Gender Bias in Classic Academic Systems

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1 Introduction

We performed a Systematic Litterature Review Study focused on those works that lie at the intersection of algorithmic bias and Learning Systems. The Systematic Litterature Review is carried on in the following way:

- Identification of the literature:
  - we started by broadly searching through scholarly books, journal articles;
  - we understood what terms are accurate and helpful.
- Critically analysis of the literature:
  - the analysis of the works explore relationships, major themes, and any critical gaps in the research expressed in the work;
  - each source is summarized with an eye toward analyzing authority, currency, coverage, methodology, and relationship to other works.

This paper is organized as follows: in section 2 we discuss the process used to identify the papers that are related to the gender bias in the educational system and that are relevant for our purpose. In section 3 we summarize the key points of each selected paper in terms of context, purpose, data used, method applied and results. Section 4 describes five significant papers in more detail, with a particular focus on their methodology. Section 5 is dedicated to an overall summary of all the selected papers. Finally, section 6 presents some conclusions.

2 Papers Selection Process

The literature research was conducted on Google Scholar. The process started by identifying the most appropriate queries and terms for the study. The queries

are reported in section 2.1. From the results obtained on the Google Scholar website, primary studies were chosen using specific selection criteria (see section 2.2). Figure 2 shows the steps of the overall selection process.

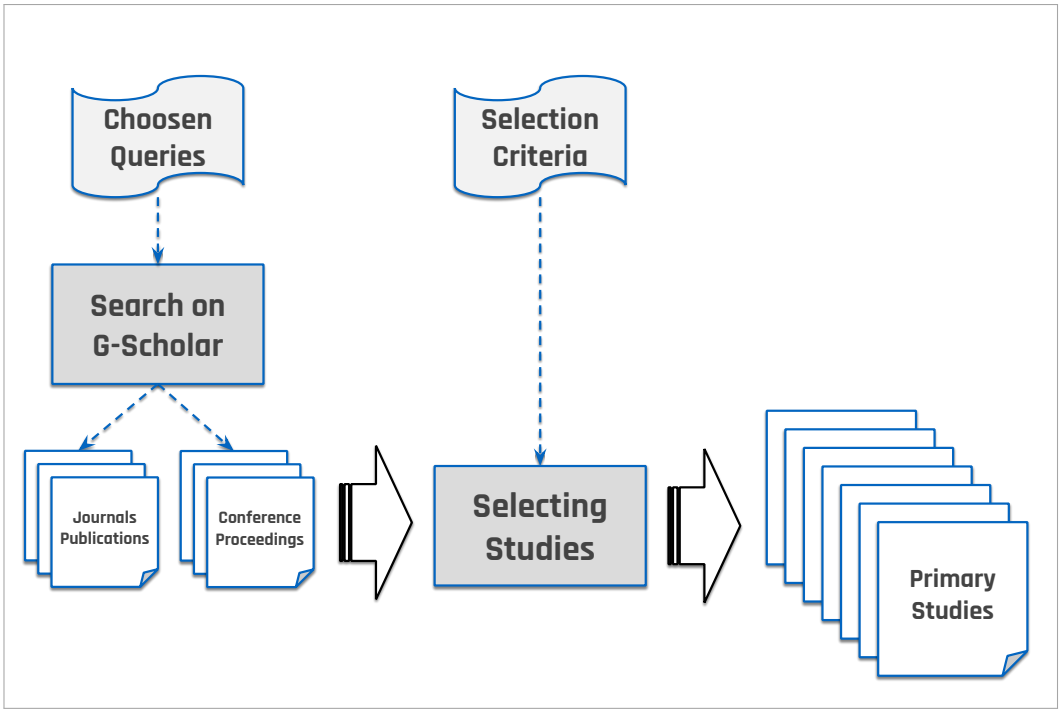

Figure 1: Conceptual map showing the steps followed.

2.1 Chosen queries

A total of 12 queries were performed on Google Scholar:

Q1: "Gender bias in academic recruitment"

Q2: "Italian academia gender discrimination"

Q3: "Women's success faculty recruitment"

Q4: "Women's faculty equity in academia"

Q5: "Gender in career advancements in Italian universities"

Q6: "Academic promotions gender discrimination"

Q7: *Cited by* of "Being good isn't good enough: gender discrimination in Italian academia"

Q8: "Impact of bias in faculty recruitment"

Q9: "Gender differences in Italian academic system"

Q10: "Gender discrimination and promotion in academia"

Q11: "Impact of gender and family factors in productivity"

Q12: "Female representation in academic institutions"

Q13: "Gender bias in selection processes for professors"

2.2 Selection Criteria

Three types of criteria were used for the selection of articles:

General criteria: The work selection was primarily focused on studying and analyzing those works dedicated to the Italian Educational Systems. To have a wider vision and a comparison with the practices and techniques used, articles that analyze practices and techniques used by foreign Educational Systems were also included.

Inclusion criteria: Articles related to the recruitment, promotion and productivity level of academic staff, i.e., full professors, associate professors and researchers.

Exclusion criteria: Articles pertaining to specific faculties or to the gender bias present in the general working world.

3 In-depth Analysis of Literature

In this section we summarize the key points of each selected paper in terms of context, purpose, data used, method applied and results. The following papers are ordered by date of publication, oldest to most recent.

3.1 Gender and Promotion in Academia [20] - (2000)

Context: The University of Western Australia (UWA).

Purpose: Changes to the promotion policies and practices within Australian universities, identifying the outcomes by gender.

