discrimination due to the limited understanding of the UN. A more inclusive and intersectional approach would improve the SDGs in order to offer equal opportunities to all people.

Even though the SDGs face criticism, they do form the leading pathway towards a sustainable future and are adopted in many levels of society as mentioned in a previous section. Because of this impact the SDGs have throughout society, I will focus on these goals regardless of the criticism they face.

Chapter 3

AI and Sustainability

3.1 AI and sustainability

This is where AI enters the conversation. AI is often defined as a type of computer technology which is concerned with making machines work in an intelligent manner, similar to how human minds work (Collins, 2014). With the increase of AI's popularity, there is also an increase in interest in the use of AI to achieve the SDGs. If we look at the topic of AI and sustainability there are quite some works to consider. However, there are only a few published works that focus specifically on the topic of how AI can benefit or undermine the SDGs. This section will go over three of the most recent and influential works.

3.1.1 AI for the Sustainable Development Goals - Henrik Skaug Sætra (2022)

A very recent work on the SDGs and AI was written by Henrik Skaug Sætra (2022). This is a book that is part of the series AI for Everything which explores the role of AI in different aspects of contemporary life. This instalment of the series focusses on how AI effects the SDGs. The book aims to present a method for evaluating the impacts of AI on economic, social, and environmental dimensions of sustainability.

The book starts with an extensive background on the SDGs and AI. This is followed by a chapter which presents a framework for analyzing the impacts of AI which is used for the remainder of the book where the impacts of AI related to economic, social, environmental and general sustainability are considered. The analytical approach the book distinguishes between direct and indirect effects. These indirect effects deal with the previously discussed interrelations between different SDGs. Furthermore, the book discerns between micro-, meso- and macro-levels. Where micro-level effects impact individuals or small groups, meso-level effects impact a more significantly sized group such as organizations and nations, and macro-level effects refer to the level of entire political and economic systems. Sætra emphasizes that this framework is meant to highlight considerations of the different sustainability impacts AI has. It therefore does not go into details and nuances.

The book prioritizes an accessible introduction to the topic over an in-depth scientific approach meaning that it does not go in depth for all goals and targets. A mere one and a half page are dedicated to SDG 5. Sætra mentions that AI innovations related

to household work might relieve women and girls of domestic work which is a pathway to paid work in other sectors. The section continues that the inclusion of AI in decision making processes can prevent human biases usually involved which in turn can combat discrimination. Here, Sætra emphasizes that we need to keep in mind that the choices made in the creation of these decision making algorithms, such as what data is used, can still introduce human biases into the seemingly unbiased system. Sætra continues to discuss target 5b specifically as it mentions how enabling technologies can help empower women. Rather than highlighting such technologies, he mentions the potential pitfalls related to the fact that AI is a male dominated field. This is how Sætra concludes the (short) discussion on SDG 5.

The goal of the book, as mentioned by the author, is to offer an introduction into the complicated question of whether AI can contribute to the SDGs. So although the book offers a broad and insightful overview of the crossroad between AI and the SDGs, it fails to cover each goal extensively. The section on SDG 5 is therefor quite short and lacks nuance and depth. While touching on important topics such as data quality, it leaves a great deal unexplored and under-critiqued.

3.1.2 Notes from the AI frontier: applying AI for social good - Chui et al. (2018)

This is a discussion paper published by the McKinsey Global Institute in 2018. It is mentioned by Sætra as a comprehensive and balanced key source of insight into the issue of how AI impacts the SDGs.

The paper analyses how existing AI applications could contribute to achieving the SDGs. It does so by looking at ten domains where AI could be applied (see 3.1). The numbers pictured are the possible AI use cases they found per domain.

Figure 3.1: The 10 domains of AI applications for the SDGs (Chui et al., 2018)

The paper found 160 possible use cases for AI in tackling social issues. Each use

case highlight a societal problem that can be solved by some kind of AI application. For each such case the researchers tried to identify an existing case study to underline how AI can contribute to the solution. An example of such a use case is how computer vision can help visually impaired people to navigate their environment (Chui et al., 2018).

The paper highlights how the use cases they found cover all 17 SDGs and support some aspect of each one (see 3.2). The use cases do not exactly match the SDGs as the paper focusses on goals that directly relate to AI usage whereas the SDGs do not. The paper does provide an overview of how the use cases they found tie in with the SDGs. As becomes visible from the figure, only three of the use cases can help achieve goal 5. These use cases all fall under the equality and inclusion domain which makes sense.

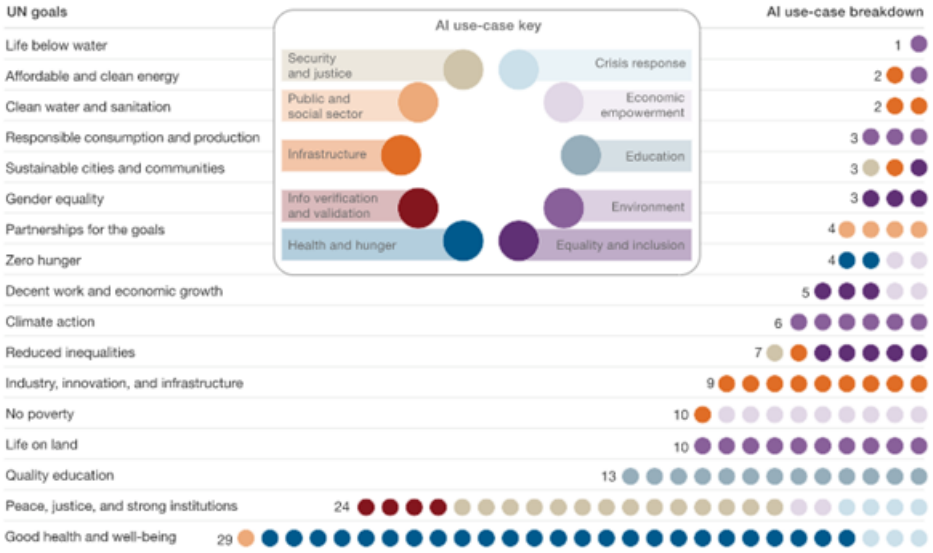

Figure 3.2: Use cases per SDG (Chui et al., 2018)

The paper additionally highlights the risks and bottlenecks that AI faces when it comes to using it as a tool to tackle social problems. They identified these bottlenecks by interviewing both domain experts and people in the AI field. The concerns that are highlighted in the paper related to the implementation of these solutions are a lack of data accessibility and a short supply of AI talent. Furthermore the paper analyzes the risks that have to be managed when working with AI solutions. The paper introduces four categories of risk: bias and fairness, privacy, safe use and security and the explainability of certain decisions.

