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Research Article

Gender Disparity In Different Facets Of Research: A Multidisciplinary Review

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Introduction

The terms “gender” and “sex” are deceptive. Both terms seem to convey the same meaning and are often used interchangeably by the masses without much effort, but there are differences between the two (Pryzgoda & Chrisler, 2000). The term “sex" indicates the biological differences between males and females, i.e. their genetic and genitalia differences and it (sex) remains the same irrespective of time and culture. In contrast, the term “gender” defines the difference in the roles constructed for men and women in society and these roles may or may not change with the change in time and culture (Newman, 2018). Societies around the world differ in terms of roles played by gender. Still, the only thing common between societies is that the major and significant role in each society is almost dominated by a specific gender overpowering the other, giving rise to gender disparity (Sengupta & Rooj, 2018). Gender disparity is the difference in men’s and women’s access to resources, social wellbeing, status, power, etc., in which one gender is usually preferred over the other. When this phenomenon is favoured by law, society and culture, gender disparity takes its legal form (Afza & Rashid, 2009)**.** Research is one of the core activities carried out in the society. Many critical decisions about diverse fields are taken based on research output. Therefore, the research process is under continuous pressure to be relevant to society **(**Gul, Shah, Hamade, Mushtaq & Koul, 2016)**.** But the research process can only be termed as relevant when the process carried out is independent and unbiased. Unfortunately, the research process also experiences several obstacles in its path and gender disparity is one such obstacle (Blumberg, 2008). Gender bias affects the process, progress, and result of the research, which proves detrimental to the advancement of any discipline (Lup, Beauregard & Adamson, 2018). Gender disparity in research has many faces, like low research productivity of females, high research impact of males compared to females, low presence of women in editorial advisory boards of journals, less acceptance of research funding applications from females by the research funding agencies etc. Such obstacles hinder women from having similar career advancements as men (Kobrynowicz & Branscombe, 1997). Since the aim of the research process in any branch of knowledge is to address cutting-edge issues to tackle the problems of existing and developing information societies, therefore the research process in any discipline or field must be free from all sorts of biases, including the gender bias which can affect and hinder its growth (Flyl, 2020). Thus, in this context, the study aims to examine how gender bias affects different facets of research in various disciplines by examining the published literature

Objectives

To analyze how gender bias affects female researchers in terms of their: -

1. Research Productivity
2. Citations
3. Research Funding
4. Collaboration Pattern

Methodology

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The comprehensive literature survey was conducted in various online databases like Web of Science, Wiley Online Library, Taylor and Francis Online etc. and through various search engines like Google Scholar to observe the trend in various facets of research in the context of gender. The study combines electronic and manual searches to identify relevant studies using keywords such as "gender," "gender bias," "gender and research funding," "gender and research productivity," etc.

Literature Review

Gender and Research Productivity

There is a growing concern in most countries regarding the lower participation and productivity of women in research. In most fields of science, medicine, and technology, men comprise more than half of the workforce, while women form a minority and are often less trained in elite groups and are promoted slowly compared to men (Holman, Stuart-Fox & Hauser 2018). Although governments across the globe are encouraging female participation and contribution in research by making women-centric policies and offering grants and support, the continuing attrition of women from research areas suggests that current strategies are unsuccessful. Aguinis, Ji and Joo (2018) conducted a study to examine the gender productivity gap in Science, Technology, Engineering, Mathematics, and other scientific fields (i.e., applied psychology and mathematical psychology). Authors found a considerable gender productivity gap in favour of men across the fields. Though women in certain disciplines are in more significant proportion still, they publish less often than males. They are, therefore, less visible and less likely to gain recognition and prestige for their findings. Bendels**,** Müller, Brueggmann and Groneberg (2018) analysed the articles from the journals listed in the Nature Index covering disciplines of Life Science, Multidisciplinary, Earth & Environmental and Chemistry to elucidate the state of gender equality in high-quality research. They found that women publish fewer articles than men and are underrepresented at productivity levels. Mauleon and Bordons (2006) compared the scientific performance of male and female scientists in Materials Science at the Spanish Council for Scientific Research. They found that single male authors are more productive than single female authors. Abramo, D'Angelo, and Caprasecca (2009) conducted a study on the entire population of research personnel working in the scientific-technological disciplines of the Italian university system to analyse the relationship between gender and research productivity. They found that men have higher average productivity than of females. However, the major gap is recorded when the quantitative aspect is considered, but when quality index and contribution intensity are considered, the gap between the sexes, although still present, seems less pronounced. Larivière, Vignola-Gagné, Villeneuve, Gélinas and Gingras (2011) conducted a study on Quebec university professors to know the relationship between sex and publication rates. Authors found that males, on average, publish more articles than their female counterparts in Health, Natural Science, Engineering, Social Science and Humanities. The authors also found that female researchers publish book chapters more than research articles. Eloy et al. (2013) conducted a study on academic physicians representing 34 medical specialities to examine whether gender disparities in research productivity exist throughout various specialities. They found that female academic physicians have decreased research productivity compared to men. Men had statistically overall higher research productivity at all academic ranks studied.