Data Used: Data was gathered from a wide range of university documents and records, as well as from interviews.

Method Applied: Descriptive statistics and survey consisting of a set of interviews with key former and members of the Promotions and Tenure Committee to ascertain their interpretation of the changes which have occurred, the effect of these changes upon applicants by gender, and their understanding of any gender differences in the academic promotion process at UWA.

Results: The changes made to the UWA academic promotion process have been critical in removing previous inequities from the promotion process, in which success rates increased for both men and women but substantially more so for women.

Reserch queries: Q10

3.2 Gender and Promotion in the Academic Profession [21] - (2001)

Context: Universities in Scotland.

Purpose: Gender rank distribution explained by the differing average characteristics of male and female academics, and by barriers to female promotion.

Data Used: The data-set include detailed information on personal background, education, working history, productivity and job satisfaction of academics (data collected through the use of a questionnaire to all academic staff).

Method Applied: Static discrete choice model of rank attainment and simulation of the female rank distribution that would hold if females faced similar assignment to rank as men.

Results: The small representation of female professors is due to the cumulate impact of gender differences in promotion as staff move up the job hierarchy. There is a significant contribution of the unequal treatment of male and female academic characteristics between ranks which suggests the need for renewed anti-discrimination policy at promotion decision.

Reserch queries: Q6

3.3 Issues in the recruitment and success of women in academic surgery [19] - (2002)

Context: Academic surgery.

Purpose: Survey of male and female academic surgeons to identify issues and perceptions surrounding the success of women in surgery.

Data Used: Data were collected through tested survey instrument sent to female and male academic surgeons.

Method Applied: Descriptive statistics and t-tests to enter and compare across a number of categories the answers to a previously tested survey instrument.

Results: Women report similar objective experience, but have very different perceptions of the issues in academic surgery than do men.Differences include access to collaboration and support and issues in balancing family and work life.

Reserch queries: Q3

3.4 Gender, Family Characteristics, and Publication Productivity among Scientists [9] - (2005)

Context: Publication productivity for women in academic science.

Purpose: Full-time, tenured, or tenure-track academics in doctoral-granting, university departments, to examine gender disparity in publication productivity.

Data Used: Research, graduate-level teaching and background characteristics (the data are from a national mail survey).

Method Applied: Statistical analysis sampling of doctoral-granting departments as being: consistently low, consistently high or most improved in proportions of doctoral degrees awarded to women over a 17-year period.

Results: Women in subsequent marriages have higher productivity than women in first marriages,and when married to a scientist, the effects for productivity are positive.

Reserch queries: Q11

3.5 Does excellence have a gender? A national research study on recruitment and selection procedures for professorial appointments in The Netherlands [3] - (2006)

Context: Dutch universities.

Purpose: Academic recruitment and selection practices for full professors, to examine whether is a gendered process.

Data Used: Type of chair (full time or part time) and gender (data collected from Dutch universities, National Statistics (CBS), Committee reports 1999-2003).

Method Applied: Descriptive statistics determining the success rates of male and female applicants for each discipline and testing the predictions concerning the type of recruitment (open/closed) and the gender composition of the committee.

Results: The findings show gender differences in selection procedure outcomes. There is a disparity in the proportion of male and female applicants who are appointed to professorships and the realization of female potential.

Reserch queries: Q1, Q13

3.6 Gender differences in research productivity: A bibliometric analysis of the Italian academic system [1] - (2009)

Context: Italian university system.

Purpose: Research personnel working in the scientific-technological disciplines to analyse the difference in research productivity between the sexes.

Data Used: Academic role and gender from the Ministry of Universities and Research website [1].

Method Applied: Descriptive statistics which shows individual performance on the basis of a number of indicators.

[1] http://cercauniversita.cineca.it/php5/docenti/cerca.php

Results: Males do demonstrate a higher average productivity with respect to that of females for all the performance indicators considered, mostly in the quantitative dimension of output.

Reserch queries: Q9

3.7 Recruiting and Hiring Women in STEM Fields [11] - (2010)

Context: Western research-oriented doctoral granting university.

Purpose: Gender disparities within the STEM fields that hinder or promote the hiring of women into tenure-track position.

Data Used: Unique data set of all tenure-track searches in the STEM fields at a research-oriented doctoral granting university (PsycINFO Database Record (c) 2016 APA, all rights reserved).

Method Applied: Statistical analysis pertaining to gender using OLS regression and logistic regression, and then descriptive statistics' analysis.

Results: The study has identified two specific strategies for the successful recruitment and hiring of women faculty in STEM fields: increasing the percentage of women applicants and placing advertisements in venues that target women.

Reserch queries: Q3, Q8

3.8 Gender Discrimination and Evaluators' Gender: Evidence from the Italian Academy [15] - (2011)

Context: Italian universities.

Purpose: Promotion to associate and full professor, analyzing if gender discrimination is affected by the gender of evaluators.

Data Used: Scientific productivity and a number of individual characteristics of participants. Data from MIUR web page [2].

[2] http://cercauniversita.cineca.it/php5/docenti/cerca.php

Method Applied: Statistical analysis and descriptive statistics to examine the probability of success of each candidate in relation to the committee gender composition.

Results: Results confirm that the gender committee composition matters for discrimination against women.

Reserch queries: Q2, Q6, Q10

3.9 Gender bias in academic recruitment [2] - (2016)

Context: Italian academy.

Purpose: Recruitment of academic Assistant Professors to examine whether women are subject to more or less bias than men.

