**Universidad del Rosario**

# Hiring Bias in Technical Recruitment Practices: STEM fields
CRITEO

Graduating Project

María Paula Pedraza Sedano

Bogotá, Colombia

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Bachelor's in international business administration
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**Glossary**

**Machine Learning:** Machine Learning is the study of computer algorithms that improve automatically through experience. Applications range from datamining programs that discover general rules in large data sets, to information filtering systems that automatically learn users' interests (Mitchell, 1997).

**Artificial Intelligence: "**AI technologies appear to think and to analyze like humas do, but are really just computers crunching large amounts of data to make decisions. Therefore, whereas humans display *natural intelligence*, we say that computers display *artificial intelligence*, built to solve a problem, or task with well-defined inputs and outputs. An AI's model, or brain, learns or adapts and improves its behavior, based on the data that is given" (Trivedi, 2019).

**Marketing Retargeting:** Retargeting is an advertising practice that most often consists of targeting an individual who has visited a website or a product sheet, but for whom there has been no purchase or transformation during this visit. The most common retargeting practices are those implemented by e-commerce players. In this context, an individual who has consulted one or more product sheets without making a purchase is then exposed, during his Internet browsing, to advertising creations highlighting the product(s) initially consulted (Beaugé, 2000).

**Resumen**

Encontrar candidatos calificados específicamente en el sector STEM es cada vez más complicado debido a la alta competencia que existe por captar a los mejores talentos en el mercado. Además, contar con prácticas inclusivas a la hora de considerar a los candidatos es todo un reto teniendo en cuenta la falta de representación de las mujeres y las minorías en estos campos específicos, sin mencionar el sesgo que existe en los equipos de reclutamiento técnico.

Todo lo anterior hace que la mayoría de los departamentos de investigación y desarrollo de las grandes empresas de tecnología en el mundo, estén en su mayoría, compuestos por hombres. Existen un par de herramientas y prácticas impulsadas por la Inteligencia Artificial que afirman que es posible acabar con este sesgo de contratación existente para encontrar a los candidatos adecuados y hacerlo de forma inclusiva permitiendo procesos más equitativos y específicos, descartando la influencia de la subjetividad y forzando el desarrollo de nuevos perfiles profesionales relacionados con la creación de un sistema automatizado. Este proyecto tiene como objetivo fundamental mostrar la situación actual de CRITEO SAS en términos de diversidad e inclusión, discutir las herramientas, prácticas y esfuerzos que la empresa ha puesto en práctica en la construcción de un pipeline de candidatos diverso y sólido apoyado por la situación en términos de igualdad de género específicamente en Europa.

**Abstract**

Trying to find skilled and suitable candidates specifically in STEM fields is becoming more and more complicated with the pass of time. In addition, trying to have a diverse and inclusive pipeline when considering candidates is even more difficult taking into account the underrepresentation of women and minorities in this specific fields.

Much has been said in relation with the lack of diversity and inclusion and the fact that it is not just due to the underrepresentation of this specific communities in STEM fields but that there is also a hiring bias very present in the talent acquisition departments and technical recruitment processes when looking for the candidates to fill the different roles. However, there are a couple of tools and practices AI powered that claim it is possible to end this existing and sometimes even unconscious hiring bias for finding the suitable candidates and doing it in an inclusive way allowing more equitable and specific processes, discarding the influence of subjectivity and forcing the development of new professional profiles related to the creation of automated system. This project has as fundamental objective to show the actual situation of CRITEO SAS in terms of diversity and inclusion. Discussing the tools, practices and efforts that the company has put on building a diverse and solid pipeline supported by the situation in terms of gender equality specifically in Europe.

The information here presented in relation with the situation of the company in terms of gender equality and diversity inside the company was collected using the internal tools that the company is using to measure and control the current pipeline and as well the employees (Criteo, 2018).

**Keywords**

Diversity and Inclusion, Gender Equality, STEM fields, Hiring Bias, Technical Recruitment, Equitable Recruitment Practices, Criteo

**Table of acronyms and abbreviations**

| | |
|---|---|
| **AI** | Artificial Intelligence |
| **ML** | Machine Learning |
| **STEM** | Science, Technology, Engineering and Mathematics |
| **EU** | European Union |
| **HDI** | Human Development Index |
| **GEM** | Gender Empowerment Measure |
| **GGGR** | Global Gender Gap Report |
| **WEF** | World Economic Forum |
| **GEI** | Gender Equality Index |
| **EIGE** | European Institute for Gender Equality |
| **EU** | European Union |
| **R&D** | Research and Development |
| **D&I** | Diversity and Inclusion |

# 1. Introduction

## 1.1. Objectives of the project

As a result of the work carried out by the group in charge of the technical recruitment process in a company, different techniques have been developed to try to achieve an appropriate methodology in the selection of people in a diverse and inclusive way, trying to identify the existence or not of hiring bias.

It is evident that scientific and technological progress is having an important boom in the last few decades. What is initially thought to affect more mechanical and functional areas of life is having an ever-increasing impact on certain sectors, which a priori we consider to be executable only by ONE human being. That is why the aim of this project is to show the impact that technology can have in the recruitment process. More specifically, the intervention of artificial intelligence in diverse and inclusive technological selection processes.

It is important to find mechanisms that help companies to make very high-quality personnel selection processes doing it with a diverse pipeline, but the complexity of organizations and positions makes this not easy. The process takes place at a high level of uncertainty and requires the experience of experts to make decisions in very varied contexts. Capturing an individual with the right talent can be an extensive and difficult search. For successful results it is important to have the key talent and methodology to make a difference. Keeping efficiency operational is an important axis for the development of the company. Taking into account the number of CVs that

reach companies, the talent search process can be long, complex and tedious, until the right person is found for the job.

Thanks to technological improvements, companies have within reach the opportunity to innovate in their operational processes thanks to new trends. We will focus on the area of human resources, but more specifically on recruitment processes. Indeed, digital transformation is not an exclusive subject of the technology area, since according to Criteo's internal research it is estimated that for the next few years artificial intelligence will play a leading role in selection processes and will intervene in more than 50% of large companies, and in 2 years the selection and ranking algorithms will be able to design and create new profiles.

The recruitment and selection process are nowadays essential to be able to attract talent in companies. Due to its importance, organizations are investing their resources and generate new strategies to implement innovative methodologies that facilitate the attraction of suitable talent based on the needs of companies using diversity and inclusion policies.

## 1.2. General Objective

To determine if the influence of AI powered tools and practices could end the possibly existent hiring bias in the technical recruitment process at Criteo.

## 1.3. Specific Objectives

**1.3.1.** Theoretically explain the impact of artificial intelligence in selection processes using different strategies that facilitate the object of the project.

**1.3.2.** Take into account the current indices in terms of diversity and inclusion in Europe for being able to compare with Criteo's specific case.

**1.3.3.** Know the effectiveness of selection processes using artificial intelligence to find the most suitable candidates keeping a diverse and inclusive pipeline.