The studies show that female researchers lag behind their male counterparts in most scientific fields. In social sciences, men are also dominant in research productivity, e.g. Grossman (2020) examined the publication patterns in the European Journal of Political Research. The authors found that the publication rates of women are less than men. Snell, Sorensen, Rodriguez and Kuanliang (2009) conducted a study on Criminology and Criminal Justice scholars to know the contribution of women researchers in the respective field. They found males were nearly twice as productive as females**.** Mayer and Rathmann (2018) conducted a study on the research productivity of psychology professors in Germany to analyse to what extent research output is related to gender. Authors found that though most professors in the field are women, men are still more productive in terms of research

output. Authors found no or less difference in the publication of less prestigious book chapters; however, significant gender differences are found in the research productivity relating to academic journals, which are more important for career advancement and peer recognition. Negi (2018) conducted a study examining the articles published in Annals of Library and Information Studies for analysing author's productivity in terms of gender. The author found that the solo contributions of male authors are higher than those of females. The study further reveals that male and female authors are more productive as working professionals than teachers or scholars.

Similarly, Gul, Shah, Hamade, Mushtaq and Koul (2016) conducted a study on a prominent Library and Information Science journal, The Electronic Library, to understand the influence of author gender on their research productivity. They found an imbalance in research productivity between male and female researchers in the library and information science field, with males being more productive. Bisaria (2018) studied research articles published in the DESIDOC Journal of Library and Information Science from a gender perspective. Authors found significant differences between male and female research output, i.e. males outperforming females**.** Patel and Verma (2020) examined the SRELS Journal of Information Management, a leading journal in library and information science, for measuring the productivity of male and female authors. They found the contribution of female authors very unsatisfactory as compared to men.

Such discussions underscore that despite the advances, women continue to face barriers to progression in a research career. Considering the mentioned studies, achieving gender equality in research publishing seems complicated. However, various findings show that there are specific fields where female researchers progress and surpass their male counterparts in research productivity. Sotudeh and Khoshian (2014) conducted a study in Nano Science and Technology to analyse women's scientific productivity and impact performance. Authors found that although female Nano researchers are scarce in number, they equally perform in terms of scientific production and impact, which indicates gender egalitarianism in the field**.** Tower, Plummer and Ridgewell (2007) studied the top six journals from Science, Business and Social Science to check gender-based research productivity. They found no difference between women's and men's productivity when the percentage of women participating in the academic workforce was factored in. Van Arensbergen, Van der Weijden and Van den Besselaar (2012) conducted a study on social scientists in Norway to analyse the productivity difference. Authors found that the young female researchers were equally productive and, in some cases, more productive than their male counterparts. The difference in the research productivity favouring men was only found among the senior researchers.

