



GENDER DIVERSITY IN AI

Why companies & organizations need to consider bias and ethics in AI



Feb 2020

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By Mai-Britt Poulsen, Matias Pollmann-Larsen, Jacob Hansen and Sofie Bertram

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SINCE THE ESTABLISHMENT OF the Gender Diversity Roundtable in 2016, it has aimed to contribute to the advancement of gender diversity in Denmark. Both in the Roundtable and more broadly in Denmark, the debate on diversity has evolved significantly over the past four years. There is a greater focus on the problem and a broad consensus around the need for action. This need is exemplified by the Danish Chamber of Commerce's and the Confederation of Danish Industry's recent support for earmarked paternity leave and numerous board initiatives.

WHILE THE COMMITMENT TO action is indeed positive, Denmark continues to lag behind its Nordic peers when it comes to gender diversity. In the newly published gender gap report from the World Economic Forum, Sweden, Norway, Finland and Iceland occupy the top four places, far above Denmark in the 14th place¹. The downwards trajectory continued this year, as Denmark dropped from 95 to 102 on Women in leadership, from 38 to 41 on Economic opportunity and participation and from 13 to 14 overall – a drop of six places since 2006². Despite the latter years' media attention, global movements, company and organizational pledges, Denmark still has a long way to go to ensure that organizations and society realize the full value of gender diversity.

IN BCG'S 'WAKE UP DENMARK' report published in 2019, bias is assessed to be a key barrier to gender diversity in Denmark. Even though 67% of the Danes believe their daily life to be free of bias, it nonetheless contributes to a diminishing pattern of representation across leadership and technical fields. Although Denmark appears well positioned to reduce gender gaps in STEM-related fields, women continue to be underrepresented. In Danish elementary schools, a higher proportion of 15-year-old girls than boys strongly expect to work within science and achieve a higher grade point average in related topics. Yet, women make up only one third of students in STEM study lines³. There is a need to step up change efforts and look for other tools to do so. Artificial intelligence, a seemingly objective evaluator, holds promise to become one such solution.

AI has the power to mitigate bias if diversity is considered during its creation. But, if we are not careful, it can come to replicate or even reinforce biases.

IT MAY COME AS NO SURPRISE that AI technology – with its ability to emulate human performance by observing its environment, adapting to change and taking action - will come to transform the competitive landscape in the 2020s. In a 2019 BCG and MIT Sloan Management Review Study, nine out of ten global executives recognized the opportunity AI represents, and 45% perceived it as a competitive risk if not pursued⁴. There is a first-mover advantage to the technology and an urgency to deploy it. Its use spans all aspects of the value chain, enabling the identification of quality issues, elimination of defects and reduction of waste⁵ - which also encompasses the lost potential from lack of diversity.