**1.3.4.** Assess artificial intelligence against the performance of human resources personnel.

## 2. Company Overview: Criteo


**Figure 1*. Source: Confluence - Internal information / Official logo 2018-2019 (CRITEO SAS, 2019).

Criteo is a French company created in 2005 by 3 engineers, at first they developed a sophisticated Machine Learning platform that was meant to analyze user behavior which at the beginning they applied to movie reviews and e-commerce purchases, later the founders saw that the Ad Tech industry could use the personalized technology that they developed being now a B2B company that help its customers to build smarter ad campaigns, create hyper-relevant ads tailored for each customer in specific, served at the perfect moment in the perfect place, everything with the power of Artificial Intelligence and Machine Learning.

Currently the company is all over the world with 31 different offices and counts with more than 2800 employees, the R&D offices of this French giant are located in (France: Paris, Grenoble- South of France) (USA: Palo Alto, California and Ann Arbor in Michigan).

Criteo was at the very beginning just offering one product putting all of its efforts in Dynamic Retargeting which analyzes and understands an individual's purchase intent across their entire online shopping journey across the company's vast global publisher network. It delivers

personalized product ads at the time they are most likely to convert on web, social media and mobile apps, but right now with the ambition of being a multi-product company and reacting to the market actual conditions and challenges the R&D teams developed the Criteo Sponsored Products which came into the portfolio as the result of the acquisition of HookLogic in 2016. It allows merchants to monetize their online properties by enabling consumer brands they support to place sponsored, native product ads.

Developing 2 BETA products as well being Criteo Audience Match which is intended to enable its customers to accurately target and re-engage shoppers with dynamic paid display ads across web, mobile browsers, and apps beyond the confines of walled gardens and Criteo Customer Acquisition which engages new customers based on historic shopping and browsing events, their interests and likelihood to convert for its customer's products.

Criteo addresses Advertisers which are the e-commerce sites and the brands the company is looking forward to promoting, an on the other hand the Publishers which actually own the spaces that allow Criteo to publish being this news, social media and web sites in general, the company is in the middle of both taking all the browser data of the Advertisers and then generating the personalized Ads for publishing in the Publishers web sites.

# 3. Theoretical framework

## 3.1. Background

**Artificial Intelligence and Machine Learning in Technical Recruitment practices: AI ending the hiring discrimination in STEM fields**

### 3.1.2 Gender Inequality

Achieving gender equality continues being one of the main challenges that society is facing almost all around the world in both developed and developing countries. Even if legal equality between men and women is already a fact in terms of rights in the vast majority of developed countries, it's true that there's still a long way to go to make progress in other areas, particularly with regard to equal opportunities between the sexes.

Demands for equality are thus still relevant in the political agenda of many countries, with political proposals that come not only from interest groups or from associations, but also from international organizations or academia. Thus, gender equality is an objective to defend not only from a point of view of equality as a social objective, but also due to the positive impact that policies in favor of equality can have in on individuals and also on the society at a large.
Over the last few decades, there have been the few measures that have been adopted in the developed countries with the aim of reducing gender gaps in different socio-economic areas: positive discrimination in companies and politics, family reconciliation policies or awareness

campaigns are some of the clearest examples in this regard. However, different countries have opted for different paths in their goal of seeking equality, at the same time as policies of equality have been embedded in different economic and social structures (EIGE, 2017).

In order to be able to approach the status of gender equality in today's international context the two main gender equality indices- the Global Gender Gap Report and the European Union Gender Equality Index- are going to be used with the aim of identifying which dimensions of the inequality are better and worse off, which countries are closer to achieving equality, and what is the evolution of different indicators and dimensions of gender inequality in the international context. The analysis focuses its attention on four spheres: the education, politics, economics and health with special emphasis on the countries of the European Union (EU) to facilitate comparison and having enough information to support the main topic of the project.

Gender equality goes beyond the simple legal equality between women and men. Abundant research in this regard considers gender inequality as a multidimensional phenomenon (Moorhouse, 2017) in which different fields interact with each other, such as economic empowerment, political representation, decision making within the country and educational opportunities. Such multidimensionality presents a lot of challenges in measuring inequality of gender in its entirety, as well in the moment of establishing 10 comparisons between countries or to measure the evolution of inequality as a whole over time (McClain & Grossman, 2009). This series of problems have led, for about two decades now, to the elaboration of gender equality indices that aggregate different dimensions of inequality and make possible the comparison between countries, for instance the Human Development Index (HDI) and the Gender

Empowerment Measure (GEM) both introduced by the United Nations in 19952. Since then, different indices and ways of measuring inequality have appeared, among which the following currently stand out over the others such as the Global Gender Gap Report (GGGR), produced annually since 2006 by the World Economic Forum (WEF) (Schuler, 2006).

The GGGR analyzes the state of gender inequality in more than a hundred countries, through 70 indicators classified into four subcategories: economic participation and opportunities, academic achievement, health and survival and political empowerment. On the other hand, the GEI analyses the 28 Member States through 31 indicators in seven subcategories: work, economic resources, knowledge, time, power and health. On this basis, the objective is to present the indicators of the latest versions of these indices, in order to expose the status of the gender equality in the international context. Beginning with the GEI, the country at the top of the index is Sweden, the only one in the EU which exceeds 80 points out of 100, this country leads precisely with 82.6 points, and also lead four of the six dimensions of the index, placed in second place in the remaining two (knowledge and economic resources). Six other EU countries are over 70 points in the index: Denmark, Finland, Netherlands, France, United Kingdom and Belgium. The results of the GEI are summarized in the figure 1.

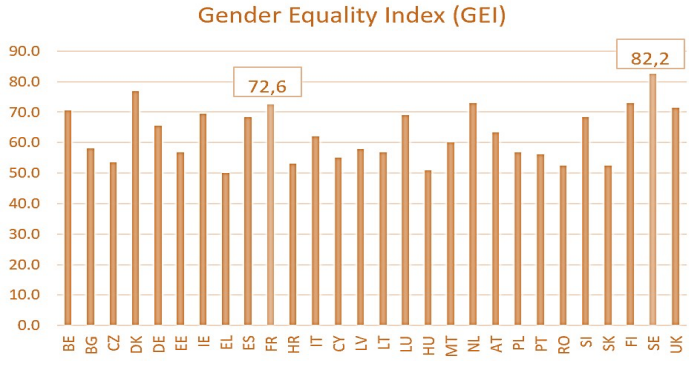


**Figure 2*. Source: Own preparation from (EIGE 2017b).

The GGGR results show similar trends. The country with the best unemployment rate according to this index is Finland, with a score of 0.87 over 1 point. Four other countries exceed the barrier of 0.8 points: Norway, Finland, Sweden and Slovenia. It can be observed, therefore, that both indices identify the same countries as leaders of the world in terms of equality, with the sole exception of Slovenia, the fifth in the sample of countries (and the third among the countries of the world) but ranked in tenth place in the EU by the GEI. This may be due to the low score of this country in the area of knowledge in the GEI results which, as will be seen below, measures it substantially different from the GGGR.