Gender and Citations

Citations are increasingly used as performance indicators in research policy and the research system. Citations are a good measure of scholarly merit. It defines the bargaining power and reputation of scholars in academia. Usually, citations are assumed to reflect the impact of the research and its quality **(**Aksnes, Langfeldt & Wouters 2019). Various studies have shown that women receive fewer citations than men, which directly harms women's career prospects and creates a barrier to diversifying the methods field (Esarey & Bryant 2018). Bendels, Müller, Brueggmann and Groneberg (2018) studied various journals listed in the Nature Index covering the categories *of Life Science*, *Multidisciplinary*, *Earth* & *Environmental* and *Chemistry* to elucidate the state of gender equality in high-quality research. Authors found that articles with female key authors are less frequently cited than articles with male key authors.

Similar results were found by Turner and Mairesse (2005) in their study on French physicists. Authors found that women, on average, obtain fewer citations per paper than their male colleagues. Beaudry and Larivière (2016) conducted a study in Health Sciences, Natural Science and Engineering (NSE) to examine whether gendered collaboration patterns influence the propensity to receive more citations. They found that researchers collaborating with a higher proportion of female co-authors are consistently less cited in the health and NSE fields than when they publish with a male-dominated group of co-authors. Larivière, Gingras, Cronin and Sugimoto (2013) conducted a study to analyse gender disparities in science. Authors found that articles with women in dominant author positions

receive fewer citations than those with men in the same positions. Fox and Paine (2019) conducted a study on the manuscripts submitted to the six journals in Ecology and Evolution to know the gender differences in peer review outcomes and manuscript impact. They found that papers authored by women have lower acceptance rates and are less cited than papers authored by men. Aksnes, Rorstad, Piro and Sivertsen (2011) conducted a study on Norwegian researchers from a wide range of scientific fields to analyse the effects of gender on citation rates. Authors found that although the difference is insignificant, men are more frequently cited than women. Kane et al. (2019) conducted a study on publications from 50 top-ranking surgery journals to analyse gender disparity in the citation of Surgical Research. Authors found that publications with female first and last authors had lower citation rates than publications with male first and last authors. Benjamens et al. (2020) conducted a study to examine gender differences in the citations in Transplantation Research. The authors found that the differences in citation rates remain striking, with men amassing more citations than females.

In social sciences, most studies also reveal that women receive fewer citations than men. Maliniak, Powers and Walter (2013) conducted a study to investigate the extent to which citation patterns differ between men and women in the international relations (IR) literature. They found that women, on average, are systematically cited less than men. Liu, Devine, and Gauder (2020) conducted a study on students in Political Science to examine the citation patterns among students. They found that male students are significantly less likely to cite papers written by female authors, leading to less scholarly impact for females. Caplar, Tacchella and Birrer (2017) conducted a study in Astronomy to analyse the difference in the citation rates of men and women researchers. They found an intrinsic difference in the property of papers written by men and women. Papers with women as lead authors receive fewer citations than expected if a male had written the same. Nunkoo, Hal, Rughoobur-Seetah and Teeroovengadum (2019) conducted a study to explore the differences in citation practices of scholars in the top-cited articles in Tourism research. Authors found that the author's gender notably determines the number of citations an article receives, and men, on average, are more cited than women. McElhinny, Hols, Holtzkener, Unger and Hicks (2003) conducted a study investigating gender–citation rates in five core sociolinguistics journals. They found that men are more likely to cite other men's work than women's.

Similarly, Dion, Sumner and Mitchell (2018) conducted a study to estimate the gender gap in citations across political science subfields. Authors found that women's work is less likely to be cited by men and mixed-gender author teams, even in subfields populated predominantly by women scholars. Håkanson (2005) studied the three library and information science journals: College & Research Libraries, Journal of Academic Librarianship, and Library Quarterly, to find the impact of gender on citations. Authors found that women authors, on average, receive a much lower share of citations than men.