Actual vs. displayed female representation in professions

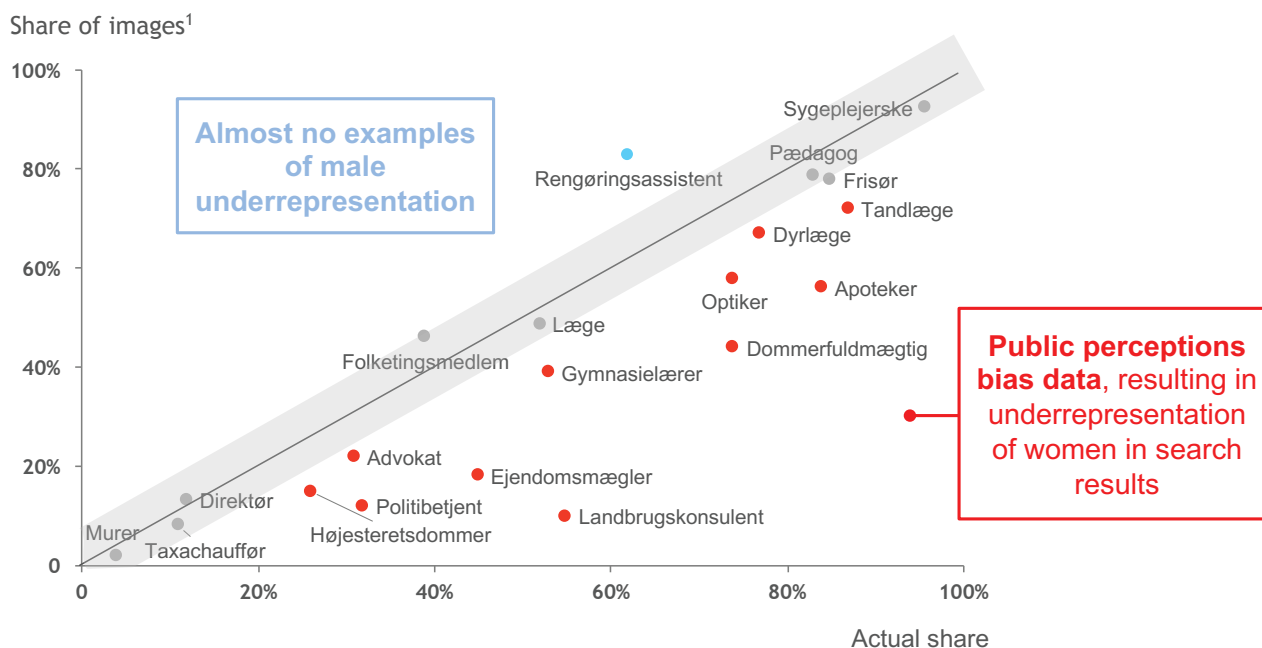


FIGURE 1: ONLINE, INCOGNITO IMAGE SEARCH ON PROFESSIONS IN DANISH; SHARE OF IMAGES FOR EACH PROFESSIONS CALCULATED FROM N = 200

SOURCE: LÆGER.DK (2018); DRS (2018); DANMARKS STATISTIK (2017); DJOEF (2019); GYMNASIESKOLERNES LÆRERFORENING (2019); DR (2016), 'LIGESTILLING: SE HVORDAN DET GÅR I DIN BRANCHE'; KVINDEF (2019); BCG ANALYSIS

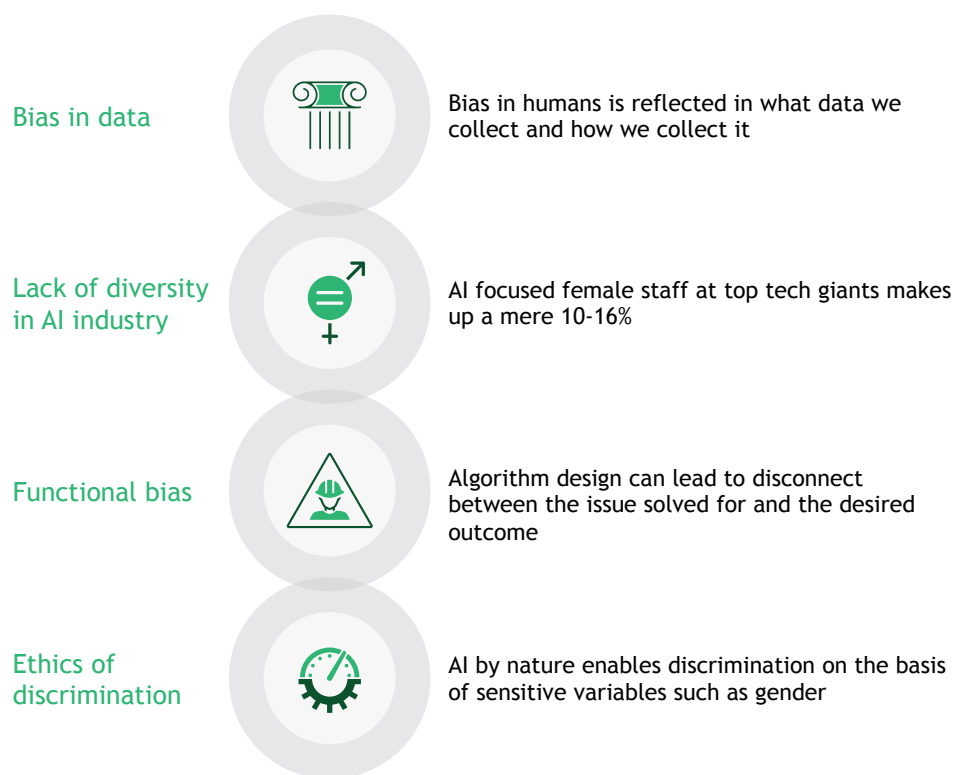
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MAKE NO MISTAKE, HOWEVER, AI is not actually intelligent. It combines endless memory with a lot of trial and error, and it does so very, very fast. Hence, it relies on humans to feed it data and train it⁶. It follows that biased data or the biases of the person creating the algorithm will set it up so it replicates or even enhances those distorted patterns.