**Global Gender Gap Report 2018**

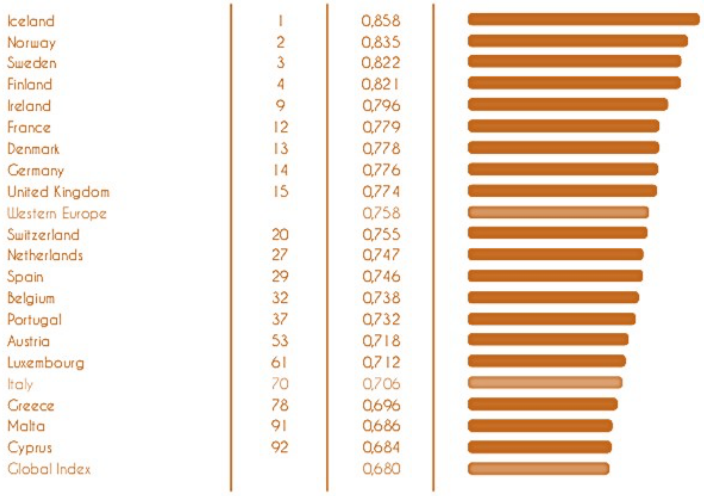


**Figure 3*. Source: World Economic Forum, Global Gender Gap Report (WEF, 2018).

### 3.1.3 The education


**Figure 4*. **Gender gap in education.** Source: World Economic Forum, Global Gender Gap Report (WEF, 2018).

Both access to education and equality in terms of results are key variables to achieving equality. The education is seen as an engine for social changing as well as a powerful tool for achieving gender equality, social inclusion and even for poverty elimination (EIGE, 2017b;29). A higher level of education translates into a greater access to better-paid jobs, having an impact on elements as the economic independence of women and in the reduction of the wage gap (Bruckauf & Chzhen, 2017).

The analysis of the educational dimension of the GGGR focuses almost exclusively on the existence of equal access to education between men and women, which completely makes sense, taking into account that the index includes a wide number of developing countries. In the group of countries analyzed here, according to the indicators used in the previously mentioned index,

the gap would already be closed on 17 of them, and it would be insignificant in the rest of the sample: the worst score in this sense is Germany, with a reason women-men in terms of access to education of 0.97.

In the context of the EU, equality in the terms of access to education is one of the most important dimensions in which the gender gap has reduced the more, and is, in fact, smaller. Thus, in the EU as a whole, there is the same proportion of men and women enrolled in higher education and between generations who are completing their studies, and actually the proportion of women with higher education degrees is a bit bigger than men but the gender gap persists, of course, among those who already have left the education system (EIGE, 2017).

Even if in terms of participation and number of people with higher education one could say that the gender gap is progressing adequately, both the GEI and the GGGR identify a big challenge in the education field for a major part of the countries: sectorial segregation. The indicators of the GEI show that the segregation by gender in terms of activity sector has hardly been reduced between 2005 y 2015. Thus, men are over-represented in science-related studies, technology, engineering and mathematics (STEM fields), while women are in the majority in the so-called "care" sectors, such as healthcare, education, and humanities careers.

At European level, women represent around 78 per cent of all the students in areas such as education, healthcare and wellness and up to 71 per cent of students in humanitarian areas (EIGE, 2017).

This the trend exists even in those countries that scored better on both indices at the general level. Thus, according to the GEI, the highest levels of segregation are found in Finland, Estonia, Belgium, Denmark and Ireland (recall that Denmark and Finland are situated as second and third country in the ranking general index, respectively). On the other hand, the countries with the least segregation are Italy, Romania and Bulgaria, but these countries have barely carried out policies to reduce the number of segregations.

It should be noted that this segregation into the education sector has a direct impact on the labor market, and potentially in the between men and women. As well as is pointed out in the GGGR, the professions traditionally more occupied by women tend to be less well payed (WEF, 2018). And only that: the wage level of some professions could come down when a large number of women become part of a profession, as evidenced by some investigations (Sandra E. Black & Alexandra Spitz-Oener, 2010).

In addition, while sectoral segregation can be at least partially explained in terms of preferences, research on the theme also points to other factors, such as the socialization or the existence of barriers to entry into traditionally male professions (IMF, 2010).

### 3.1.4 Politics

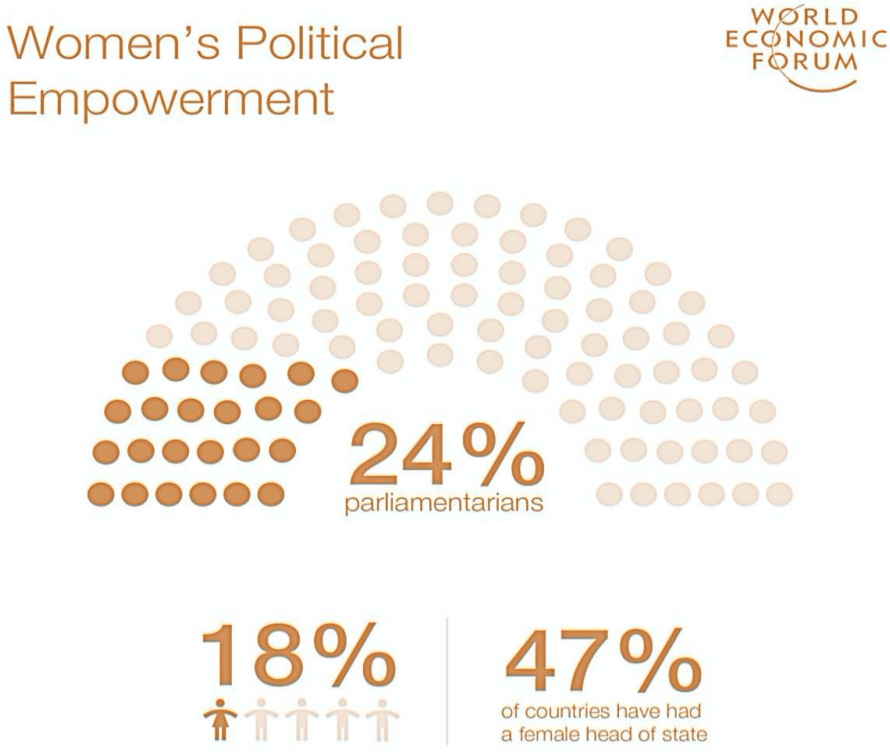


******Figure 5*. **Women's Political Empowerment.** Source: World Economic Forum, Global Gender Gap Report (WEF, 2018).

The greater presence of women in positions of political power can have two principal effects. First of all, to increase the descriptive representation which represents the number of women in politics (Pitkin, 1967) would have a direct effect on the substantive representation; meaning the way in which their interest as women is represented (Mazur, 2002). On the other hand, the standardization of the presence of women in the field could incentivize gender equality way beyond it, by the action of women politicians as role models even more for the younger generations (Campbell & Wolbrecht, 2006).

In addition to these positive effects for gender equality in general, the presence of women in parliaments could improve the quality of the policies as a whole, since the women who come to parliaments tend to be more educated and better prepared than the men they replace (Besley, Folke, Persson, & Rickne, 2017).

The dimension of political power, measured in the GEI through the proportion of women in ministerial jobs and national and regional parliamentary assembles, shows a progression of 8.9 points out of 100 between 2005 and 2015 in the EU. In addition, the level of equality in the political power exceeds in more than 10 points to the equality in economic power. The GGGR uses a similar methodology in its subcategory of political empowerment, which is calculated at function of the ratio between men and women in ministerial and parliamentary positions. This index shows progress as well in the political power of women (The gender gap in this dimension has narrowed 9 per cent since 2006), but this progress is slow: at the current rate, the gap would take 99 more years to close (FEM,
2017: 25).