Even though the paper highlights the potential of AI to be used for social good in many ways, the use cases are not distributed evenly over the SDGs. To be exact, the SDG that is treated in this thesis, gender equality, is associated with just three use cases. Furthermore, the use case library that is continuously referred to in the paper does not seem publicly accessible. This means there is no insight into the specific use cases and how the conclusions in the paper were reached. I have reached out to the authors of the paper but am yet to receive a reply.

3.1.3 The role of AI in achieving the SDGs - Vinuesa et al. (2020)

One of the most recent and influential papers on the potential influence of AI on the SDGs was written in 2020 by Vinuesa et al. The previously discussed work by Sætra emphasizes that this is an influential work on this specific topic (Saetra, 2022).

The article is brief but is based on extensive research into the possible influence of AI on each SDG target. It starts with mentioning that there is an important lack of studies that systematically assess the extent to which AI might impact all aspects of sustainable development. It continues by saying this research aims to fill this gap. The authors try to do so using a consensus-based expert elicitation process. This means the authors performed a literature search to find connections between AI and every SDG. The literature they found was then used to complete an analysis on the effect of AI on said SDG. One published study was considered enough to map an interlinkage. The analysis would then be discussed among different contributors until the analysis was sufficiently refined. The literature that was used to reach conclusions on each SDG is included in the extensive appendix.

The paper presents the results by summarizing the findings per pillar of sustainable development. It goes over AI and societal outcomes, AI and economic outcomes and AI and environmental outcomes. The researchers found that AI can enable 123 SDG targets but might inhibit 59 of them.

When we look at target 5B in particular, the paper found that AI may inhibit as well as positively impact progress. In the appendix we find that this conclusion is based on 4 different papers. The explanation is given in just one paragraph.

> There is only weak evidence so far that AI is tackling this specific SDG. Ref. (1) discusses the 'half the sky movement', a game that enables the player to experience the world through the eyes of a young Indian woman. However, elsewhere (2), this game - and other similar approaches - are critiqued for their neoliberal approach to empowerment, and their lack of focus on altering the systematic biases that disempower women, particularly in the Global South. Ref. (3) discusses unfairness in the ways in which large scale resume search engines use algorithms to determine which candidates are relevant to a given query and their ordering, subject to any specified filters. They show how [feminine] curriculum vitaes (CVs) are slighted penalized in the returned search results, and discuss the likelihood that these reflect structural inequalities in society, rather than the specifics of the designed algorithm. There is some evidence (4) that the automation of work is likely to disproportionately affect women (men will gain 1 job for every 3 jobs lost, and women 1 for every five jobs lost) as they stand to lose previously paid roles as [care givers], or within manufacturing.

These findings are based on findings by Hilbert Mann (2018), Fisher (2016), Chen et al. (2018), and Faith (2017). The reasoning as to why conclusions were drawn are very short and do not account for (long-term) effects. Similar to the two previously discussed works, this paper does not go into the details and nuances of why certain conclusions are drawn. Furthermore, conclusions are drawn on very little evidence as is prevalent for

target 5B. The authors acknowledge this and explicitly mention that there is an important shortcoming of AI in context of SDG 5 as there is insufficient research on the impact of AI technologies on discrimination against women and minorities.

3.1.4 Gap

These three papers expose a clear gap in the research into how AI might benefit or inhibit the SDGs when it comes to gender equality. The three works offer some insight into the topic but lack nuance and depth. As there is a more broad discussion on using AI in order to benefit the SDGs, it is important to detangle the intersection of these topics as AI might enable instead of inhibit discrimination and ultimately obstruct SDG 5 and (gender) equality. This thesis focusses on target 5B as this target specifically mentions enhancing the use of enabling technology to promote the empowerment of women. As the UN is dedicated to using enabling technology for this cause, it is of utmost importance to dive into the specifics. What are positive effects of enabling technology on gender equality? And more importantly: what are the pitfalls?

Chapter 4

Enabling technology and gender

AI and gender in the context of SDG 5B: "Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women". When looking for research on AI applications that can help promote female empowerment, there was not much to find. When looking for examples that I initially thought to have potential in opposing gender equalities, I found alarming pit-falls for almost all of them. This was for example the case for automation in the work field and AI assisting in hiring processes. This section will discuss some technologies that are thought to possibly contribute to gender equality. It also serves as a build up to chapter 4 by introducing the caveats and pit-falls that need to be taken into account.

4.1 Phones and ICT

As mentioned previously, subgoal 5B focusses on the use of ICT in particular. The subgoal's only indicator focusses on the proportion of individuals that owns a mobile phone by sex (UNCG-CSO, 2017). This section will discuss the subgoal in the strictest sense and explain how ICT, and in particular phones, can help to promote the empowerment of women and what possible has led to the UN including these technologies in particular.

ICTs can offer women opportunities in order to break down barriers that they are facing. It has played a considerable role in women's empowerment over the past couple of decades (Noor, Asghar, Sarwar, & Arfeen, 2021). There is however a significant gender gap when it comes to access to digital tools. Globally women are 14% less likely than men to own a phone (Faith, 2017). The UN gives this as the reason why they have chosen to use phone ownership as an indicator (United Nations, 2015).

