



# The EU Mutual Learning Programme in Gender Equality


## Artificial Intelligence and Gender Biases in Recruitment and Selection Processes

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# How to reduce gender biases in selection and recruitment processes?

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## 1. Introduction

Globalisation is the process that brings many benefits to our lives while also producing new challenges and issues in different areas. Many organisations and companies are dealing with high recruitment volumes that make the recruitment process time- and cost-consuming. Instead of manual selection processes that include manual evaluation of each candidate, many global corporations are already using automated Artificial Intelligence (AI)-based software. They aim at saving costs, increasing efficiency and removing subjectivity that is prone to bias within the recruitment processes. The traditional selection process relies on experience and good practices but is highly dependent on the person or team doing it<sup>1</sup>. Automation, supported by Artificial Intelligence, is being offered as something that will remove those biases produced within the traditional selection and recruitment processes. However, several issues arise from those automated processes that deserve our full attention and action.

From Slovenia, we cannot report on any major research performed within the companies and organisations regarding the AI-supported recruitment processes. We can assume that global corporations and large enterprises present in Slovenia are using software that is facilitating those processes. However, those companies in Slovenia represent a small share, since data available from 2016 reveal that the share of Small and Medium Enterprises (SMEs) in Slovenia was 99.8 %<sup>2</sup>. Those companies might find it harder to afford or do not yet see the need for these automated procedures. Nevertheless, they are assessing the information available on a candidate's LinkedIn profile, as well as performing personality assessment by reviewing posts on social media. However, they are not reporting on providing those assessments in an automated manner.

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<sup>1</sup> Koch, A. J., D'Mello, S. D., & Sackett, P. R.: A meta-analysis of gender stereotypes and bias in experimental simulations of employment decision making. *Journal of Applied Psychology*, 100(1), 128–161 (2015). <https://doi.org/10.1037/a0036734>

<sup>2</sup> Statistical office Republic of Slovenia, The economy consists mostly of small and medium-sized enterprises, (2018).

Droga Kolinska, a member of the Atlantic Group, announced publicly using advanced data analytics to reduce unwanted departures<sup>3</sup>. Already in 2017, all unwanted departures from recent years had been analysed to obtain essential elements for forecasting future departures of employees from the company. They also added data on commitment in departments, employee involvement in education, projects, and promotions, comparison of salary and bonuses of employees in the departments and outside the company. However, they do not report on using AI-based selection and recruitment software.

Information on using AI-supported recruitment processes is barely announced publicly since such information causes discomfort, distrust and negative public attitude<sup>4</sup>. Algorithms can be extremely powerful in our daily lives; therefore, we have to understand fully the way they function and be careful using them.

AI algorithms are as good as the data that the algorithms are trained on. It means that biased data input will provoke a biased result, which will be replicating and furthering existing biases. Algorithms are trained on historical data. If those data lack a population diversity, the results obtained by algorithms will not be able to predict future behaviour correctly. People generate data and through their influence, can introduce prejudice and bias into the data consciously or subconsciously. It is necessary to be aware of this issue. People make decisions on algorithms, such as which data will be chosen for training algorithms, what is the purpose and goal of the algorithm itself, etc.<sup>5,6</sup> Algorithms are not biased in themselves, but the built predictive models might be. The models merely summarise the given patterns. Why those patterns exist in the first place, is the crucial question.

It is of the utmost importance that we address and raise the awareness on the existing issues related to selection and recruitment processes adequately. Sustainable development of our society depends on how good we are in dealing with equality issues. Only providing equal opportunities for both women and men will guide us to progress as a society. It is important that we focus on AI for good that will put AI at the service of social innovation supporting the digital transformation and reaching sustainable development goals.

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<sup>3</sup> Lutovac Lah, J.: Digitalizacija preperečuje, da vam odidejo najboljši! MQ revija, no. 46, (2020).

<https://www.mqportal.si/digitalizacija-preprecuje-da-vam-odidejo-najboljsi>

<sup>4</sup> van Esch, P., Black, J.S., Ferolie, J.: Marketing AI recruitment: the next phase in job application and selection. *Comput. Hum. Behav.* 90, 215–222, (2019). <https://doi.org/10.1016/j.chb.2018.09.009>

<sup>5</sup> PODGORELEC, Vili, KARAKATIČ, Sašo. Pasti pri implementaciji rešitev umetne inteligence. *Sodobne informacijske tehnologije in storitve : OTS 2019*, pp. 6-16, (2019), ISBN 978-961-286-283-1.

<sup>6</sup> PODGORELEC, Vili. Tveganja in možnosti kontrol pri rešitvah umetne inteligence = The risks and control options in artificial intelligence solutions. *Sir\*ius*, 5, pp. 1-4, (2020), ISSN 2335-3252.