There are also various studies which show that there exists no relationship between the gender of an author and the number of citations received. Van den Besselaar and Sandström (2017) conducted a study on the Swedish author dataset of 47,000 researchers and their Web of Science publications from 2008 through 2011 with citations to know whether male and female-authored papers have an equal impact. The authors found that males dominate the research output in terms of numbers. Still, in terms of citations or research impact, female researchers, on average, had at least a similar impact as productive male researchers. In some cases, the ratio between top-cited papers and productivity is considerably higher for women than men. Nielsen (2015) conducted a study on researchers working in a Danish university to investigate the link between gender and research performance regarding citations. The authors found no clear indication of any significant gender gap in the citation rates of male and female researchers. Andersen, Schneider, Jagsi and Nielsen (2019) did a comprehensive global analysis of possible gender variations in the per-paper citation impact of medical researchers. They found that papers with female authors, on average, are cited less. However, after adjusting for self-citations, the authors found a near-identical impact for men and women.

Borsuk, Budden, Leimu, Aarssen and Lortie (2009) examined citation rates concerning the author's gender in Ecology. They found no relation between the two; instead, there is a relation between the number of authors and the citation rates, i.e. the more the number of authors in collaboration

(irrespective of gender), the more citations received. Similarly, Thelwall and Nevill (2019) conducted a study in the field of Science Technology, Engineering and Mathematics (STEM) subjects in the USA. They found no evidence of citation bias. Cooper, Aharony and Bar-Ilan (2019) conducted a study to examine the faculty member's citations based on their gender in Israeli academia using four fields, i.e. Psychology, Linguistics, Public Health and Chemistry. They found an overall increase in the average citations per female researcher. Thelwall (2020) conducted a study on journal articles published in the field of Psychology to investigate the citation pattern of male and female authors. The author found that females have the citation advantage in all areas of psychology compared to men.

Gender and Funding

Access to funding is one of the keys to success in academic careers, both for women and men. Indeed, the role of competitive funding is increasing daily, and success in the competition for research funding is often used as a measure of scientific excellence at both individual and institutional levels (Leemann & Stutz, 2008). Gender disparity in research funding is a well-known phenomenon in the scientific community, with varying intensity. Women researchers are usually not preferred by funding agencies as they receive limited funds than male researchers, which may be one of the reasons for low research productivity (Larivière, Vignola-Gagné, Villeneuve, Gélinas & Gingras, 2011). Van der Lee and Ellemers (2015) investigated whether there exists any research funding gap among the young scholarly population of the Netherlands and analysed the grant applications received and processed by Netherlands Organization for Scientific Research (NWO). The authors found evidence of gender bias in application evaluations and success rates. Male applicants received significantly higher application success rates than female applicants. Ebadi and Schiffauerova (2016) conducted their study on Canadian-funded researchers active in natural science and engineering to analyse their scientific performance and their share in federal funding. They found that research funding is more biased towards male researchers. Similarly, Whiteman, Hendricks, Strauss, and Tannenbaum (2019) analysed the funding application success rates at the Canadian Institutes of Health Research (CIHR). The authors found that when the research funding agencies assessed the applications of researchers without knowing their gender, the difference between the grants received by the male and female authors was very negligible. Still, when the gender of the applicants was apparent to the funding agencies, they preferred to fund male authors much more than females. Head, Fitchett, Cooke, Wurie, and Atun (2013) conducted a study on differences in research funding for women scientists in the UK. They found consistent differences in funding received by men and women. Women have fewer funded studies and receive less funding in absolute and relative terms. Zhou et al. (2018) studied UK cancer research funding from a gender perspective. They found that females clearly and consistently receive less funding than their male counterparts in total investment and number of funded awards. A study conducted by researchers in Sweden shows that female applicants must be more productive than male applicants to achieve the same success scores on their grant applications (Wold & Wennerås,1997). Oliveira, Woodruff, and Uzzi (2019) conducted a study on the number of grants distributed among first-time male and female investigators by the National Institutes of Health Sciences to analyse whether there is any gender disparity in the process. The authors found that for all first-time principal investigators across all grant types and institutions, women received fewer grants than men. Bornmann, Mutz, and Daniel (2007), while analysing gender disparities in the research funding process, found that women, to some extent, are deprived of research grants only based on their gender. Bedi, Van Dam and Munafo (2012) conducted a study on a major biomedical funding body in the UK to assess the difference in the number of grants awarded to men versus women. The authors found a significant gender difference, with men awarded more funds on average than women. Van den Besselaar, Schiffbaenker, Sandström, and Mom (2018) conducted a study in the life sciences field to analyse European Research Council (ERC) funding pattern. They found the prevalence of gender bias in favour of men. The study provides empirical evidence that evaluation practices lead to gender-biased practices and outcomes. Svider et al. (2014) conducted a study to determine whether gender differences exist in individual National Institutes of Health (NIH) awards and funding totals in