There are several areas in which access to ICT services can contribute to women's empowerment. It can for example offer a way for easier communication and access to information. This allows women to have their voice heard, create their own communities and create awareness on empowerment issues. Activists can take action and find each other through the internet. The MeToo movement which sparked conversations about gender-based violence was largely organized online and had serious impact throughout society. This is an example of how online spaces can enable debates on topics concerning gender inequality. These online debates and campaigns can lead to collective action and mobilization and in several instances have led to concrete actions and outcomes (O'Donnell & Sweetman, 2018). Furthermore, Mansell When (1998) found that effective

use of ICT can lead to better education. There has been a rise of e-learning programs and technologies over the past two decades (Chin-Roemer, DeCrease, & Gomez, 2011). This can be especially beneficial to women as they face more barriers to education (World Bank, 2022a). These facts implicate that access to ICT might help educate women and girls and assist in combating gender inequalities in education.

Other studies found that ICT can have a positive impact on the participation of women in the labor force (Noor et al., 2021). It can for example enable women to access global markets through the internet or start an online business. Additionally, it could be an opportunity to work remotely which can help women in more rural areas. This gives potential to a more even playing field for businesses around the world and lower barriers for women to participate in the labor force. Access to communication and information, education and labor are just a few examples of how ICT and phones in particular can be an enabler in women's empowerment.

As mentioned previously there is a gender gap in access to digital tools. However, another, even bigger gender gap exists in the design of ICTs and technology in general with women making up fewer than 20% of people who work in tech worldwide (Madgavkar et al., 2019). Furthermore, technology mirrors the society which creates it (O'Donnell & Sweetman, 2018). This implicates that new technologies might reflect existing power imbalances and actually deepen already existent gender inequalities. Besides focusing on what percentage of women own phones and have access to ICT, it is important to tackle these more structural issues. Merely ensuring access to and ownership of ICTs will not solve these underlying issues. This concern will be discussed in large in a different section.

It is important to note that many of these solutions cannot function on their own. They are created to take part in a system. If this system is lacking, the solution itself will also fall short. For example, there is no use in giving phones to people if there is no access to a network/the internet. Additionally, if people are not properly educated on how to make use of novel ICT solutions, they will be unable to benefit from them. So even though access to a phone might contribute to equality in some ways, it will not be enough to overcome structural inequalities. In this way the indicator used by the UN is lacking as it fails to tackle these issues at the root.

4.2 Job automation

Enabling technology has a great influence on the automation of many jobs. This automation will likely happen as the replacement of human labor can increase the productivity of the world's economy. Some research has shown that 47% of jobs in the United States, 85% of jobs in Ethiopia and 77% of jobs in China are at risk of automation during the coming years (Faith, 2017). Other estimates are more reserved and say that jobs will be transformed rather than fully automated, meaning that workers will switch to tasks that work together with new technologies rather than being replaced fully (EIGE, 2020). These two examples, alongside many others, show that there are different predictions about how automation will influence the workforce (Hegewisch, Childers, & Hartmann, 2019). All accounts however agree that change in the workforce is impending over the coming years.

This development does not directly relate to gender, but possibly has big influences

on existing gender inequalities in the workforce. Worldwide, women earn on average 77% of what men earn and only 46% of women of working-age are part of the labor force. Furthermore, in emerging economies, women are on average employed in less-productive and lower-paid sectors (International Labour Organization, 2017a). Women also carry greater responsibility for unpaid (care) work (Hegewisch et al., 2019). Can enabling technology and AI in the sense of automation of jobs lead to the empowerment of women?

There are a few things that need to be taken into consideration. First of all, women are more likely to lose their job due to automation (International Monetary Fund, 2018). The International Monetary Fund found that 11% of working women were at risk of losing their job due to automation, compared to 9% of men. These differences are due to already existing differences in the workforce between men and women as women are more likely to work in occupations with a high risk of automation (Hegewisch et al., 2019). Although this difference might seem small, this means that 40 million to 160 million women will be affected by job displacement (Madgavkar et al., 2019). People whose job is (partially) automated will likely have to move into higher-skilled jobs (Madgavkar et al., 2019). What is significant about this is that women face more barriers in their transition to move into higher-skilled jobs (Madgavkar et al., 2019). Additionally, due to the increase of ICT and automation in the workforce, there will be a higher demand for people who work in tech. The issue at hand is that women worldwide are less likely to have an education and thus work in tech (Hegewisch et al., 2019). This means that if measures towards inclusion of women in higher-skilled jobs and higher education are not taken, the gender gap in the workforce will likely grow.

As becomes clear from this analysis, the future of the job market is uncertain. However, change due to automation seems inevitable and will probably negatively impact women more so than men. This is due to more women facing displacement and women facing more barriers in up-scaling to higher-skilled jobs. As there are prevalent gender issues in the workforce already, it is critical to address the upcoming changes due to technological advances in the context of gender inequality. Awareness of the gender inequalities is of utmost importance as the impending change will impact women differently than men. Policy makers have to understand these issues as the full effect of the changes caused by displacement due to automation will be determined by the policies that are implemented in order to deal with them. If addressed incorrectly, automation due to enabling technologies in the workforce will likely lead to deeper gender inequalities in the workforce than already present.

An important side note is that in many studies mentioned the findings in what technology will do to the workforce differs between countries. This has important implications as this means solutions have to be region-specific. Additionally, many effects of automation that will effect women differently than men, are due to already existing differences in the workforce and are thus rooted elsewhere. This implicates that solutions too need to be implemented elsewhere in order to solve already existing inequalities in the workforce. For example, many of the studies into job loss due to automation and gender equality, do not take into account countries where women hardly work such as Afghanistan, India and Iran where less than 22% of women are part of the workforce (World Bank, 2022b). Simply applying possible solutions to prevent job loss due to automation will not solve the existing gender gap in the workforce.