TO ASSESS BIAS IN an AI-powered algorithm in a Danish context, we conducted an analysis of a widely used image search engine. We compared the female representation in the top 200 images of a profession with the actual share of female representation within that profession [Figure 1]. The conclusion is clear: in female and male dominated professions alike, women are consistently underrepresented in online image search results in Danish. In 55% of the investigated professions, the underestimation of the displayed images relative to the actual share of women exceeded 10 ppt. [data points in red in Figure 1]. In contrast, overexposure of females was identified in only one out of 20 professions: the cleaning profession. Overall, this fact illustrates that when public perception is biased, it distorts the data on which the AI-powered image search engine is based, thereby harming the diversity of the AI output. This underrepresentation might appear trivial, but similar bias may have severe consequences when AI outcomes have a direct impact on people's lives, e.g. in hiring, credit or insurance evaluations, etc.

In Danish image searches for female and male dominated professions alike, women are consistently underrepresented.

The topic of diversity in AI prompts 4 interrelated challenges that need to be addressed



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FIGURE 2: 4 CHALLENGES TO DIVERSITY IN AI
SOURCE: EXPERT INTERVIEWS; BCG ANALYSIS

BIAS IN DATA, HOWEVER, is only one of four interrelated challenges for diversity in AI [Figure 2]. As in many other technical professions, AI programming is male-dominated. Less than 16% of AI researchers and programmers at top tech giants are women⁷. The lack of gender diversity in the industry makes it all the more difficult for companies and organizations to evaluate whether diversity is adequately considered and treated correctly. This shortfall makes the lack of Danish female talent in STEM even more concerning. The third issue, functional bias, refers to bias in algorithm design. Wrong decisions on design, e.g. the variables to include or weights to assign, carry a risk of decoupling the outcome and the initial issue for which the data was applied. For example, if we had attempted to assess the level of crime in different areas using the number of solved cases as a key variable. If the number of police officers is high, it may designate certain areas as being more prone to crime. In that case, the number of solved cases would not reflect the level of crime as intended, but rather the level of police activity. The fourth challenge, the ethics of discrimination, refers to the decision made by companies and organizations to treat different groups differently depending on AI outcomes. In a relatively unregulated area, where should we draw the line between personalized offerings and discrimination?

IF THESE CHALLENGES ARE not adequately addressed, they pose a risk of value destruction. In market-focused applications such as personalized marketing and fraud detection, economic value is the core success criterion. Diversity is highly relevant, but as a topic that requires careful consideration and treatment to hinder negative impact. If biased AI solutions are deployed, companies and organizations risk widespread negative media attention. In 2019, the social media platforms erupted with allegations that married partners were rewarded differing credit limits despite joint assets and loans. The case reached newspapers globally, sparking an investigation into the algorithm. While the case is still under investigation, it illustrates that even the suspicion of discriminatory AI solutions can lead to significant brand damage.

AMAZON EXPERIENCED A SIMILAR issue with AI-related bias when their recruitment tool began to discriminate against women for technical jobs. It screened resumes based on those of previously successful employees, the majority of which were male. As a consequence, the algorithm punished resumes using the word “women” and favored language more frequently used by men⁸. This situation ultimately led to the tool being scrapped. When even tech giants struggle with diversity within AI, there can be no question that it is a key topic that companies generally need to resolve in order to fully leverage the potential of the technology.

IF THE CHALLENGES ARE addressed, however, AI may strengthen diversity and thereby unlock value. In organization-focused applications such as recruitment and compensation tools, promotion of diversity is a core success criterion. The AI solutions in this space generally aim to create equal opportunities by ensuring an unbiased decision-making process. An example of this is the AI start-up Pymetrics. Rather than basing applicant assessments on resumes, Pymetric’s gamified software tests applicant performance on 50+ cognitive, social and personality traits in unbiased assessments. These assessments are compared with data on high performers in the relevant position at the respective company, which has been tested and cleansed of bias. This approach allows for an unbiased match of applicants with positions for which they are well suited⁹. The tool has enabled Unilever to increase the gender diversity of their new hires by 16%. Hence, if diversity is treated properly, AI solutions can be of great value to companies and organizations.