While political power remains dominated by men, who still count on average with more. than two thirds of the jobs in the EU, the trends in the number of female representations are positive. Between 2005 and 2015, the percentage of women in assemblies has risen from 21 to 28 per cent. Inequality, however, is more visible by observing the positions of more power of these assemblies: the number of spokespersons men double that of women, and when it's about pursuing these positions, the number of men quadruples that of women (EIGE, 2017).

By country, Sweden was in March of 2018 the country of the sample here analyzed with a higher percentage of women in their parliament (43.6 per cent), only Finland and Norway showed levels also above 40 per cent. From the countries included in the sample, the worst off the list is Hungary, with barely one 10.1 percent of women in their national parliament.

The conclusions drawn by the authors from the GEI is that the countries with the best results are also those in which they are underway gender quotas, and that the best progress occurs in those where these quotas lead to more time being effective (EIGE, 2017). This is consistent with existing literature, according to which quotas and positive discrimination can help to standardize the visibility of the women in politics, improving both their ability to progress within masculinized political parties (Dahlerup, 2007) as well as the re-election in their constituencies.

Regarding the representation of women in governments, in the EU this goes from 21 per cent in 2005 to 27 per cent in 2015, a slow progress that does not even ensure to women a third of the positions in the national executives. In 2015, only five governments of the EU showed parity between sexes: Germany, France, Slovenia, Finland and Sweden. In addition to under-representation of women in executive positions, the GEI highlights another challenge that must be faced by the European governments: Segregation in the ministerial portfolios. For instance, women tend to be over-represented in the ministries of sociocultural lines, while men and women are traditionally over-represented in the most relevant ministerial positions such as foreign affairs, economy or defense (EIGE, 2017b:50).

For the GGGR, which adds both dimensions -parliaments and executives, Iceland is the only country where the ratio of women to men exceeds 70 percent. The following country of the sample, more than 20 points behind, is Norway, with 53 percent. Finland Ireland and Sweden have levels similar to the Norwegian ones in this category. The worst country standing in this dimension in the GGGR is, a once again, Hungary, with a reason of barely a 3.5 percent.

### 3.1.5 Economy

**Gender Pay Gap in the EU and Member States**

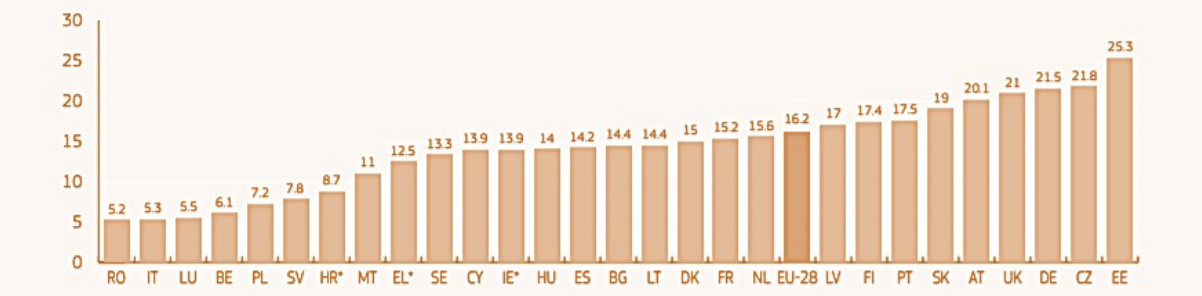


**Figure 6*. Source: The Gender Pay Gap in the EU and Member States (%). (European Commission, 2018)

In this section the analysis focuses mainly on two main elements, on first place economic independence of women and on the other hand economic power, understood as ability to influence economic decisions relevant to society through, on the one hand, the everything, his role in business. Women's economic independence is one of the central dimensions of the gender equality, as it is directly related with a large number of factors that affect inequality. This has traditionally been hampered by factors such as the high incidence among women in unpaid work,

interruptions to work, and in the working career to become childcare or part-time work, among others.

On the other hand, the relevance of economic power lies both in the positive effect, in the terms of future role models generations, which supposes the fact of having women in key power positions in the economy. (Bae & Skaggs, 2017) as in the positive impact that an increase in the number of women on boards of directors could to have in the economic results of the companies.

Beginning with economic independence, the GEI analyzes this dimension in the subcategory that collects both the economic resources of men and women as their own and economic situation as well. For its part, the sub-index of economic empowerment of the GGGR includes among its indicators the difference in the men's participation in the labor market and women, and the pay gap as well. Both indices have an impact on the importance of the wage gap, which still exists in the United States. All countries analyzed according to data from the OECD7 and the country that score worst are Estonia, with a 28.3 per cent gap, and Latvia, with 21.1 per cent, the only two countries that exceed 20 percent in the entire index. The country that scored best in this respect is Luxembourg, where the gap is 3.4 per cent, while that up to 10 other countries are below the target of the 10 per cent threshold: Greece, Belgium, Slovakia, Italy, Denmark, Norway, New Zealand, Hungary, France and Iceland. It is difficult to draw conclusions about effective policies of this group of countries, that present both institutional designs as individually they count with very different political priorities. In addition, the multiplicity of factor affecting the wage gap makes it necessary to consider different political ways to deal with it effectively.

One of the main causes of the wage gap seems to be directly related with motherhood, as has been shown by various research. In the EU as a whole, the wage gap among single persons is 14 per cent rising to 30 percent between men and women living as a couple, and even more, up to 38 percent, among men and women with children (EIGE, 2017b). In general terms, having children increases, on average, the men's monthly incomes, while which has the opposite effect on women. This phenomenon is known as the " maternity gender gap" and "Premium salary for paternity" (Grimshaw & Rubery, 2015).

Another of the indicators highlighted by the GEI is the gender gap in poverty, especially in developing countries and when it is broken down by age. Aggregate data do not suggest that the risk of poverty in general has a gender component itself despite being slightly superior among women: 17 per cent of women were at risk of poverty in 2015 in the EU, one point above men, poverty gap between men and women is, in addition, less than 5 points in all countries with the exception of Latvia.

The situation, however, is different when we analyze the population group of older age. In this sense, in all EU countries men receive higher pensions than women: the gender gap in terms of the pensions is 38 per cent in the EU average, stressing negatively Germany with 45 percent. In this band of age, poverty does have a gender component: 18 per cent of women over 75 years old are at risk of poverty in the EU; the corresponding figure among males is at 12 percent.

Economic power is measured in the GEI within the global dimension of power, through indicators that focus on the number of women in the main companies of each country, as well as in central banks. In GGGR, within the dimension of economic empowerment, we find indicators that measure the presence of men and women in different jobs at the level of responsibility and decision-making capacity. With regard to the representation of women in decision-making positions in the economic dominance, the GEI shows that this is the area in which most progress has been made between 2005 and 2015.

During this period, there has been a substantial increase in the number of women on boards of directors, something that the authors of the report relate directly to the pressure policy resulting from the increase in the number of women in parliamentary and political power positions. Thus, during this period the percentage of women on boards of directors of the main companies in the EU rises from a 10 percent in 2005 to 22 percent in 2006. In addition, the percentage of companies with only men in their meetings have gone down from 50 per cent in 2005 to 21 per cent in 2015. The largest increase in women on boards is produced in France, the Netherlands, Belgium, Spain, Denmark and Germany.