<https://www.tax-fin-lex.si/Dokument/Predogled?rootEntityId=ed53ea6e-c148-4aa4-8eae-5fdf6fb7c815&returnUrl=https%3A%2F%2Fwww.tax-fin-lex.si%2FDokument%2FPodrobnosti%3FrootEntityId%3Ded53ea6e-c148-4aa4-8eae-5fdf6fb7c815>

## 2. Legislative framework on gender equality

Slovenia, already in the period of socialist self-government, had special bodies that provided the promotion of gender equality in public life. Some researches see this as the reason why the attempts of pushing women into the traditional role of housewives in the period of transition in the 1990s were less efficient in Slovenia than in some other post-socialist countries<sup>7</sup>. The Constitution and numerous laws ensure gender equality in Slovenia. The most general laws covering this topic are the Act on Equal Opportunities for Women and Men adopted in July 2002, and the Protection against Discrimination Act adopted in May 2016. Additionally, the Employment Relationships Act, adopted in January 2003, prohibits discrimination and supports equal opportunities for men and women in terms of employment, promotion, training, education, salary, remuneration, absence from work, working conditions, working hours and termination of the Employment Contract. It forbids gender discrimination in job advertisements and sexual harassment, advocates the principle of equal pay for equal work, etc. Considering the equality between women and men, Slovenia is in a good position in EU scale. According to the European Gender Equality Index<sup>8</sup> published by the European Institute for Gender Equality, Slovenia ranks 11th in the EU. Slovenia can also boast a Resolution on the National Programme for Equal Opportunities for Women and Men 2015-2020, published by the Ministry of Labour, Family, Social Affairs, and Equal Opportunities. At the moment of writing this paper, a new National Programme is being prepared for the period of 2021-2030 by the Equal Opportunities Department of the Ministry. The programme will include six areas, among others eliminating gender inequalities in employment and ensuring equal economic independence; reducing inequalities between women and men in education, science and sport and overcoming gender stereotypes encouraging women and men to engage in gender non-stereotypical occupations; promoting a balanced representation of women and men in decision-making, etc. The national programme will be presented to the Expert Council for Gender Equality, which is established as a consultative expert body of the Minister. The Council is composed of various professionals working in a variety of fields, from academia to trade unions and non-governmental organisations (NGOs) active in the area of gender equality, alongside the Advocate of the Principle of Equality, an independent body for the promotion of equal treatment of women and men.

Considering the legislation, the equality between men and women is at a high level. Still, unfortunately, in many areas of everyday life, we cannot yet talk about equal participation, representation and social power of men and women. In order to address the needs of all groups of the population, men and women should participate fully in

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<sup>7</sup> Jogan, M.: The Decomposition of Sexism in the Second Part of the 20th Century in Slovenia. Women's Movements: Networks and Debates in post-communist countries in the 19th and 20th Centuries, (2006).

<sup>8</sup> European institute for gender equality: Gender Equality Index 2019, (2019).  
<https://doi.org/10.2839/274040>

planning policies that affect their lives. This is affected directly if men and women do not realise all their potentials due to the social message that a certain activity, profession or hobby is not suitable for their gender.

## 3. Gender biases

### 3.1 Dealing with gender biases in society

Considering the labour market data indicate that the employment rate of women is lower than that of men, there are more women among the unemployed, there are more part-time employees among women, and they occupy significantly fewer decision-making positions in the economy than men do. In Slovenia, women are better educated than men. More women graduate each year (71% at the second Bologna cycle), but there are fewer of them in academic positions (25% full-time and 34% part-time Professors). Among the members of the Slovenian Academy of Sciences and Arts, only 4% of women have been members since its establishment.<sup>9</sup>

The issues of women's representation in the so-called male-dominant professions are increasingly present in the economy, education and society in general. Despite the established laws and initiatives, women remain underrepresented in higher-paid professions and higher positions. Nowadays, we lack mechanisms that would be able to bring girls closer to studying Science, Technology, Engineering and Mathematics (STEM) and later keep them in those professions. In Slovenia, around 23 % of all STEM graduates are women<sup>10</sup>. All engineering professions lack female professionals for a variety of reasons. The most decisive influencing factor are social stereotypes, which should be addressed seriously. We can do a lot by encouraging girls and boys to choose activities that they show an affinity for, even though traditionally their gender is not represented in them. It is also essential that we raise awareness among children on gender stereotypes. Measures to limit such discriminatory effects need to be set widely to provide equal opportunities for success and career development for both men and women. Only in this manner can our society progress. Even gender quotas, in women underrepresented professions, seem necessary until society balances and internalises this kind of mindset, that balanced teams are needed and produce much more sustainable solutions.