4.3 Recruitment and hiring

Over the past decade there has been growing interest in the possibility of using AI applications in recruitment and hiring processes. These applications can be implemented on websites such as LinkedIn to decide which job opportunities people learn about through advertisements (UNESCO, 2022). Additionally, these systems can advise recruitment specialists with selecting appropriate candidates by assisting in for example resume screening. These types of systems are mostly used in order to save time and cost (Köchling & Wehner, 2020). Another driving force behind the implementation of these systems was an opportunity to avoid human biases (Langer, König, & Papathanasiou, 2019). This sounds like a great opportunity to overcome human biases in recruitment and hiring. But is this really the case?

One AI application that is involved in job recruitment is targeted ads that promote certain jobs to certain people. Google for example uses an ad system that bases what ads will be shown to which people based on user data (Datta, Tschantz, & Datta, 2017). There is however a threat that these targeted ads contribute to gender discrimination. A study from 2015 found that male job seekers were much more likely than female job seekers to be shown ads for certain high-executive jobs regardless of their capabilities (Datta et al., 2017). This is harmful as the information that people are exposed to through these systems can influence the decisions they make and thus enhance already existing gender inequalities in the workforce. Moreover, it influences the decisions they see as plausible. If they are not presented with certain jobs, they might perceive themselves as being able to apply for jobs of that type. An additional issue with this discrepancy in showing different ads based on the gender of a user, is that it is uncertain how these decisions are made (Datta et al., 2017). As these systems can have great societal influence, it is important to understand how they work and why they make certain decisions. If we do not know how these biased decisions come to be, we cannot take proper steps to combat them. This issue will be further discussed in the next chapter.

These decision making algorithms are also used in selecting appropriate candidates for certain jobs. Algorithmic decision-making adopted in the hiring process because companies belief that these systems will pay equal attention to every candidate regardless of human biases (Köchling & Wehner, 2020). At first glance this logic makes sense as people often believe that algorithms do not carry bias. This is however not the case. Even though these algorithms do not carry bias the same way humans do, they are still prone to carry biases none the less. This is because algorithms can produce biased outcomes when they are trained on biased or unrepresentative input data (Köchling & Wehner, 2020). What further complicates the matter is that these biases are often only recognized after the system has started making decisions (Köchling & Wehner, 2020).

An example comes from Amazon. The company started using an algorithm to rate candidates that applied for certain jobs to help them in deciding which applicant to hire (Dastin, 2018). This could in turn help job recruiters with selecting the 'best' candidates. However, in 2015 the company found that the system was biased and preferred men over women when it came to technical vacancies (Dastin, 2018). The system had this preference because it was trained on the companies hiring history of the past 10 years which was biased. As the resumes submitted over the past 10 years for tech jobs were mostly men, the system reflected this bias in its decision making.

This example illustrates how even when we believe AI applications will reduce bias, they actually reinforce it. This is a problem that extends to all AI applications, as they are, by definition, trained on data. This issue will be explored in more depth in the next chapter.

4.4 Local solutions

As mentioned previously, there is no one size fits all solution on how to use ICT and AI in order to promote gender equality. It is also hard to estimate how ICT solutions affect gender equality in a broad sense as many factors are region and culture specific and cannot be analyzed on a global level. Incidentally, there is a way to do so by looking at locally implemented solutions. This section will go over three local solutions where enhancing technology has helped female empowerment.

In Thailand, sexual violence against women is high. Every year there are an estimated number of 30,000 rape cases. These numbers are uncertain as incidents of such cases remain unreported around 87% meaning that many cases go under the radar (Eileen Skinnider, 2017). Nonetheless, this makes Thailand one of the most prevalent countries for violence against women. The lack of data makes it hard to grasp the extent of the problem and address the problem adequately. To help with the underreporting of sexual harassment cases and more importantly to provide information to survivors, Lieutenant Colonel Mekhiyanont developed a chat bot. This so-called Sis Bot provides information to survivors which is available on their phones and computers (UN Women, 2019). The chat bot not only provides information on support services but also on how to report to the police and how to preserve evidence (UN Women, 2019). As many female survivors do not know what their options are, the chat bot offers them tools to make an informed decision through an accessible means. Additionally, the chat bot provides information on how to preserve evidence and press charges which helps police investigations.

A digital platform in Rwanda allows farmers to know the exact size of their land, helps them forecast production and allows them to access markets. The application connects small farm holders to supply chains and provides them with critical information on the weather and market prices (UN Women, 2016). This real-time information allows the farmers to make better decisions that suit climate variability and the changing market. The application is called 'Buy from Women' and is revolutionizing the way they farm and sell (UN Women, 2016). The application is especially useful for female farmers as they are traditionally not involved in all segments of the supply chain. Access to the platform enables female farmers to participate and in that way bridges inequalities in the agricultural section in Rwanda.

There are great issues in Myanmar when it comes to maternal care. 250 mothers die per 100,000 live births and only 60% of births are attended by skilled healthcare workers (World Bank, 2019). These numbers are staggering if we compare them to for example the Netherlands where less than 10 women die per live birth among the entire population of 17 million people (Centraal Bureau Statistiek, 2014). In order to improve prenatal care in Myanmar, the Maymay app was developed (Tilton, 2016). This mobile application offers medical information to pregnant people. On the app users can find information, keep track of their appointments and can contact health professionals. The app allows

for personal information to be entered in order to tailor the information to the user. Additionally, the application uses GPS information to provide the user with information on where to find local doctor services. Through these services the application aims to reduce mortality rates of young children and provide healthcare to pregnant people. The app is popular and at one point had 6,000 new users each month (Tilton, 2016).