### 3.1.6 STEM fields

Historically, women have been underrepresented in the fields of science, technology, engineering and mathematics (STEM), having very little information about the recognition, with a small or invisible role. The path undertaken to be able to enter in fields dominated by men has not been easy and although nowadays many of the obstacles that the women encountered many women pioneers in science and technology are outperformed and the situation has improved, there continues to be an inequality between genres.

Today, women make up the majority of the world's population, however the number of women that get to be in the most important positions are still much lower than that percentage of men. Cultural factors such as sex discrimination in the classroom, materialization of women and subtle sexism cultivate a negative feeling in women when choosing a career in STEM fields, and society often expects us to act in a certain way depending on who we are and what the "norms" are in a particular culture.

From childhood, through interactions with the family, parents, the teachers and the general environment, we form some gender schemes that describe "correct" behaviors. There is evidence that teachers, albeit unconsciously, treat their female students and male students in different ways. Women are forced to choose between their career and their family. In this way they are encouraged and create conditions for women to prioritize dedicating themselves to their families and promote that they do not have in account for their own career development and even goals or dreams.

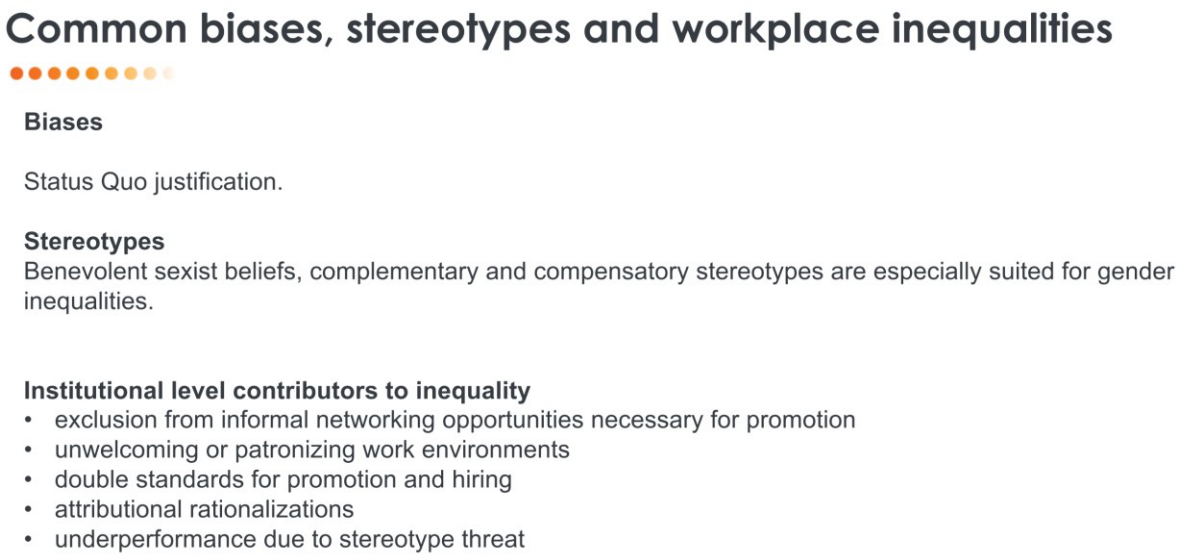


**Figure 7*. Source: Confluence - Internal information / D&I Training on common biases (CRITEO SAS, 2019).

Widespread tendency in the academic field, especially in the form of micro-aggressions. These may not seem very harmful, even normal or unimportant in interactions, but it's devastating power is sometimes exerted by reiteration through time. Not to support this type of attitudes or manifestations and to evidence them providing girls "role models" is important to challenge a woman's beliefs that women aren't as good at science as boys.

A "mentality growth" refers to the belief that our intelligence and our skills can be improved through time, work and dedication. The increase in self-esteem and self-concept that girls have about themselves in the scientific field is a crucial step as they often underestimate themselves believing they have fewer skills and opportunities than the boys.

The importance of female scientist role models is huge, and some studies claim that fewer women than men choose to enter careers in STEM areas. However, female students throughout

their school careers have shown a high level of satisfaction with their education. better overall performance compared to their male peers (Jr, Osborn, Uhl-Bien, & Hunt,2011).

One way to encourage women to do studies in the stem area is to transmit to them the model of successful women in such areas (Lockwood, 2006). It is increasingly accepted that female role models are effective in inspiring to girls, such as the books of the National Academy of Science and Women's Adventures in Science, stem as a tool for encourage engineering studies With the aim of promoting the insertion of women in the productive sector, which in turn is a fundamental element for economic development, the OECD establishes education policies for Latin America based on the stem model: this model combines a number of different types of content that accentuate the strategies. in order to motivate and avoid the desertion of students. women in engineering, e.g.: stays in companies for the practical application of knowledge acquired in the university, implementation of workshops experiences, critical reading, debates, discussion tables, critical thinking, science fairs and competitions, research clubs and networks, as well as workshops and seminars talks of successful mentors in the stem areas.

### 3.1.7 Diversity and Inclusion: Impact on performance

In many studies, diversity - both inherent (e.g., race, gender) and acquired (experience, cultural background) - is associated with the business success. For example, a 2009 analysis of 506 companies finds that companies with greater racial or gender diversity had higher incomes due to sales, more customers and higher profits. In 2016 the analysis of more than 20,000 companies in 91 countries found that the companies with the most female executives were more profitable. In a 2011 study of management teams exhibiting a range of broader educational and employment background produced more products innovative.

These are mere correlations; laboratory experiments have also been demonstrated the direct effect of diversity on team performance. In study of the jury's simulations of 2006, for example, when the blacks were added to the jury, white jurors prosecuted the facts of the case with the most and deliberated more effectively. Object of growing scrutiny and taking into account the benefits of the diversity at the bottom line, many companies are trying to recruit and retrain. retain a more diverse workforce. Success has so far been marginal. A Despite the evidence and the results the homogeneous teams are merely feel more effective. In addition, people believe that diverse computers reproduce more conflicts than they actually generate. The combination of these biases to the light can allow ways to combat them.

### 3.1.8 Artificial Intelligence

Artificial intelligence is one of the major upheavals that is affecting our time. Rarely a technological evolution will have generated as many opportunities for problem solving, changes in usage, and so many fears as well. Yet, this is not absolutely a technological breakthrough. AI is part of the continuity of computing whose power of calculation continues to grow, augmented by the availability of large volumes of data that the Internet world knows how to aggregate. AI is now allowing cars to drive without drivers, robots to become more and more autonomous, doctors to make finer diagnoses, lawyers to make more specific contracts.

Giving AI an actual definition is not an easy task as it has completely drifted and changed through the years mainly because it is a complete enigma whether it is a benefit to the humanity or not and as well taking into account the "threats" it represents. Of course, the definition of AI will change according to the field that is looking forward to defining it.

Even if the concept is rounding since the early 1950 when it was actually established as an academic discipline, this project is not going to focus in the roots of the concept but pretty much in the actual one and the future of it for having good bases to the topic that is going to be discussed which is why after the respective research with the intention of finding a relevant definition an explication to this project (Haenlein & Kaplan, 2019) define AI as an ability that a system possess to interpret external data in the correct way after learning from such external data and using the acquired knowledge to achieve certain goals through flexible adaptation, but what is important for instance is the real influence that AI has in companies

currently and how it impacts the process of decision making in the firms that are currently using it in its processes. Criteo for instance tried using AI powered tools trying to help the technical recruitment team avoiding any possible bias that may exist when sourcing and screening candidates. The idea of this tool is filtering all the applications before they get to the Applicant Tracking Software so that characteristics such as the gender, ethnicity and age do not appear when reviewing a candidate's application.