### 3.2 Good practices on raising collective awareness

In Slovenia, several initiatives help build a collective awareness of the presence and need for women in the engineering professions. The first one, called Inženirke in

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<sup>9</sup> Snemimo roza-modra očala: Ustvarjamo družbo enakih možnosti in priložnosti za dekleta in fante. Ministrstvo za delo, družino, socialne zadeve in enake možnosti, Sektor za enake možnosti, (2018).

<sup>10</sup> Stoet, G., Geary, D. C.: The Gender-Equality Paradox in Science, Technology, Engineering, and Mathematics Education. *Psychological Science*, vol. 29, no. 4, pp. 581–593, (2018).  
<https://doi.org/10.1177/0956797617741719>

inženirji bomo!<sup>11</sup> (We will be engineers (female and male)), aims at promoting engineering, technological and natural science professions and innovation among students of leading Slovenian High Schools. They encourage the development of talents and inspire young people to be creative in technical occupations and innovation, which will lead to raising competitiveness, knowledge and competencies. One of the reasons why young women are not choosing STEM careers is also a lack of role models and inadequate explanation of the role of engineers in societal development. Therefore, in Slovenia for the third consecutive year, an event of awarding a Female Engineer of the Year<sup>12</sup> is being organised. The event aims to promote women in STEM, addressing the problem of the invisibility of female engineers in society. The aim is to present female engineers and show how they contribute to societal progress with their knowledge and work, becoming role models for young women's generations.

### 3.3 Dealing with gender biases in Artificial Intelligence

#### 3.3.1 Artificial Intelligence in Slovenia

Slovenia has a long tradition of research in the field of AI. UNESCO proposed the establishment of the first International Research Centre for Artificial Intelligence<sup>13</sup> in Slovenia. It has been hosted at the Jožef Stefan Institute in Ljubljana since March 2020. The goal of this Centre involves research on AI from a broader societal perspective, dealing on using AI to address global challenges. The purpose of the centre is also to provide an open and transparent environment that may provide support to stakeholders around the world in developing guidelines and action plans in the field of AI. Slovenia is also among the countries that have established a global partnership for Artificial Intelligence<sup>14</sup>. The partnership is based at the Organization for Economic Co-operation and Development (OECD) in Paris. Its purpose is to support and guide the responsible use and development of Artificial Intelligence, which will promote innovation and economic growth, respecting human rights, inclusion and diversity. They work on introducing AI following the ethics, legislation, human rights and democratic principles into society for the benefit of citizens.

Additionally, in 2020 AI4SI<sup>15</sup> (Artificial Intelligence for Slovenia) initiative was established within the Association of Informatics and Telecommunications at the Chamber of Commerce and Industry of Slovenia aiming at fostering the transfer of AI research results into practice. At the moment, a National Program for the Promotion of the Development and Use of Artificial Intelligence in the Republic of Slovenia until 2025 is in preparation, which will be the basis for implementing activities at national,

<sup>11</sup> Inženirke in inženirji bomo!, <https://www.inzenirji-bomo.si/> (accessed 28/10/2020)

<sup>12</sup> Inženirka leta, <https://www.inzenirka-leta.si/> (accessed 28/10/2020)

<sup>13</sup> International Research Centre on Artificial Intelligence, <https://ircai.org/> (accessed 28/10/2020)

<sup>14</sup> Plonk, A.: The Global Partnership on AI takes off – at the OECD, (2020). <https://oecd.ai/wonk/oecd-and-g7-artificial-intelligence-initiatives-side-by-side-for-responsible-ai>

<sup>15</sup> AI4SI, <https://ai4si.gzs.si/> (accessed 28/10/2020)



EU and international levels. Slovenia is preparing for the presidency of the Council of the European Union in the second half of 2021. Priority will be given to the topics of digitalisation and AI.

### 3.3.2 AI-powered tools - issues and potential solutions

AI algorithms for producing correct results need adequate training with an appropriate quantity of quality data. These data can be biased or have specific characteristics that encourage unequal treatment of the individual in comparison with someone else on the grounds of nationality, race, ethnic origin, gender, health status, disability, language, religious belief, age, sexual orientation, education, property status, social position or any other personal circumstance. The developers or company managers can introduce prejudices in the AI algorithms consciously by including exactly as much data, and only those data, that will produce wanted results, or subconsciously through data with embedded opinions, patterns, and values. Therefore, we have to question algorithms and inject ethics in the process of building them. Usage of explainable AI is crucial and enables the implementation of security mechanisms, which will ensure that procedures powered by the AI are objective and not violating the candidates' rights. Those who build algorithms do not necessarily work on the principle of fairness. Therefore, it is necessary to doubt the algorithms and subject them to auditing. Algorithms should be audited for accuracy, bias, transparency, consistency and fairness. We need to audit the assumptions on the type, quality and quantity of data, data pre-processing, algorithm training process, implementation as well as the execution.