These local solutions are tailored to users in their respective locations but are promising accounts of how AI can benefit female empowerment. Because of their successes they could potentially be upscaled or altered for use in other areas. However, as of now, these local solutions do not carry substantial influence on gender equality worldwide.

4.5 Conclusions

This chapter highlights some examples of potential influences of AI on gender equality. There are some developments that seem to have a positive effect and are able to empower women. For example, ICTs can be used to allow access to information and create awareness. Moreover, there are several locally implemented AI solutions that have been successful. However, when we look at AI solutions that are visible throughout the world, there are some key issues. This is likely due to existing, structural inequalities in society, bias in the data that algorithms are trained on, and a significant gender gap in tech. The next chapter will dive deeper into these three key issues.

Chapter 5

Pitfalls

As becomes clear from the previous chapter, there are many pitfalls that need to be taken into account when we talk about the development and use of AI applications in order to combat gender inequalities. This chapter will discuss three of the most important risks that need to be taken into account when it comes to AI and gender inequality. It will discuss bias in data used to train AI applications, a lack of diversity in the development of AI applications and how AI cannot solve structural gender issues in society.

5.1 Bias

There is a lot of evidence that biases are reflected or even amplified in disruptive technology (Rubin, Hakspiel, & Gray, 2021). This means that implementations of these technologies will increase inequalities instead of combating them, even if the intention to fight inequality is there. As many decision making processes are being (partially) automized, it is vital that we consider these embedded biases and their effects. How do these biases come about? And what are the effects and how what should we do about them?

Many AI applications rely on algorithms that are trained on labeled data. This means that if the data is biased, the algorithm will likely be biased to. If there are not enough women present in a training set used to develop the algorithm and in the development process itself, the application will lack knowledge on women which can lead to bias errors. Additionally, if the data carries bias in any other way, this will be reflected in the working of the application. There is extensive proof that this is indeed the case.

The decisions to use biased data are often not on purpose. It is often the case that the data is biased as it is by definition based on history meaning that it reflects the biases and inequalities in society (Vinnova, 2020). Natural language processing applications that are the key to systems such as Alexa and Siri have been found to carry gender bias (Bolukbasi, Chang, Zou, Saligrama, & Kalai, 2016). This bias stems from the Google News articles the application was trained on. The system exhibited disturbing gender stereotypes that it learned from these new articles (Bolukbasi et al., 2016). It for example associated homemaker with women and computer programmer with men (Bolukbasi et al., 2016). This is an example of how a system can reflect bias in society.

It can also be the case that data is biased because certain groups are underrepresented or even absent. Another example can be found in facial recognition algorithms that have

trouble with recognizing darker-skinned women. This was due to a lack of representation in the data that the algorithm is trained on (Buolamwini & Gebru, 2018). As the data consisted of 75% male faces and 80% white faces, the algorithm had a 99% accuracy in detecting male faces. It only scored 65% accuracy for darker-skinned women (Buolamwini & Gebru, 2018). In this case the application is biased because a certain demographic is underrepresented in the data that it is trained on. Both these examples show how biases and inequalities in society can be directly reflected in AI applications.

The consequences of data biases can be severe. An example can be found in cardiovascular diseases (Regitz-Zagrosek et al., 2016). Applications based on health data related to these types of diseases are based on mainly data collected from male patients. However, there are many differences between symptoms, treatment and outcomes between men and women (Regitz-Zagrosek et al., 2016). An application however, might not be aware of these differences due to the skewed data and misdiagnose a female user because of this. There is generally a big data gap when it comes to female bodies and health (Niethammer, 2020). In cases like this, the gender gap in data can be life threatening. This is of course not always the case, but does convey how serious this issue is.

Even if these biased software applications are just used to assist, they can still be harmful. For example, if an algorithm picks out potential candidates for a job application but is biased toward men, the selection it will come up with will most likely exclude qualified female applicants. This is because the algorithm is trained on predominantly male resumes and might fail to recognize female applicants as suitable employees. If the selection made by the application is then used to pick the final candidates for the application, the biased effect of the algorithm still has an effect on the final decision that is made. There are many more examples of how skewed data has significant effects on the accuracy and fairness of AI applications. They can lead to further unfair treatment or unequal opportunities for the people excluded from the data. These types of discrimination or exclusion caused by AI systems perpetuate existing inequalities in our society.

As becomes clear, we need to be careful about data collection and we need to be intentional with how technology is designed in order to address these types of biases. This is of utter importance as basically all AI applications are built on data. Logically, the most important aspect to address is the quality of the data that is used to train these applications. One way to go about this is to ensure that the data collection happens in an inclusive way and represents everyone in our society equally. This means that we make sure that all demographics are represented equally and use appropriate methods. However, we do not always have control over the data collection as sometimes already existing data is used. In this case, it is important to ensure that the data used is diverse and inclusive. This can be done through pre-processing before the data is fed to the AI application. In order to do so we need to make sure the data is balanced and representative of society. If this is not the case, the data can be augmented to guarantee that it is. This can be done through for example additional data collection or altering the existing data.

An additional measure to combat bias in AI applications is making sure that the workforce is diverse and inclusive. This is an issue at the moment as fewer than 20% of the people who work in tech are women (Madgavkar et al., 2019). This in turn can lead to a lack of perspective in the creation of AI applications and can cause inequalities to be

overlooked as marginalized groups are not involved in development processes. The causes and effects of this issue will be discussed in depth in an upcoming section.

As becomes clear from this section, there is evidence that gender biases are reflected or even amplified in AI applications due to bias in the data used to train them. These biases are caused by data that reflects bias and inequality in society and data in which certain groups are underrepresented or missing. It is important to consider these biases as the effects on gender inequality can be severe. We can address them by ensuring data is representative and diverse, and making sure to have diversity in the development of AI applications. This will be further discussed in chapter 5.