Data Used: Gender and UDA (University Disciplinary Areas). For the MIUR web portal [3].

Method Applied: Statistical analysis using the logistic regression model, whose binary results predict the competition outcomes.

Results: There is unmistakable gender difference in the propensity to apply to the observed competitions much more than any phenomena of bias as revealed by the current study.

Reserch queries: Q1, Q13

3.10 Gender differences in the propensity to apply for promotion: evidence from the Italian Scientific Qualification [7] - (2017)

Context: Italian academy.

Purpose: Analysis of gender differences in the propensity to apply for academic promotion credentials in Italy for associate and full professor positions.

Data Used: Data about gender, the affiliation of candidates and of committee members, candidates' tenure, years of experience, productivity (data from the University Ministry website [4], and from the NSQ's webpage [5]).

[3] http://reclutamento.murst.it/

[4] http://cercauniversita.cineca.it/php5/docenti/cerca.php

[5] http://abilitazione.miur.it/public/pubblicacandidati.php

Method Applied: Descriptive statistics for potential candidates divided by gender.

Results: Results suggest that the reluctance of women to apply for promotion might be related to the fear of being discriminated against.

Reserch queries: Q5, Q9

3.11 The trench warfare of gender discrimination: evidence from academic promotions to full professor in Italy [14] - (2018)

Context: Italian universities.

Purpose: Understand if gender makes a difference in the path to promotion to full professor.

Data Used: Scientific productivity, normalised number of available vacancies, result of national research evaluation, age, current rank-and-file position from MIUR Ministry and ASN repository.

Method Applied: Statistical analysis with multilevel logistic regression using a binary variable (promoted or not promoted along 2013 until 2016) to investigate gender inequality.

Results: Among those who obtained the ASN (National Scientific Qualification) and at parity of other conditions, men have around 24 percent more probability to be promoted at parity of scientific production, which reveals a relevant gender discrimination.

Reserch queries: Q2, Q6, Q10

3.12 The Glass Door of Academia: Unveiling New Gendered Bias in Academic Recruitment [16] - (2019)

Context: Italian academy.

Purpose: Recruitment of academic staff,to measure gendering processes taking place in the recruitment stages.

Data Used: The data concern the composition of Italian academia and are provided by Italian Ministry of Education, Universities and Research. [6].

Method Applied: Quantitative analysis which uses the glass ceiling index and the glass door index to measure and compare the effects of gendered practices in two different stages of the academic career (the precarious stage and full professorship).

Results: The results show that the selection effect to the disadvantage of women, has been strengthened and is greater precisely in sectors where there is a greater presence of women in the early career stage.

Reserch queries: Q1

3.13 Recognizing the Impact of Bias in Faculty Recruitment, Retention, and Advancement Processes [17] - (2019)

Context: Academic leadership.

Purpose: An academic unit leader's biases result in processes and practices toward faculty, particularly in the key areas of academic leadership: faculty recruitment (hiring), retention (evaluation), and advancement (promotion).

Data Used: Gender, sexual orientation/affinity, age, ethnicity, race of faculty are highlighted.

Method Applied: Recommendations, promising practices, and strategies for minimizing the impact of implicit bias.

Results: The decision-making process is one that is susceptible to a number of implicit biases. Without a plan for advancement that results in tenure and promotion, faculty will consistently leave willingly for "greener pastures" or be required to leave based on institutional policy.

Reserch queries: Q1, Q8

[6] http://ustat.miur.it/opendata

3.14 An evidence-based faculty recruitment workshop influences departmental hiring practice perceptions among university faculty [18] - (2019)

Context: Colleges and universities.

Purpose: Workshop for faculty search committees, to increase the representation of women and underrepresented racial-ethnic minority (URM) faculty.

Data Used: Faculty who had or had not attended an FRW (information from the university's human resources office).

Method Applied: Interview to respondents about their attitudes and their intentions to use specific equitable search practices.

Results: An evidence-based recruitment workshop can lead faculty to adopt more favorable attitudes toward strategies that promote gender diversity in hiring.

Reserch queries: Q8

3.15 Turning Chutes into Ladders for Women Faculty: A Review and Roadmap for Equity in Academia [5] - (2020)

Context: Academic career.

Purpose: The recruitment, advancement, and promotion of women in academia remain low.

Data Used: Gender and faculty level (the majority of the data presented are from the postdoctoral level and above of departments of United States).

Method Applied: Synthesis of the obstacles that impede the careers of women faculty, and supply of feasible recommendations for enacting policies to achieve gender equity.

Results: Behavior is shaped by unconscious implicit biases based on stereotypes, and academics are not immune to these.Many solutions require research to evaluate effectiveness and possible unintended consequences, thus is recommended data collection before, during, and after implementation of recommendations.

Reserch queries: Q4

3.16 Just a Matter of Time? Women's Career Advancement in Neo-Liberal Academia. An Analysis of Recruitment Trends in Italian Universities [10] - (2020)

Context: Italian universities.

Purpose: This study investigates the variation of the female disadvantage in career advancement and how it has changed across time.

Data Used: Number of researchers and professors currently on the job and the number of researchers and professors recruited by gender, rank and scientific field in Italian universities. From MIUR's statistical offices: [7] and [8].

Method Applied: Descriptive statistics, including frequency distributions, cross-tables, and segregation indexes.

Results: The analysis of recruitment data shows that women keep being recruited to a smaller extent than men among associate and full professors, and this gap has been quite constant over the last years.