Despite a low adoption, Denmark seems particularly aware and ready to embrace AI

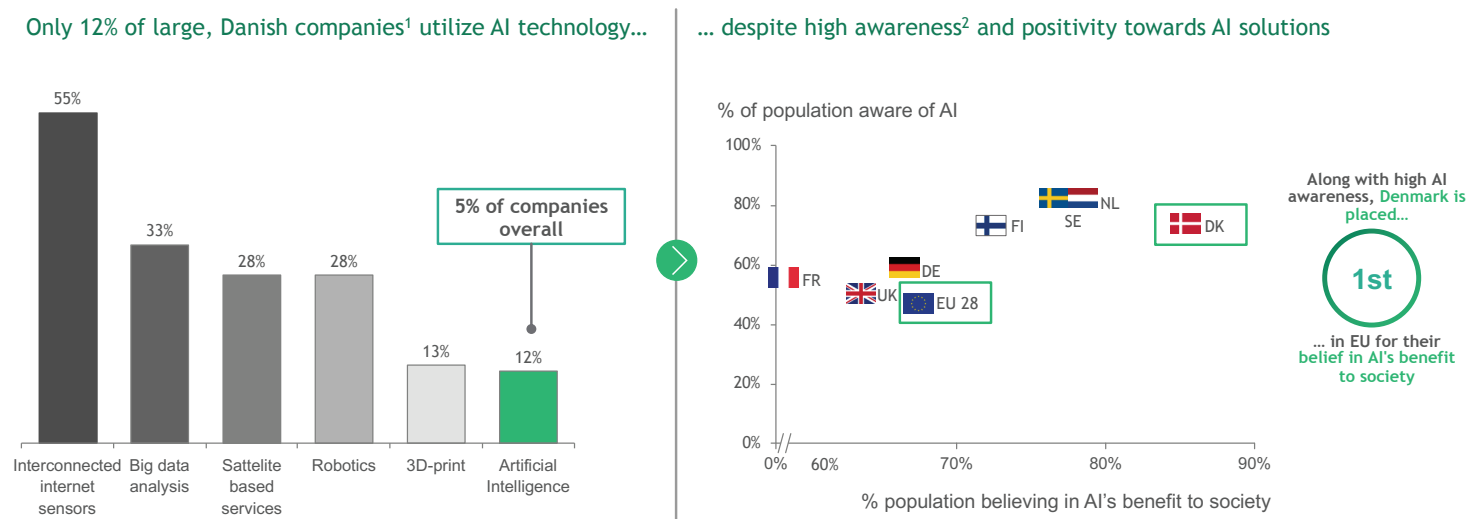


FIGURE 3: ADOPTION OF AND ATTITUDE TOWARDS AI IN DENMARK

SOURCE: DANMARKS STATISTIK (2018); SPECIAL EUROBAROMETER (2017), 'ATTITUDES TOWARDS THE IMPACT OF DIGITIZATION AND AUTOMATION ON DAILY

DESPITE A LOW AI adoption rate of only 5% among Danish companies (12% among companies with 100+ employees)¹⁰, Denmark appears uniquely positioned to leverage AI relative to its European peers [Figure 3]. The Danish population has a high awareness of AI: approx. 75% of the population recall having heard of AI in the past 12 months, ~25 ppt. above the European mean. Moreover, ~85% of the Danish population believes that AI will come to benefit society, “because they [robots/AI] help people do their jobs or carry out daily tasks at home”, which is the highest share of any country in the EU¹¹. Denmark also takes the 1st place in the EU regarding comfort around receiving goods delivered by drones/robots. These positive attitudes towards AI indicate high receptivity to AI-powered offerings in a relatively immature market. Hence, Danish companies have the chance to move on AI while competition is low and receptivity is high.