5.2 The Industry

Worldwide, women only make up 35% of STEM students and only 20% of tech workers (Madgavkar et al., 2019). As mentioned a few times, this lack of diversity in the industry can have serious consequences for the tech applications that are developed. These consequences are becoming more and more prevalent as our lives intertwine more and more with technology.

An important cause of the gender gap in the tech industry is a hiring bias that is often held by the people in charge. People are more likely to hire candidates that are not only professionally skilled, but also are similar to themselves (Turnbull, 2014). Globally, over 75% of people in executive and senior positions in tech are men (McKinsey Company, 2015). This together with the previous facts, means that women have a serious disadvantage when it comes to their chances of being hired in tech. Another study found that women face discrimination in the hiring process and are generally twice less likely to be hired in a science position regardless of whether a man or a woman is in charge of the hiring process (Reuben, Sapienza, & Zingales, 2014). The study emphasizes that this is due to negative sex-based stereotypes. Working in tech is often perceived as 'for boys' which leads to it being hard for women to identify with a role in tech alongside it being harder for them to be hired (Peacock & Irons, 2017).

An issue that goes hand in hand with inequalities in hiring is that there is a clear gender disparity in pay among tech workers. A tracking study in the United States found that in 2020 men were offered higher salaries for the same tech job 63% of the time (Needle, 2022). This pay gap is not limited to tech but present throughout all industries. On average, women globally are paid 20% less than men (International Labour Organization, 2017b). This pay gap leads to less financial security for the affected people. It might also make it more difficult for women to advance their career and achieve leadership positions. The lack of opportunities for women to advance in their careers in tech is already an issue regardless of the pay gap (Neveen, 2021). This in turn can perpetuate the already existing gender inequality that persists in the tech industry.

Another important cause of gender disparities in the tech industry is the workplace culture caused by male-dominated workplaces. A 2017 poll in the United States found that 74% of women working in computer jobs and 78% of women working in male-dominated workplaces experienced gender discrimination (White, 2021). Additionally, 79% of women working in male-dominated workplaces felt a constant need to prove themselves (White, 2021). These numbers were significantly lower for women working in more gender-diverse

teams. Moreover, there is a heightened level of sexual harassment, more bias related to women's' abilities and more hostility when raising concerns regarding unfair treatment in male-dominated industries (Dresden, Dresden, & Ridge, 2018). These numbers all raise concerns about the support and wellbeing of women working in tech and emphasize how challenging it can be for women to work in a male-dominate field. This in turn can be a cause for women to not work in tech as they may be fearful of similar treatment. Similarly, women in tech can be inclined to leave the industry due to this type of treatment and the stress that comes with it.

Because of the points mentioned above, there is a lack of female representation in the tech industry. This gender inequality has serious consequences. The most obvious consequence is that a lack of representation is self-perpetuating. As there are only few women active in the tech industry, there is a lack of female role models in the industry as well as tech education. Role models can serve as an important source of inspiration and can help people picture themselves in that role (Porter & Serra, 2020). More importantly, a lack of representation and role models can cause an inability to picture oneself in a certain role (Porter & Serra, 2020). This means that a lack of representation can lead to discouragement to enter the field, which in turn perpetuates the lack of representation and deepen the existing inequalities.

Another effect is that the hostile environment that has been previously discussed can have severe personal consequences and can ultimately cause women to leave the field. Survey data shows that 38% of women working in tech in the US are considering leaving their job in tech by 2023 (Montilla, 2023). Another report by Girls Who Code, found that women are 50% more likely to drop tech roles before they reach 35 (girls who code, 2020). This is compared to 20% of women in other types of jobs. The issues mentioned previously in this section are most likely the cause of these high numbers.

The tech industry plays a powerful role in shaping the way we live and work as became clear from the previous section. When women are marginalized in the industry, which they are, it will most definitely have negative consequences on the development of new technologies for women as their needs may not be taken into account. For example, the discussed inequalities can lead to technologies that are useful to people in a similar situation as the developers and less helpful or even harmful to for example women or other marginalized groups that are not represented in the workforce. An example can be found in the development of car safety which was done in a male dominated field. As a result of breasts and pregnant bodies not being taken into account in the development of headrests, airbags, and seatbelts, women are 47% more likely to be seriously injured in a car accident (Niethammer, 2020)). This example does not directly apply to the development of AI applications, but similar risks are at hand as explained in the previous section about bias. This means that the gender gap in the tech industry is a risk to further perpetuate these biases through a lack of female perspective and oversight.

An arguably less important effect of the gender discrepancies in tech is that companies miss opportunities by not employing women. Research has shown that companies with a corporate board of at least 30% women, perform better on climate governance and innovation among other areas (BloombergNEF, 2020). These companies also tend to have four times as many resource and development investments compared to companies with no women on their boards (BloombergNEF, 2020). This obviously means that companies

without women on their corporate boards perform worse in these areas. This could function as a motivation for said companies to hire more women in higher functions. Even though using this as a reasoning to actively support women in tech might not be the most desirable motivation, it can help companies to make an effort none the less.

As becomes clear from the previous sections, there is an under-representation of women in the tech industry. The causes of this discrepancy are a lack of female role models, a male-dominated, often toxic work environment, a hiring bias, and a pay gap. This issue is self-perpetuating and has serious consequences which do not only harm women in the tech industry but can have consequences throughout society. It is therefore important to make an effort to address these issues and create awareness. Ones the awareness is created, steps needs to be taken to ensure a diverse, inclusive and equitable industry. An advice on what needs to be done in order to achieve these goals will be discussed in chapter 5.

5.3 Structural change

A third important pitfall that needs to be address before using AI to benefit gender equality, is the fact that AI alone cannot solve structural societal issues. There are several reasons for this, including the fact that it is not a one size fits all solution, the unfairness in access to digital tools, and an inability of AI to alter cultural norms and values.