Reserch queries: Q7

3.17 Female Careers in Italian Universities: The Role of Gender Budgeting to Achieve Equality between Women and Men [4] - (2021)

Context: Italian universities.

Purpose: Female careers in Italian academia and implications related to the adoption of Gender Budgeting at universities.

Data Used: Data on dis-aggregation by gender on university populations at various levels are fulfilled by the MIUR and ISTAT.

[7] http://ustat.miur.it/
[8] https://cercauniversita.cineca.it/php5/docenti/cerca.php

Method Applied: Developing of a theoretical framework used for quantitative research.

Results: Gender Budgeting is a key tool for measuring and monitoring the level of gender mainstreaming within universities. It helps eliminate discrimination based on gender in University's activities.

Reserch queries: Q5

3.18 Gender Bias in Academic Recruitment: Evidence from a Survey Experiment in the Nordic Region [6] - (2021)

Context: Northern universities.

Purpose: Recruitment of academic Associate Professors to examine the role of gender disparities.

Data Used: Data about gender, ownership of children and the publication list, collected filling out a survey sent to relevant faculties and departments in the largest universities in Iceland, Norway, and Sweden.

Method Applied: Statistical analysis using OLS regressions in which the constants are the average evaluations of the male candidate, while the coefficient for a female CV shows the difference in rating for the female candidate compared to the male candidate.

Results: For both competence and hireability ratings, female CVs get higher ratings than male CVs.

Reserch queries: Q5

3.19 'Being good isn't good enough': gender discrimination in Italian academia [8] - (2021)

Context: Italian universities.

Purpose: The effect of gender in career advancements of assistant and associate professors.

Data Used: Gender, macro disciplinary area, scientific sub-sector of belonging and the university and department of affiliation of the whole population of the academic staff from the MIUR web site [9] , from the National Scientific Qualification (NSQ) and from the SciVal web site].

Method Applied: Descriptive statistics to merge the MIUR data on the Italian academic population with the data on NSQ (National Scientific Qualification). It has been done by individual's name and surname and by scientific macro area to which the individual belongs.

Results: The observed lower promotion of women among associate and full professors in the Italian universities cannot be explained by the lower scientific productivity of female scientists, nor by a negative self-selection of women that apply less for career advancement. The existence of discrimination in the Italian universities leads to questioning about possible solution to give men and women equal opportunities of career.

Reserch queries: Q2, Q5, Q9

3.20 Where are the women deans? The importance of gender bias and self-selection processes for the deanship ambition of female and male professors [12] - (2022)

Context: Higher university management positions such as university headships, or presidencies in Germany, Austria and Switzerland.

Purpose: Under-representation of women in university leadership by focusing on the middle management role of dean.

Data Used: A multi-source and time-lagged study with two measurement occasions collected survey data online from full professors and associate professors at Swiss, German and Austrian universities.

Method Applied: Descriptive statistics and statistical analysis using multiple logistic regression.

Results: The amount of professors' administrative leadership experience related positively to receiving deanship recommendations, equally for women and men.

[9] https://cercauniversita.cineca.it/

Reserch queries: Q13

3.21 A Snapshot of Female Representation in Twelve Academic Psychiatry Institutions Around the World [13] - (2022)

Context: Neuroscience/schizophrenia academic or clinical departments in several institutions around the world.

Purpose: Bring a global perspective to the phenomenon of unequal representation of females in science.

Data Used: Data related to sex, acquired by co-authors/network participants.

Method Applied: Descriptive statistic showing classification across different career stages (Early Career, Mid Career and Senior positions).

Results: There exist negative correlation between career stages and female presence in science, since they find significant barriers in their promotion to senior academic appointments.

Reserch queries: Q12

4 Selected articles

In this section we describe five significant papers in more detail with a particular focus on their methodology. The selected papers refer to both Italian and foreign universities and are grouped into two categories: papers belong to the first category provide recommendations and strategies to minimize the bias (the first two papers); papers belong to the second perform statistical analysis (the last 3).

4.1 Recognizing the Impact of Bias in Faculty Recruitment, Retention, and Advancement Processes [17] - (2019)

Context: Academic leadership.

Purpose: An academic unit leader's biases result in the justification, rationalization, and facilitation of exclusionary processes and practices toward faculty, particularly those from diverse and underrepresented backgrounds. In fact bias, whether explicit or implicit and regardless of what attribute (e.g., race, ethnicity, gender) is the focus, plays a significant role in any leader's decision-making processes, particularly as she or he attempts to meet the needs, requests, and directives of a diverse faculty, staff, stakeholders, and their respective superiors. So the impact of a leader's biases toward diversity attributes (e.g., gender, sexual orientation/affinity, age, ethnicity, race) of faculty are highlighted, to face the fact that the immediate impact of implicit bias on administrative decision making can lead to racist, exclusionary, or marginalizing policies and practices' being implemented that disproportionately affect a segment of faculty or staff.

Data Used: To address the purpose of this paper, reference is made to various information from other sources such as books or previously published articles.

Method Applied: Firstly, a general definition and characterisation of implicit biases is provided. Next, to provide academic leadership general information regarding the concept of bias, the focus of the discussion shifts to how implicit bias affects three key academic leadership decision-making processes common in higher education that are susceptible to implicit bias. The first is faculty recruitment (hiring), because bias can influence the search and selection process. The second major area of academic leadership that could be influenced by implicit bias practices is retention, particularly faculty-evaluation processes used by the unit. Faculty who do not perceive their work as valued or their evaluation as fair and equitable will eventually leave a unit. Finally there is the faculty advancement (promotion and tenure processes) This is another area of academic leadership that is susceptible to a number of the aforementioned forms of implicit bias.