Denmark appears uniquely positioned to leverage AI relative to its European peers

DEGREE OF AUTONOMOUS DECISION POWER

	A	B	C	D	E
TYPE	Isolated option space	Reactive offering	Segmented offering	Segmented evaluation	Segment-based action
EXPLANATION	No human impact with clearly defined option space	Limited interaction with reactive option space based on transparent input	Tailored offering through assumptions based on specific user characteristics	Recommendation towards person based on assessment of various criteria	Autonomous and quick decision-making through segmentation
EXAMPLES	<ul style="list-style-type: none"> Autonomous robots at assembly lines Supply chain optimization 	<ul style="list-style-type: none"> Pension package offering Traffic direction Google image search results 	<ul style="list-style-type: none"> Automatic content generation Personalized marketing Trend prediction 	<ul style="list-style-type: none"> Long offering evaluations Fraud detection Health diagnostics support 	<ul style="list-style-type: none"> Autonomous vehicles Surgical robots Military drones and weapons

FIGURE 4. ETHICAL CONSIDERATION AS FUNCTION OF AUTONOMOUS DECISION POWER

SOURCE: BCG ANALYSIS

To ADOPT AI, the BCG experience from best-in-class companies points to four steps to build successful AI solutions¹²:

1

Develop a strategy for AI

Study potential and effect of AI use cases to understand value pools.

2

Ideate and prioritize use cases

Ensure the right number of cases to not spread the effort too wide or focus on one case.

3

Build and deploy use cases

Ensure the right expertise to build optimal models and algorithms (and reduce bias)

4

Transform operating model

Structure an ecosystem to develop the people, skills and processes.

AT EACH STEP, we call for companies and organizations to evaluate ethics and diversity consciously and continuously in their AI solutions, from strategy development to implementation and beyond [Figure 4]. That said, the need for ethical discussion varies, depending on the degree of autonomous decision power. In supply chain optimization, there is little human impact and a limited defined option space. Hence the need for such discussion is low. In highly impactful applications such as autonomous vehicles, surgical robots etc., which take autonomous, segment-based action, a discussion on diversity and ethics is paramount. While it is important to get technology and programming right, the people and processes preceding this accounts for 70% of a successful solution. It is in the interest of companies, organizations as well as the broader society to limit the risk of bias in AI and leverage it to strengthen gender diversity in Denmark

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Acknowledgments

The authors are grateful for the support of their BCG colleagues Lars Ransborg and Amalie Butze.

In addition, the authors would like to thank our close partners on the diversity agenda: Thomas Thune Andersen, chairman, Ørsted; Pernille Erenbjerg, deputy chair, Millicom; Anders Bjarklev, president, DTU; Hanne Leth Andersen, president, RUC; Henriette Laursen, director, KVINFO; Henrik C. Wegener, president, UCPH; Jais Valeur, CEO, Danish Crown; Jens Munch Holst, CEO, MP Pension; Kasper Sand Kjær, former president, DUF; Lars Werge Andersen, president, Dansk Journalistforbund; Malou Aamund, country director, Google; Mette Fjord Sørensen, head of research, diversity and higher education, Dansk Industri; Morten Mølholm Hansen, CEO, DIF; Nikolaj Malchow-Møller, president, CBS; Peder Holk Nielsen, former president and CEO, Novozymes; Per Michael Johansen, president, AAU and Caroline Rusten, director, Nordic Office, UN Women, for their insightful sparring and discussions.



1 World Economic Forum (2020) Global Gender Gap Report 2020
[Feb 4 Feb. 2020]

2 World Economic Forum (2006) Global Gender Gap Report 2006
[Feb 4 Feb. 2020]

3 Boston Consulting Group (2019) Wake up Denmark [online presentation]
March 8, 2019.

4 MIT Sloan Review, the Boston Consulting Group (2019) Winning with AI
[4 Feb 2020]

5 The Boston Consulting Group (2018) AI in the Factory of the Future
[4 Feb 2020]

6 The Boston Consulting Group (2019) AI Masterclass [online presentation] 19
September 2019. BCG Platinion.

7 Stathoulopoulos, K., Mateos-Garcia, J., & Hannah, O. (2019) 'Gender Diversity
in AI Research'. nesta 17 July.

8 Gallego, A., Krentz, M., Taplett, F. B., Tsusaka, M. & Yousif N. (2019) How AI
Could Help – or Hinder – Women in the Workforce [Feb 2 2020]

9 Pymetrics, Using Neuroscience and Data Science to Revolutionize Talent
Management [30 Jan 2020]

10 Dansk Statistik (2019) Danske virksomheder er i EU's digitale top
[Feb 14 2020]

11 European Commission (2017) Attitudes towards the impact of digitization
and automation on daily life [Feb 28 2020]

12 BCG Bruce Henderson Institute (2018) The Big Leap Toward AI at Scale
[Feb 2 2020]