Several aspects should be taken into consideration:

- (1) Those developing the solution set the goal of the algorithm. Therefore, goals might be biased with embedded subconscious stereotypes and prejudice. A solution for this issue needs to be sought in training developers in equality issues, raising awareness and taking advantage of the latest research achievements in the field.
- (2) Algorithms' training (learning process) and optimisation is based on databases that might hold biased data and patterns. A potential consequence lays in poor population generalisation. We have to strive to create representative databases and fill the gender data gap. All the initiatives mentioned above might help and lead us to this goal.
- (3) Algorithms' assessment should be based on the definition of fairness<sup>16</sup>. A wrong definition, or no definition, will result in discriminating choices of the built decision models, as well as in propagation and amplification of those biases. It is necessary to define fairness, as well as develop audit tools that will audit algorithms for accuracy, bias and fairness.

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<sup>16</sup> Verma, S., Rubin, J.: Fairness definitions explained. International Workshop on Software Fairness (FairWare '18). Association for Computing Machinery, New York, NY, USA, 1–7, (2018). DOI:<https://doi.org/10.1145/3194770.3194776>



(4) Records on data used to train the algorithms as well as documentation of decisions made with the algorithms, should be kept, and available within the auditing processes. The candidate should be acquainted with the rules of conducting the assessment using AI, and with the report on reasons for the selection or rejection. The appeal procedure should be made clear to the candidate, which would allow him/her to challenge decisions made using AI.

(5) The code of the final product/software could be reused. This might cause the bias further propagation. It should be avoided by the regulation transparency and encoding equality, which provisions recommending as many male/female candidates for a given job, ensure equal salary, transform a whole text in gender-neutral form, or, in the case of Slovenia, using both male and female forms, etc. Finally, based on the auditing mechanisms, a certification process of a tool/software should be provisioned.

It is undeniable that the automation of recruitment and selection processes is attracting more and more researchers trying to find solutions for real-world problems. Slovenia is not an exception. Several researchers detected issues related to recruitment processes and offered some pilot solutions.

Keršič et al.<sup>17</sup> proposed a pilot implementation of a blockchain- and AI-based platform for global employability. The proposed solution provides the search for adequate candidates considering their skills and not only their formal education. Their solution is implemented as an Ethereum-based blockchain platform providing benefits such as managing project's success voting, and creation of own non-fungible skill tokens, which serve as proof of experience (skills) and reliability. On the other hand, AI is used to facilitate the matching process, determining the best match for a given task using supervised learning. This process is performed in three stages: candidates are assessed according to the requirements of the project, potential teams are constructed so that all project requirements are met, and all potential teams are evaluated on the possibility of completing the project successfully. The aggregation of candidate's experience, type of work and skill tokens is used to construct the profile.

Additionally, Karakatič et al.<sup>18</sup> propose building candidates' skills profiles using the skill2vec structure to create personnel profiles for the military unit formation and role selection. This structure is used to form personnel2vec models, which are further aggregated into the unit2vec model of a particular unit, embodying all of the properties of its members.

Furthermore, Blockchain- and AI- based platform also incorporates an auditing mechanism in the case of conflict between the candidate/team and project owner. They provision the usage of voters to assess the quality of completed services. This

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<sup>17</sup> Keršič, V., Štukelj, P., Kamišalić, A., Karakatič, S., Turkanović, M.: A Blockchain- and AI-based Platform for Global Employability. *Blockchain and Applications. Advances in Intelligent Systems and Computing*, vol 1010. Springer, Cham., (2020). [https://doi.org/10.1007/978-3-030-23813-1\\_20](https://doi.org/10.1007/978-3-030-23813-1_20)

<sup>18</sup> Karakatič, S., Kamišalić, A., Turkanović, M., Brezočnik, L., Faganel, R.: Creating personnel profiles for military unit formation and role selection with artificial intelligence. *Big data and artificial intelligence for military decision making : STO-MP-IST-160*, (2018), ISBN 978-92-837-2181-9.

can be taken as an example of a good practice since it is essential that auditing mechanism are incorporated to address potential disputes. The Employment Relationships Act, addresses any form of unequal treatment while introducing the inverted burden of proof to the employer, who must prove that he/she has not violated the principle of equal treatment and non-discrimination in the event of a dispute. Therefore, it can also be seen as an advantage for employers, who in the case of any dispute would be able to respond adequately and stand behind the decisions taken.