Results: Best and promising practices, strategies, and recommendations for minimizing implicit bias's impact on decision-making processes in academic units are provided, because of the implicit bias that can lead to continued lack of diversity representation in faculty ranks. When not discussed as part of faculty preparation for evaluation processes, it can lead to individuals', particularly those from underrepresented groups, being rated much more harshly than their colleagues. As a result, the retention of faculty becomes a problem and without a plan for advancement that results in tenure and promotion, faculty will consistently leave willingly for "greener pastures" or be required to leave.

4.2 Turning Chutes into Ladders for Women Faculty: A Review and Roadmap for Equity in Academia [5] - (2020)

Context: Academic career.

Purpose: The recruitment, advancement, and promotion of women in academia remain low, because of the perception that women are less competent and their outputs of lesser quality, implicit bias in teaching evaluations and grant funding decisions, and lower citation rates. All this leads to negative consequences, such as the fact that at all faculty levels, women have significantly lower salaries than men. These negative differences that add up have a direct impact also on the retention and tenure of women academics.

Data Used: The majority of the data presented are from the postdoctoral level and above, and different information from departments of the United States concerning gender bias present especially at the faculty level was also considered for this study.

Method Applied: Chutes—structures that drive women out of academic careers or prevent them from rising to higher levels in academia, and ladders—feasible policies and strategies that can be adopted by academic institutions to enable women to stay in academia and reach higher levels of academic achievement are presented. More precisely, these presented chutes and respective ladders concern: recruitment and selection (chutes affecting recruitment and selection include environments that promote work hours incompatible with family life, lack of mentoring, and bias against marriage or having children), mentoring (a lack of mentoring has been identified as an obstacle to career and personal development among women), teaching evaluations (these are often biased against women professors), academic service (women faculty engage in a disproportionate amount of service), leave policies (women are more likely men to leave the labour force during their peak productivity years to care for elderly parents or children), domestic workload and work-related travel (work/life balance is more difficult for women given the disproportionate domestic workload they bear), breastfeeding (while 75 percent of women choose to breastfeed after delivery, only 40 percent continue breastfeeding after returning to work), work-related events (women report significantly more dissatisfaction related to work/life balance than men), productivity and advancement (significantly more male assistant professors receive tenure/promotion and are trained for administrative leadership than their female counterparts)

and finally gender disparity for grant funding (for NIH grants awarded from 2006 to 2017, only 43.6 percent of grants given to first-time primary investigators were women, despite no baseline performance measure differences).

Results: Enacting policies that function as 'ladders' rather than 'chutes' for academic women is essential to even the playing field, achieve gender equity, and foster economic, societal, and cultural benefits of academia. These changes could make academic careers more attractive to women, and contribute to the academic engines of creativity and productivity. In this way can be avoided that women face a gauntlet of chutes out of academia and advancement. The problem is that behavior is shaped by unconscious implicit biases based on stereotypes, and academics are not immune to these. But to achieve significant results, many solutions require research to evaluate effectiveness and possible unintended consequences, thus is recommended data collection before, during, and after implementation of recommendations.

4.3 Female Careers in Italian Universities: The Role of Gender Budgeting to Achieve Equality between Women and Men [4] - (2021)

Context: Italian universities.

Purpose: Due to the gender inequality, a lack of personal recognition, the absence of merit and the loss of talent and innovation are some of the negative consequences that are visible in the female careers in Italian academia. It is necessary to build the essential strategies and policies by creating the conditions for imbalance in the recognition of rights and the provision of equal opportunities to all individuals without distinction, integrating the gender perspective in all decisions. The implications related to the adoption of Gender Budgeting and Gender Mainstreaming at universities are presented, in order to try to facilitate cultural change in university and research institutions. These ones bring up the problem of whether or not these tools are necessary for several factors including also equity and valuing differences.

Data Used: Data on dis-aggregation by gender on university populations at various levels, namely from students to those employed in the scientific and technology sectors, are fulfilled by the MIUR [10] for statistics on education and training and ISTAT.

[10] http://ustat.miur.it/documenti/

Method Applied: A theoretical framework was developed based on the role of Gender Budgeting and the role of the Central Guarantee Committee for equal opportunities in Italian Universities (CUG). This ones concern statistics relating to the student population, teaching staff and researchers through a gender analysis. More precisely they focus on the student population's distribution by gender and area of study, instead moving from university education to academic career, data sharpen an inversely proportional relationship between female presence and career progression. For this study there was also use of the Glass Ceiling Index (GCI), a further measure used to monitor vertical segregation and is based on the greater probability of women than men reaching the highest academic qualifications. It takes a value of 1 when there is perfect gender parity and takes values above 1 as the under-representation of women rises.

Results: Gender Budgeting is confirmed as a key tool to measure and monitor the level of gender mainstreaming, to assess the implications not only for women but in general for the least represented gender of each planned action in each area and at every level. In fact, it allows the efficiency and transparency of the University's activities to be promoted and the useful elements to be highlighted so that improvements can be made. The usefulness of Gender Budgeting occurs in informing the formulation of programmatic actions aimed at removing the obstacles that hinder the achievement of equal opportunities in the field of work and university training. But it also highlights the constant monitoring of the effects produced by the policies, measures and positive actions adopted by the University in this direction.

4.4 'Being good isn't good enough': gender discrimination in Italian academia [8] - (2021)

Context: Italian universities.