ophthalmology. They found men had higher mean NIH awards than their female colleagues and had higher total funding per individual. Moreover, men had statistically higher awards at the assistant professor level than their female counterparts. Brouns (2000) conducted a study on Gender bias in assessment procedures in the two major institutions for scientific grants in The Netherlands: the Dutch Organization for Scientific Research (NOW) and the Royal Dutch Academy for the Sciences (KNAW). The data was analysed based on a correlation of characteristics of the applicant (sex, age, and scientific productivity). The analysis indicated that women applicants are evaluated differently from male applicants and that gender matters in research funding. Jagsi (2009) conducted a study to determine the subsequent academic success of recipients of National Institutes of Health (NIH) career development awards (funds) in academic medicine. He found that women are less likely than men to receive an award, and a significant sex disparity is evident. Sex persisted as a significant independent predictor of award attainment. Bellotti et al. (2020) conducted a study to analyse gender differences in public research funding in Italy. They found that even though network setups are similar, women still get less funding than men. Similarly, Safdar et al. (2019) examined gender disparity in funding at the National Institute of Health (NIH) USA. They found that although NIH grants and awards for female researchers have increased overall, they still lag behind their male counterparts in total funding. Blumenthal et al. (2017) conducted a study to analyse sex differences in funding of faculty rank academic cardiologists. The authors found that women cardiologists had significantly lesser chances of receiving funds than their male counterparts. Gul, Shah, Hamade, Mushtaq, and Koul (2016), in their study on Electronic Library, attempted to analyse the gender differences in author productivity, impact, funding and collaboration pattern. Authors found that external funding agencies tend to fund male authors more than female ones. A male-female or male-male authorship pattern was preferred by research funding agencies more than a solo female or female-female authorship pattern. In opposition to the above studies indicating that females are consistently discriminated against during their grant/ funding application evaluations, a growing literature has argued for the absence of gender differences, asserting that women and men have relatively equal chances to obtain grant funding in different academic disciplines and countries. Mutz, Bornmann, and Daniel (2012) evaluated the grant peer-review process at the Austrian Science Fund concerning gender to identify any discrimination. The authors found that the final decision on funding was not associated with the applicant's or reviewer's gender. Authors found that overall there is no gender bias in the peer-review process of men's and women's grant applications in contrast to claims that women's grants are systematically downrated. Waisbren et al. (2008) analysed the grant applications submitted by 2480 faculty members affiliated with the Harvard Medical School to ascertain whether there are differences in the acquisition of research grant support between males and females. The authors found that the grant success rates are not significantly different between women and men. Boyle, Smith, Cooper, Williams, and O'Connor (2015) conducted a study to analyse the difference in the funding process between males and females in social science research and found that though there are slightly fewer women than men in social sciences, still women and men are equally successful in winning grants.

Similarly, Leemann and Stutz (2008) in their report titled "Gender and Research Funding" found no difference in the research funding success of male and female researchers. Beck and Halloin (2017) studied the Belgium Funding Agency Fonds de la Recherche Scientifique - FNRS (F.R.S.-FNRS) to highlight any possible effect of gender on success rates. They found that access to F.R.S.-FNRS funding is not gender-dependent for most funding schemes except one where men represent most of the applicants. There is no significant influence of gender on grant success rates