The company has as well started a D&I training for all the R&D Recruiting team at a global level for being able to identify the hiring bias that one can have when screening candidates in the pipeline in early stages. On the other hand, it is important to take into account that Engineering Hiring Managers and interviewers in the process can clearly be somehow biased as well which is why Criteo handled mandatory bootcamps for the R&D department for talking about this unconscious bias that might exist in the recruitment process. The objective of these trainings and bootcamps was as well to share with all the workforce the AI powered tools that the recruitment team decided to include in the process.

It is always interesting sharing engineers this type of software and AI powered tools that use pretty sophisticated algorithms since they are of course expecting to find a solid solution that matches the product and platform that they are currently building.

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# 4. Business Context: Criteo Case

## 4.1. Diversity and equal opportunities

At Criteo, the culture of the company is very focused in diversity, inclusion and equal opportunities for everyone, and as striving for getting more women in management positions at Criteo was a principal go last year the company hired a women global lead for Talent Management very experienced in implementing Diversity and Inclusion recruitment policies. Oana Lordachescu and the entire recruitment team is currently dealing with figures that are not quite encouraging in terms of the presence of women in the company and more specifically in the R&D department.

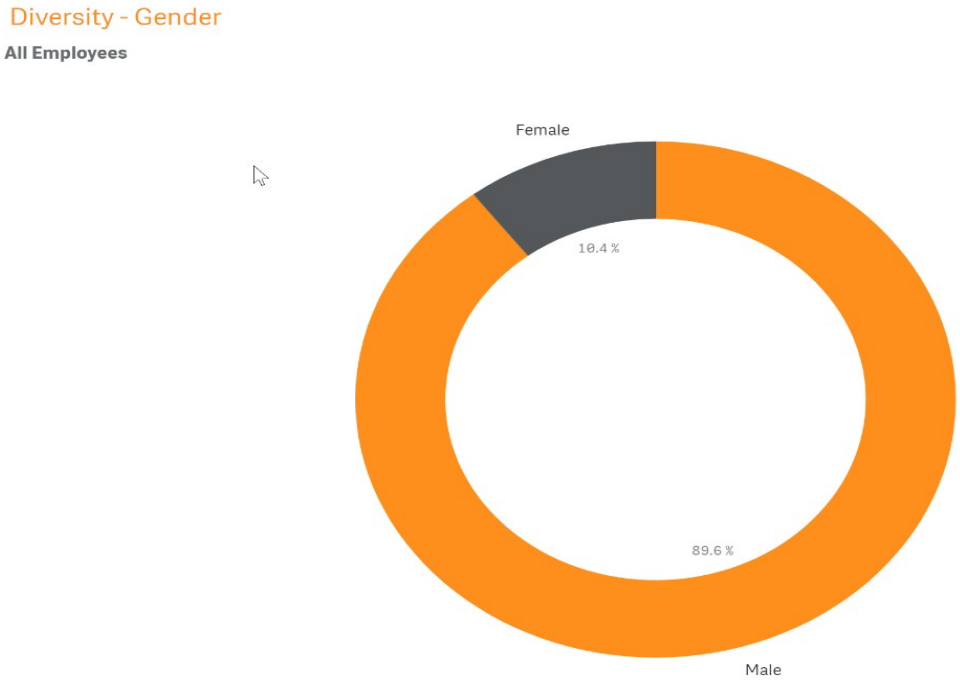


*_Figure 8_. **Gender diversity at Criteo**. Source: Confluence- Internal information/ Diversity - All employees (CRITEO SAS, 2019).

Mainly taking into account this figures, from the beginning of this year the company started implementing stronger policies, strategies and tools for being able to attract and keep women in the company's workforce considering Diversity and Inclusion one of the priorities and even a business strategy, this was actually quite timely for this project as one of the objectives is to show the reality of the gender equality inside such a big tech company where even putting efforts and the enough budget for addressing this problem is having quite a hard time trying to find diverse and of course skilled talent for doing the job.

### 4.2. Why diversity is so important at Criteo?

Criteo noticed that women account for 85% of all consumer purchases which basically means that if they could assign a gender to the ID it will be certainly female, taking into account this Criteo considers that for being able to understand preferences, necessities and even to predict shopping behavior online it is necessary to have more women or ideally the half of the R&D working in the company's solution, which is of course a long-term objective.

Diversity is very important not just in terms of contributing with policies or being conscious about gender inequality, actually internal research at Criteo showed that the higher the diversity is in a specific department or division, the higher the sales revenue is and as well performance in general.

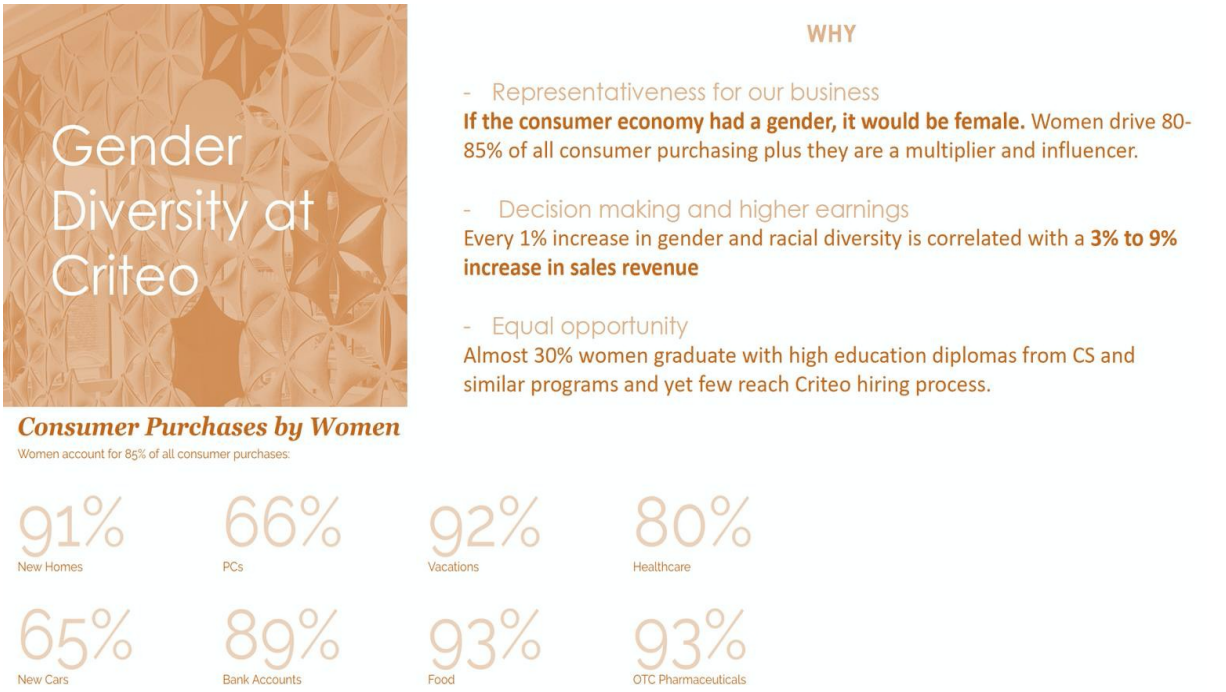


**Figure 9.* **Consumer Purchases by Women.** Source: Confluence- Internal information/ Gender Diversity at Criteo (CRITEO SAS, 2019).