Purpose: The focus is on the career advancements of assistant and associate professors in the Italian universities over the period 2012-2016 to investigate whether the gender gap is due to discrimination, considering the under-representation of women in the universities and research centres.

Data Used: The analysis uses data on the Ministry of University (MIUR) web site [11] where they are available from the year 2001 onward, and where for each year it is possible to download the list of all assistant, associate and full professors with the information on gender, macro disciplinary

[11] https://cercauniversita.cineca.it/

area, scientific sub-sector they belong to and the university and department of affiliation. Then also data on the National Scientific Qualification (NSQ) and data on scientific productivity (SciVal) for bibliometric scientific sectors were considered. To exclude the negative self-selection of female candidates for career advancement and to control the level of scientific productivity, thus measuring pure gender discrimination in Italian academia, the data from MIUR were merged with the data from the NSQ on the assistant and associated professors that got the qualification for associated and full professorship respectively in the first two years of implementation (2012 and 2013), by individual's name and surname and by scientific macro area to which the individual belongs, with two possible sources of errors. First, may have been attributed the qualification of one outsider individual to a homonyms insider belonging to the same macro area due to two homonyms that could have merged. But this does not affect the results due to the low percentage of foreigners qualifying [12]https://www.lavoce.info/archives/18356/universita-professori-universitari-concorsi-abilitazione and [13]. Second, may have been considered as qualified two homonyms insider individuals in the same macro area. To avoid this were excluded from the sample all homonyms within the same macro disciplinary area and also individuals that changed scientific macro area in the period considered.

Method Applied: Descriptive statistics in which it has been creates a logic model in which the dependent variable is the probability of having a career advancement in the period 2012-2016 for those professors that obtained the NSQ in 2012 or in 2013. The independent variable of interest is gender and is controlled for seniority, scientific macro areas, a set of five dummy variables for the size of the university and a set of dummies variable one for each university. These controls are crucial as recruitment and career advancements depend on merit, but also on the number of positions available. The career advancement can be affected by the individual's actual productivity, so for each qualified individual in the bibliometric sectors, are considered three different indicators of scientific productivity: the h-index, the number of citations and the number of publications until the year 2015 [14]. Finally is used a variable measuring the percentage of female full professors in the scientific sub-sectors to have a look to the gender composition of the sector. Three different models has been estimated. In the first model are included only the variable related to gender to estimate

[12]\unskip\protect\penalty\@M\vrulewidth\z@height\z@depth\dpff
[13]https://www.roars.it/online/asn-2012-ecco-le-statistiche-finali-diverse-da-quelle-anvur/
[14]Downloaded from SciVal web site

the overall effect of being women on the probability of having a career advancement. In the second model are added controls for the years of seniority, the scientific macro area and the size of the university of affiliation of the individual, while in the third model are substituted a set of dummy variables, one for each university, to the dummies for the size of the university. These models are used to compute the probabilities of men and women to obtain the NSQ in the different Macro disciplinary areas and then we estimated the probability of being promoted to the higher rank for assistant and associate professors that obtained the NSQ without controlling for scientific productivity and then the model has been re-estimated also controlling for productivity on the sub-sample of individuals belonging to bibliometric sub-sectors.

Results: Results show that being female decreases the probability of career advancement in all specifications. The effect seems to be stronger for promotions of associate professors to full professors. The observed lower promotion of women among associate and full professors in the Italian universities cannot be explained by the lower scientific productivity of female scientists, nor by a negative self-selection of women that apply less for career advancement. The type of data used and the mechanism for career advancement in the Italian academia allows the exclusion of these as causes of the gender gap.

4.5 Where are the women deans? The importance of gender bias and self-selection processes for the deanship ambition of female and male professors [12] - (2022)

Context: University leadership in Germany, Austria and Switzerland.

Purpose: In the mid-level administrative roles, which are ordinarily a step along the path to higher university management positions such as university headships, or presidencies, women are poorly represented. This is particularly noticeable in the role of deans, who have responsibility for managing an entire group of academic departments and institutes, known as a faculty. There is in fact evidence of both discriminatory recruitment to managerial roles and self- selection that limits women's ambition to advance. Particularly in universities in the Western European "DACH region" encompassing Germany, Austria and Switzerland, women are rarer as deans than tenured professors, because they are considered "non- professional expert- leaders". To address this issue are taken into account gender discrimination by others and self-selection processes, considering, as precursors of professors'

ambition to become a dean, both the receipt of recommendations for the deanship and the role's intrinsic appeal.

Data Used: A multi-source and time-lagged study with two measurement occasions collected survey data online from 278 full professors and associate professors at Swiss, German and Austrian universities.

Method Applied: The used theoretical model sets forth specific influences that should affect either gender bias whereby stakeholders are more likely to recommend men than women for deanship, or self-selection bias whereby men may find dean-ships more appealing than women do. In order to this descriptive statistics and statistical analysis were used. Firstly, a conceptual multi-group model of the associations between bias and self-selection factors and deanship ambition across male and female gender groups was developed in order to sampling. Then an analytic procedure was used, with a multiple logistic regression, which allows tests for equivalence of parameter estimates across groups by an ordered and specified sequence of constraining a set of parameters in accordance with the respective hypothesis tests. For the descriptive statistics the means, standard deviations, internal consistencies and zero-order correlations for the variables have been computed. Later are shown the descriptive differences between the female and male participants with their t-tests and effect sizes. Finally some test of hypothesis were computed.