AI can sound appealing to use because of the hype surrounding it. However, in order to solve an issue using AI, you need a specific and targeted problem. The solutions that are most effective are the ones that are implemented locally and targeted to a specific group of people as became clear from chapter 3. This is because local solutions can be tailored to the specific needs and circumstances of the people they intend to help which makes them more effective. For example, the farming application that was implemented in Rwanda is tailored to the local weather and market prices (UN Women, 2016). This means that the solution in its current form is not useful for farmers in areas with a different climate and market situation. Additionally, different regions have different issues related to gender inequality. A solution related to creating a more fair farming industry will not make sense in a metropolitan area.

The issue of the one size fits all solution also ties in with the issue discussed in the section about bias in AI applications. As mentioned before, these applications often carry bias against or fail to consider marginalized groups. This means that while these applications might be able to benefit certain groups in society, they will ultimately harm other, already marginalized, groups. This emphasizes how a solution that benefits one group, might harm another and AI applications should not be implemented unquestioningly without considering the effects on different groups of people. A second issue related to AI solutions is the unfairness in access to technology. There are significant (gender) gaps in the distribution of and access to digital tools (Faith, 2017). This is especially important to subgoal 5B. As the only indicator of the goal is the distribution of phones between men and women. As previously discussed, phones can offer opportunities to empower women. However, these opportunities have additional requirements next to ownership of a phone. As discussed in chapter 3, phones can offer different chances for women. They can for example offer new means of communication, access to information and educational tools. However, these solutions all require access to the internet and digital literacy. Internet

access might not be an issue in the global West, but is a prevalent problem in other regions. This inequality in access to ICT and the inability to work with ICTs due to digital illiteracy is called the digital divide (Horrigan, 2019). This digital divide makes that many people are not able to benefit from the opportunities that phones are able to offer. In order for phones to reach the potential that the UN intends them to have, this digital divide has to be tackled first. Otherwise, taking the proportion of women that own a phone as an indicator of whether enabling technology empowers women, does not make sense.

Another challenge in using AI to address gender inequalities is that it cannot bring about behavioral change or alter cultural norms. For example, an AI system that can prevent bias in hiring decision will not address issues that women face in the workplace. It cannot change the cultural values and norms that determine this social climate. To solve these structural societal issues, it is necessary to take into account the social, economic and political context in order to address the underlying issues. So, in order to address these issues we cannot turn to AI but we instead need to focus on broader societal shifts. In this sense, AI can be an enabler for human activities that might help with solving inequalities, but it cannot do so itself.

The points mentioned above demonstrate that AI cannot effectively address gender inequality on its own due to an inability to address the structural societal issues that contribute to these inequalities. There are important contexts that need to be taken into account for different groups of society and AI is not a one size-fits-all solution. Additionally, the digital divide needs to be addressed before AI and ICTs can even begin to empower women and other marginalized groups. Lastly, AI is unable to change cultural norms that lie at the core of gender inequalities.

5.4 Conclusion

This section highlights the potential negative impact of AI on gender equality. There are three main issues that can potentially inhibit gender equality rather than promoting it. First of all, AI algorithms often reflect and even amplify biases in society as they are trained on data that reflects inequalities in society. Secondly, a gender gap in the tech industry not only causes issues for women working in tech but can also inhibit the development of more fair and unbiased AI applications due to a lack of diverse perspectives. Lastly, many inequalities in society cannot be combatted using solely AI as they are structural issues which AI cannot address. The next chapter will discuss ways in which the UN should address AI in relation to gender and the SDGs taking into account the findings of this research so far.

Chapter 6

The Way Forward

6.1 Advice

As becomes clear from this research, the intersection between AI, gender and the SDGs is complex and it is not self-evident that AI applications can assist in achieving gender equality. It seems that using enhancing technology and AI to combat gender inequality as the UN aims to do with sub-goal 5B is a slippery slope with many different aspects that need to be taken into account. Based on the findings of this research I have come up with pointers for the UN that take into account the different intersections between AI, gender and the SDGs and addresses the possible pitfalls. These pointers also serve as an opening to future research as fully diving into each of them is outside of the scope of this research which is focused on highlighting the issues rather than solving them.

6.1.1 Awareness and legislation

The most important shift that needs to be made is that the UN should be aware of the possible pitfalls AI poses to gender equality in order to make sure AI does not inhibit the SDGs and progress that has been made so far. This includes doing more research into the effects of AI and the dangers it poses to achieving the SDGs as this research highlights that there is a lack of understanding the potential impact of AI. This understanding is not only important for subgoal 5B which focusses on enhancing technologies, but also on every other goal if there are plans to use AI technologies to achieve them. As Vinuesa et al. state in their previously mentioned research, important aspects are overlooked in current research and regulators need insight into the nature and potential of AI in order to respond properly to the proliferation of AI systems (2020). The most important aspect related to gender equality that need to be researched according to my findings are the influence of AI applications on different minorities such as women and the biases that we are dealing with.

Once the UN has a proper understanding of the impacts of AI, it is important to spread this awareness to developers and users. This is because developers will ultimately create the applications that might be implemented by the UN. A possible starting point would be to develop guidelines that applications need to adhere to. Such guidelines are important to ensure that AI applications that are developed are inclusive and reduce negative impacts on people and planet. The UN is already working on such documents as in 2021 all 193 member states adopted the global agreement on the Ethics of Artificial Intelligence (United Nations, 2021). However, this document solely serves as a recommendation to

construction of a legal foundation. This means that no such legislation is in place just yet and no member state is obliged to adhere to the guidelines in the document. Additionally, the document has very broad guidelines which are not tailored to any specific community. This makes sense as the document is meant as a global agreement but does mean that many guidelines are not applicable to all member states as there is great diversity among them. In order to make progress, specific legislation and policy is needed tailored to the needs and development of each member state. As becomes clear, there is a lack of proper legislation to guide the development and implementation of AI technologies towards sustainability but the implementation of such legislation is important to help direct the influence of AI on humans and planet. What is important in the development of such legislation is collaboration between policymakers and domain experts to ensure an understanding of the matter at hand. How exactly the UN should go about this is outside of the scope of this research but an important point to think about. However, it is of utmost importance as AI is already involved in processes to try benefit the SDGs.