According to different studies a diverse workforce and pipelines have proven to increase innovation inside companies (HBR, 2017), mainly because teams made up by people coming from different background, nationalities, gender, age and even seniority think of course differently, which is why having a diverse and open environment should in consequence lead to more creativity, as our client base is diverse so well Criteo will build better products if the teams better reflect the company's target audience, the real success at Criteo is based on hiring the brightest and best available talents in the market.

Criteo is very keen as well on contributing to the actual Sustainable Development Goals as it is actually the best path for transforming the world in a positive way, taking that into account

Gender Equality is actually one of the main focuses of these goals and contributing to it will actually have a kind of Domino effect over some other Development Goals.


**Figure 10.* Source: United Nations, Sustainable Development goals/ 2030.


**Figure 11.* **Criteo Cares program.** Source: Confluence- Internal information/ Gender Diversity at Criteo (CRITEO SAS, 2019).

### 4.3. Situation of the company using figures

Having a look to the current figures at Criteo in terms of gender per department and per R&D level it is possible to deduct how complicated is to achieve a gender balance in a tech company just like Criteo, even taking into account the policies, tools and efforts that have been implemented by the talent acquisition and R&D recruitment department.

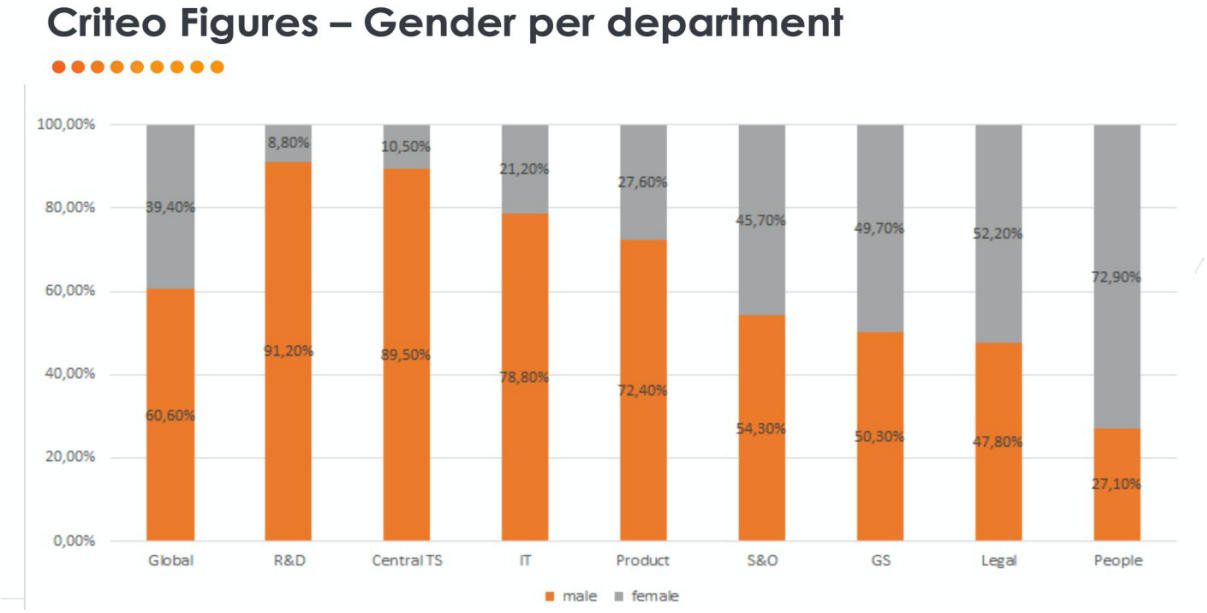


**Figure 12*. **Gender per department.** Source: Confluence- Internal information/ Gender per department (CRITEO SAS, 2019).

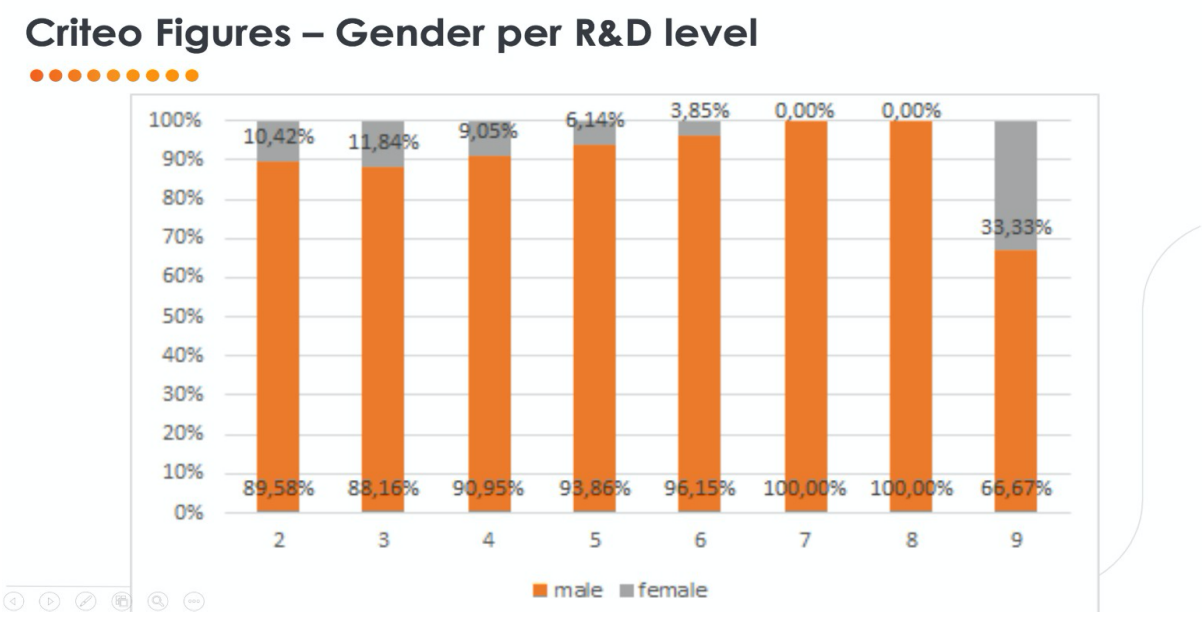


*Figure 13. **Gender per R&D level.** Source: Confluence- Internal information/ Gender per R&D level (CRITEO SAS, 2019).