Results: The study's findings offer insight concerning how universities can increase the representation of women in administrative leadership. In particular, the results yielded stronger support for self-regulatory factors as explanations for women's low share in deanship positions. Specifically the perceived presence of female deans at the academic unit was positively associated with job appeal of the deanship position for female but not male professors. In fact increasing women's overall share in administrative leadership is likely to occur when universities make salient the presence of other women in these roles, implement preferential recommendation of women for administrative service, and communicate the communal rewards that can follow from these roles.

5 Conceptual Map of the Literature

In this section we make an overall summary of the literature building a conceptual map (see Figure 5) useful for the readers.

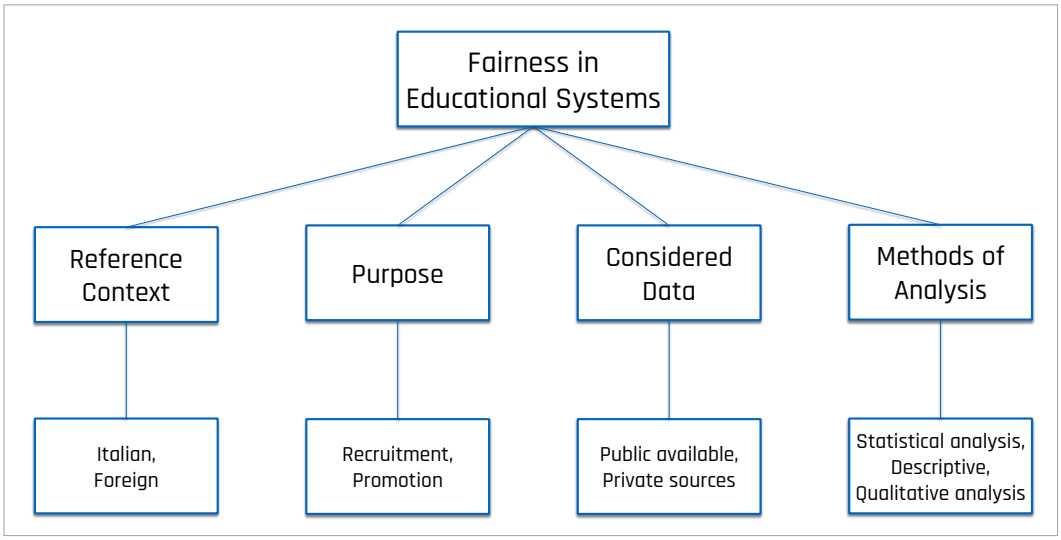

Figure 2: Conceptual map showing the 4 main concepts highlighted in the analysis of the articles.

5.1 Context

This point is necessary to understand the context in question, namely whether the academic institutional system we are talking about is Italian or not. In fact, not belonging to this dimension concerns anything that has to do with foreign systems or general surveys carried out without considering specific nationalities.

5.1.1 Italian institutions

This context is inherent in articles [2],[16], [14],[1], [15], [8], [10], [4] and [7] which deal with problems inherent to gender bias in Italian university institutions.

5.1.2 Foreign universities

Articles [6], [13], [12], [3], [5], [11],[20] and [21] concern the study of gender bias in foreign universities. In particular, in article [6] reference is made to universities in the Nordic regions, in article [13] to neuroscience / academic schizophrenia and clinical departments in various institutions around the world,

in [12] at the universities of Germany, Austria and Switzerland, in [3] at the university of the Netherlands, in [5] at the university of the United States, in [11] at a western research-oriented doctoral granting university, in [20] at the University of Australia and finally in [21] at the universities of Scotland.

5.1.3 General contexts

Articles [9], [17],[18] and [19] concern generic studies, not related to specific universities. More precisely, article [9] refers to some fields of the scientific classifications of the NRC and NSF, while the [17] speaks about academic surgery.

5.2 Purpose

The objectives covered by the articles mainly concern the recruitment of women in academic staff, the advancement of their career and productivity understood as the number of publications made. These problems are faced due to the constantly present gender bias that affects in a more or less negative way mainly in these three areas.

5.2.1 Recruitment

This problem is addressed in articles [2], [6], [16], [3], [17], [18], [19], [5], [11] and [10]. Most of them focus on providing recommendations, practices, and strategies to be introduced or simply revised and improved, for minimizing the impact of bias and reach gender equity in the recruitment process of university system, which in most cases leads to a lack of them in academia. Some of them face the problem in a different way. In particular article [2] addresses the problem of the recruitment of Assistant professors by considering bibliometric SDSs cover all the hard sciences and a few fields of Economics. Article [6] deals with the problem of recruiting Associate professors by conducting a large-scale survey experiment among faculty in some university disciplines. Article [19] used a tested survey instrument whose answers were entered and compared, finally article [11] focuses on applicants to tenure-track STEM faculty positions.

5.2.2 Promotion

The problem of gender bias in promotion of women's careers, roles and advancement is addressed by most of the articles mentioned. Many of them carry out these studies estimating the probability of promotion looking to the number of female and male academicians across different career stages or focusing also on the women in university leadership. Some of them follow different paths, like

article [15] which studies the success of each candidate in relation to the committee gender composition, controlling for individual characteristics. Articles [5] and [20] elaborate promotion policies and practices for academic women which ca be useful to monitor the level of gender mainstreaming and to achieve gender equity, and foster economic, societal, and cultural benefits of academia.

5.3 Data Source

It specifies whether the data processed and used to carry out the various analyses are public or not, namely whether they are private or accessible to anyone.