6.1.2 Pathways for women in STEM

A second important issue that was highlighted in this research is the gender gap in the tech industry and its consequences. In order to combat these negative effects, the UN should promote pathways for women in STEM. Promoting equality in the tech industry can help in combating the inequalities in the application that are developed. Having a diverse and inclusive workforce can lead to more variety in perspectives and ideas which in turn can lead to more innovative and effective solutions. This is especially important in the tech industry as women are greatly underrepresented. This under-representation can be a partial cause of why the applications and their developers fail to address the biases that are present in them, as this bias does not affect the majority of the people working on their development. Additionally, promoting inclusion can have many other positive benefits such as a safer work environment for the women that do work in tech and the presence of more role models for girls who potentially want a career in tech.

The UN can promote pathways for women in STEM in several ways. Similarly to the previous point about awareness of the potential negative impact of AI, it is in this case too, important to focus on awareness. This can be done through education and training. Additionally, it is important to focus on develop and implement programs that support the participation of women in STEM and encourage diversity to attract more women in STEM fields. The global agreement on the Ethics of Artificial Intelligence, that was mentioned before, addresses potential actions to tackle these issues. It mentions targeted programs to increase opportunities for women's participation in STEM, the wage gap and encouraging female participation in the AI life cycle (UNESCO, 2022). However, as mentioned before, this document is solely a recommendation and does not ensure any change. To ensure that the measures the UN take are effective, it is important that they focus on solutions that are binding and tailored to specific communities. As mentioned before, it is rarely the case that there is a one-size-fits-all solution to global issues. A focus on regional initiatives to promote pathways for women in STEM is needed to ensure change and progress.

6.1.3 Focus on structural solutions

Lastly, I think it is important for the UN to focus on societal gender inequalities before focusing on enabling technology. Many of the issues as to why enabling technology

cannot be a solution to gender inequality, are rooted in societal gender inequalities. For example, the bias issue that has been discussed in detail, is caused through bias in the data. In turn, the bias in the data is caused by historical gender inequalities. So before these applications even can be deployed to tackle gender inequality, there needs to be a solution to the bias issue. Addressing societal gender inequalities first will help ensure the data that is used to train AI systems is not biased and will not be perpetuate existing inequalities.

Moreover, AI is unable to address the root causes of gender inequality and is not a substitute to do so. It could be a tool but it is not a solution. It can be used to identify trends in data but it cannot change societal norms and attitudes that cause gender inequality in the first place. Changing these norms requires awareness and education in order to bring about cultural change. These are not tasks that AI can accomplish. The focus should be on increasing women's representation in leadership and decision-making, education and legal and policy reform in order to change cultural norms.

6.2 Conclusion

This research explored the complex interaction between the SDGs, AI and gender inequality. To repeat, the research question stated: What are positive effects of enabling technology on gender equality? And more importantly: what are the pitfalls? In my research I found more harmful consequences than helpful solutions. There is currently limited evidence that AI applications can effectively address gender inequality. This point was examined through an analysis of the effects of implementations such as job automation and decision-making algorithms in job hiring and its effects on women. There are some local solutions that have been helpful to specific communities, but as a whole, AI seems to inhibit progress in gender equality rather than advancing it.

On the flipside, there is evidence that AI is enforcing existing inequalities. The main reasons for this is bias in data that AI is trained on, inequalities in the tech industry and the fact that AI is unable to address societal norms. Therefore, as of now, it would not make sense to rely on AI to address gender inequality. Instead, the UN should focus on solutions in a structural way instead. Nonetheless, AI is more and more present in our daily lives which means it is crucial that these issues are addressed. Therefore, it is important to spread awareness on the potential harmful consequences of implementing certain AI applications. Besides awareness, there is a need for rules and regulations to ensure that AI systems that are implemented do not promote gender inequalities. This means that policies need to be put into place to make sure AI applications adhere to certain standards.

6.3 Limitations and further research

Although this research has led to some answers, it has also generated new questions and areas for further exploration. First of all, this research focusses on just one of the 169 sub-goals that are part of the SDGs. It is however important take into account how the different goals influence each other as they are interconnected on purpose to achieve global sustainability. Further research could dive into the interconnections between the SDGs and how AI plays into that. Additionally, the interaction between gender equality and AI is complex, but this also goes for the other goals. More research is necessary

to identify the potential harms of AI in these areas. These interactions between AI and other topics are important to take into account when thinking about rules and regulations.

This brings me to the next, very important, note. This research is focused on women but does not address other minorities, let alone intersectionality. Intersectionality is the concept that different aspects of a person's identity interact to create unique experiences of discrimination and privilege. This for example means that the effects of AI on women will be different for women of color compared to white women. It is important to note the effect on other marginalized groups as they might be similar or even more severe. Secondly, facts and figures mentioned in this thesis focus on women as a homogenous group. This is of course not the case. Many of the figures will likely be different when we take into account other parts of people's identities. For example, the number of women working in tech is low, but will likely be even lower when we look at black women. An idea for further research is to examine how these issues impact different people based on their unique intersectional identity.

Lastly I would like to mention that this research is not exhaustive. This thesis paints a picture of possible (harmful) interactions between gender, the SDGs and AI but there are many other AI applications that interact with gender that have not been discussed such as healthcare and education. To gather a more complete picture of the interactions between AI and gender, more research is necessary. As AI is becoming more and more prevalent in our day-to-day lives, it is important that the influences of AI on gender inequalities, and other issues, are taken into account. This research provides an indication, but there is much left to explore.

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