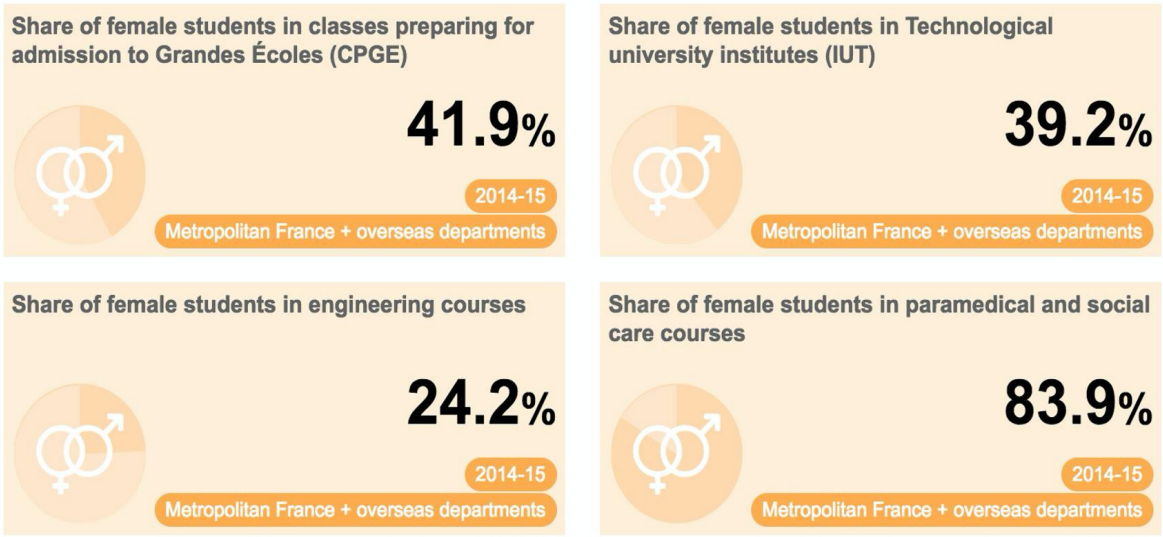


*Figure 14. **Women in STEM/ France.** Source: Confluence- Internal information/ Female , AST-CPGE France (CRITEO SAS, 2019).

But for Criteo having such worrying figures in terms of equality is just one more motivation for continuing with the Diversity and Inclusion journey, not just inside Criteo but really working with the community for being able to motivate and encourage the future generation of women to consider and hopefully choose starting a career in STEM fields and the first step for this to happen is to actually have in mind the real definition of inclusion so that the policies and practices regarding this can actually have a real impact.

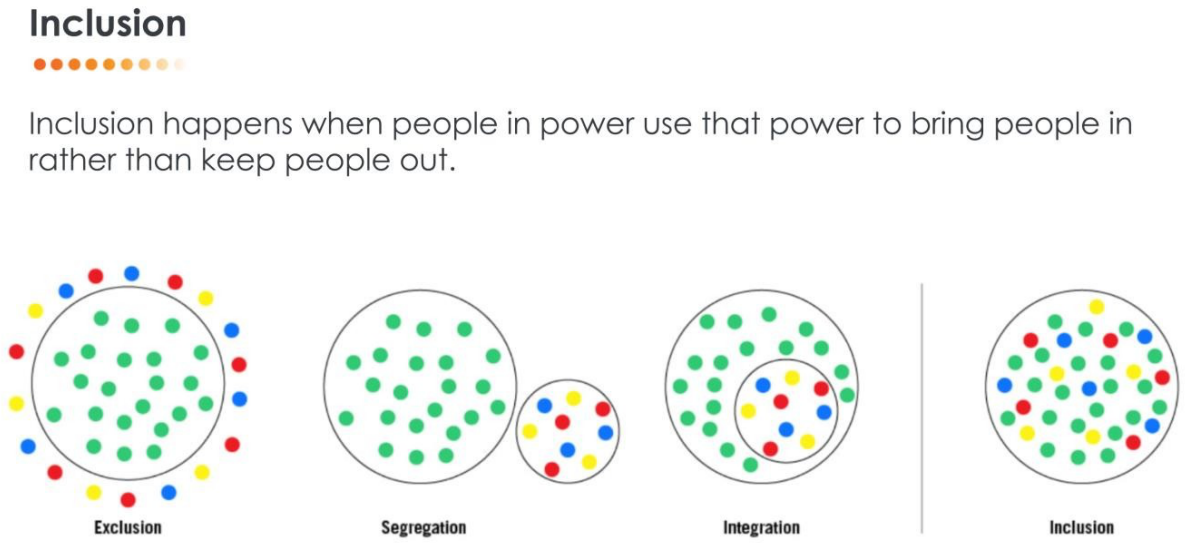


**Figure 15*. **Definition of Inclusion.** Source: Confluence- Internal information/ D&I Training (CRITEO SAS, 2019).

Taking into account this definition of inclusion the principal objective of Criteo is to actually follow perfectly the code of business and ethics inside the company making it official in all the 32 offices all over the world including of course the principle of non-discrimination, and giving exactly the same opportunities to no matter whom, completely forbidding any form of exclusion or discrimination, as well once the onboarding process is done the salary, benefits and everything

included in the remuneration package should as well be completely fair and not discrimination should exist regarding be gender, race, ethnicity, religious belief, disability, national origin, veteran status, marital status, or sexual orientation.

One of the most amazing things at Criteo is that even if the company stills has a bad time hiring more women, hiring people from all over the world is certainly something that the company has nailed, the workforce at Criteo is very diverse, keeping all the time as priority a strong mix of local talent and people from different nationalities in all the teams.

Another important factor is that at Criteo all the employees have the freedom to express their ideas and the policies implemented provide rules and measures as well to prevent any type of harassment against the entire workforce. Furthermore, all employees when joining the company should go through a rigorous onboarding process to make sure everyone knows their rights and responsibilities when joining the company, ensuring a fair and effective recruitment as well and hiring process and promoting good standards of conduct at all times.

### 4.4. Criteo's initiatives- Diversity and inclusion

4.4.1 Paris Women in Machine Learning & Data Science


*_Figure 16_. **WiMLDS Paris.** Source: http://wimlds.org/

The (WiMLDS) Meetup has the objective to support women in the STEM fields hosting events to do so like TechTalks, workshops and basically networking events conducted by very important and relevant women already working in this field for as well giving importance to the role model for girls and women at the moment of choosing their professional path.


*_Figure 17_. **Discover Computer Science.** Source: Confluence- Internal information/ Criteo cares initiatives (CRITEO SAS, 2019)

### 4.5. What is Criteo doing to ensure diversity in each team?

"Criteo has long recognized the importance of creating a culture of diversity and inclusion, where everyone has equal opportunity to feel welcomed, valued, respected and heard. Recently, a cross functional team of leaders from across Criteo gathered to learn more about the current state of perceptions on diversity and inclusion at Criteo, and to begin the process of establishing a strategy that will bring more focus and clarity on the actions we intend to take over the short and long term. We're looking forward to sharing the outcome of this gathering, including our action plans and intended outcomes. Stay tuned". This was the answer from the CEO and founder of Criteo JB during one of the monthly All-hands meeting with the entire company when asking what we are actually doing in terms of D&I.

The company has been investing an important number of resources and efforts in getting better on the D&I perspective, not only focusing on gender and race but on backgrounds and age. Criteo wants to deconstruct the concept of "corporate culture". More and more companies are becoming aware of the importance of corporate culture in the recruitment process. It is no longer enough to analyze the candidate's skills and experience; it is also crucial that they fit in with the company's culture.

But what exactly does this mean? Recruitment based on "cultural fit" is not about building a team of equals who, in turn, are like you. Rather, it is about recruiting talent capable of performing their work in alignment with the company's culture. In other words, employees who share the company's values so that they feel more committed with a real sense of belonging.

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