5.3.1 Public data

Most of the data used in the articles are public and come mainly from the MIUR web page database. In particular http://cercauniversita.cineca.it/php5/docenti/cerca.php in articles [6], [8], [10] and [16], http://ustat.miur.it/ in articles [12], [16] and http://reclutamento.murst.it/ in article [9]. But,together with the MIUR web page, were also consulted the ASN archive in article [11], ISTAT in article [17] and both the NSQ webpage http://abilitazione.miur.it/public/pubblicacandidati.php and the SciVal website in article [19].

5.3.2 Private data

Private data were collected through different tools. Interviews were used in articles [1] and [14], questionnaires to all academic staff were used in article [2] and compilation of surveys sent to relevant academic staff members, faculties and departments of universities were used in articles [3], [4], [18] and [20]. All the other articles collected data directly from the universities of interest and private databases.

5.4 Methods

The main methods used concern statistical analysis, descriptive statistics and some investigations carried out. But the most used method in this articles is descriptive analysis.

5.4.1 Descriptive statistics

This type of analysis focuses principally on the percentages of males and females across career stages and institutions, means, standard deviations, min, max or

comparisons using t-tests between men and women. Article [11] instead uses, in addition to these criteria, also cross-tables, as well as Article [10] which in addition to cross-tables also uses frequency distributions and segregation indexes. Finally, unlike the others, in article [4] was developed a theoretical framework based on the role of Gender Budgeting and the role of the Central Guarantee Committee.

5.4.2 Statistical analysis

Statistical analysis consists mainly of different types of regressions such as OLS regressions, multiple logistic regressions, multilevel logistic regressions to investigate gender inequality, or simply sampling all women in faculty positions are mainly preferred to carry out statistical analyses. But some articles, such as article [16], instead use quantitative analysis with the glass ceiling index and the glass door index to measure and compare the effects of gender practices, while article [21] relies on a static discrete-choice model for rank attainment.

5.4.3 Qualitative

This method was little used compared to the other two methods of analysis. It is used to conduct various surveys using different tools. Data were collected through surveys concerning questionnaires sent to all academic staff, from the highest to the lowest rank, whose responses were entered and compared to obtain information on the presence of women in academic careers. Or interviews with respondents were preferred to learn about their attitudes and intentions to use specific equity research practices. Instead, in articles such as [6], realistic CVs of hypothetical candidates whom the faculty interviewees evaluated for a permanent associate professor position. While in article [19], the survey sample included all women in faculty positions and questions covered social demographics, educational background, responsibilities, career expectations, perceptions of gender-based equity research practices.

	Context	Purpose		Source Data		Methods	
Paper	Italian	Recruitment	Promotion	Public	Statistical	Descriptive	Qualitative
[20]			X			X	X
[21]			X		X		X
[19]		X	X		X	X	X
[9]					X	X	X
[3]		X				X	
[1]	X			X		X	
[11]		X	X		X	X	
[15]	X		X	X	X	X	
[2, 16]	X	X		X	X	X	
[7, 8]	X		X	X		X	
[14]	X		X	X	X		
[5, 17]		X	X				X
[18]		X				X	X
[10]	X	X	X	X		X	
[4]	X		X		X	X	
[6]		X			X		X
[12]			X		X	X	
[13]			X			X	

Table 1: Summary of the Analysis of the Literature.

6 Conclusions

Gender biases negatively affect women in the university system, especially in promotion, productivity and recruitment. As far as *promotion* is concerned, most articles conclude that there is a relevant unequal treatment of male and female academic characteristics across grades, and there are significant obstacles to their promotion. This suggests the need for anti-discriminatory policies to apply in the promotion decision. In particular, article [11] shows that men are about 24 percent more likely to be promoted, which reveals significant gender discrimination. Indeed, as noted in article [1], certain changes made to the UWA academic promotion process have been instrumental in removing previous inequalities from the promotion process. Articles [19] and [20], on the other hand, show that the lower promotion of women among associate and full professors cannot be explained by the lower productivity of women nor by a negative selection of women for career advancement, but also that the amount of administrative leadership experience of professors is positively correlated with the receipt, in this case, of recommendations for the deanship, equally for women and men.

Regards women's *productivity* in academia, it is often subject to gender bias due to the possible presence of children, marriage and private life that are thought to lead to lower productivity on the part of women. But, as shown by article [1], for each role, the percentage of non-productive males is higher than that for females. This one considers gender and academic roles, and only scientific journal

publications authored by Italian university personnel are considered. Other articles, in particular, article [9], conducted a national mail survey addressing aspects of research and graduate-level teaching as background characteristics, considering gender and publication productivity of scientists in university departments. It shows that for women, the relationship between marriage and productivity varies by type of marriage, that is, women in subsequent marriages have higher productivity than women in first marriages. Finally, the article [19], was sent a tested survey instrument to male and female academics whose responses were entered and compared across a number of categories using descriptive statistics and t-tests. It reports that women have similar objective experiences but have very different perceptions of the issues in academia than do men. Differences include access to collaboration and support, issues in balancing family and work life, and to what degree perceptions are changing.

Finally, the analysis of *recruitment* shows that women keep being recruited to a smaller extent than men, and this gap has been quite constant over the last few years. Most of the articles, in particular [7], [14] and [15], talk about the adoption of many solutions and strategies that can help the reduction of gender diversity and the bias generated by stereotypes that affect academics. Instead, the technique adopted by article [17] concerns the use of the Gender Budgeting tool to eliminate discrimination based on gender in university activities. Article [8] instead confirms that also the gender committee composition matters for discrimination against women.

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