Gender and Collaboration

Gender-based differences in collaboration may well impinge on a variety of crucial issues in research and education, including team-building effectiveness but also such secondary effects as educational attainment, representativeness of the scientific workforce, recruitment and retention of scientific and technical human capital, and perhaps even the quality of the research itself (Bozeman & Gaughan, 2011). Recent evidence strongly suggests that team collaboration is greatly improved by the presence of women in the group. Further, many studies have indicated that groups with equal numbers of men

and women or groups with more women than men performed better than groups consisting of only males or most males (Bear & Woolley, 2011). But women often feel excluded from formal and informal opportunities for research collaboration (Holman & Morandin, 2019). Isolation is more notable in disciplines dominated by "old boy networks", where scientific debate, scientists' reputations, collaboration access, and research funds are heavily influenced by informal networks composed exclusively of male academics (Abramo et al., 2013). Given the importance of women collaborators and evidence that collaboration results in the creation of high-impact work, as found by Wuchty et al. (2007), it is crucial to understand systematic differences in the research collaboration pattern of male and female authors (Fell & König, 2016). Araujo et al. (2017) conducted a study in the eight major fields of study in Brazil, namely, Agricultural Sciences (AGR), Applied Social Sciences (SOC), Biological Sciences (BIO), Exact and Earth Sciences (EXA), Humanities (HUM), Health Sciences (HEA), Engineering (ENG) and Linguistics and Arts (LIN) to find the gender differences in collaboration behaviour of male and female scientists. Authors found that men are likelier to collaborate with other men than expected from the gender distribution across fields. At the same time, women are more egalitarian, i.e. they tend to collaborate equally with both genders. Bozeman and Gaughan (2011) conducted a study based on the US National Survey of Academic Scientists, belonging to various disciplines (STEM disciplines: biology, computer science, mathematics, chemistry, physics, earth and atmospheric sciences, agriculture, and sociology) to analyse the effects of gender on the propensity to collaborate. They found that, on average, men like to collaborate with other male members compared to females. Nunkoo et al. (2020), in their study on tourism research (a discipline of social science), found that both male and female first authors are more likely to collaborate with researchers from their respective genders. Still, unlike male first authors, female first authors display a high likelihood of collaborating with a team that comprises at least one other female as well as male co-authors, i.e. female first authors are more prone to collaborate with the opposite gender as compared to males, which confirm the long-standing evidence that males and females differ in research collaboration pattern. In Economics, Liu, Song and Yang (2020) conducted a study to elucidate disparities in output and influence under different group combinations. Collaboration was studied in three patterns, MM indicating male collaboration—that is if all authors of a paper are male; FF indicating female collaboration—that is, all authors of a paper are females; FM indicating at least one male and one female author of a paper. Authors found that men have apparent advantages in establishing relations; male-male authors only communication dominates the collaboration network of economic research. Holman and Morandin (2019) conducted a study in Life Sciences to test whether researchers tend to collaborate with same-gendered colleagues. Results show that homophily exists in the field of life sciences, i.e. researchers co-publish with colleagues of the same gender more often. Elsevier (2020), in their report analysing the impact of gender on various dimensions of research, also found both men and women preferentially collaborate with authors of the same gender. Kwiek and Roszka (2020) conducted a study to analyse gender differences in research collaboration among Polish university professors. The authors found that the concept of gender homophily is more in males than females.

Numerous studies show that females prefer to collaborate with females only or have no gender difference in the research collaboration of male and female authors. Jadidi, Karimi, Lietz & Wagner (2018) studied the gender disparities in the productivity, collaboration, and success of Germany's male and female computer scientists. They found females are more hemophilic in collaboration than men; they tend to engage more with females rather than with males to carry out their research works. Ebadi and Schiffauerova (2016) conducted a study on Canadian-funded researchers active in natural sciences and engineering to analyse the different aspects of research, including the collaboration pattern under the lenses of gender. Although some differences were found in research productivity, impact, and funding favouring men, no differences or gender disparity were found in the collaboration aspect of male and female researchers.

Discussion and Conclusion

From the extensive survey of the literature, it is apparent that most of the studies indicate the existence of gender bias in the research field of scientific and non-scientific disciplines, with females having low research productivity, receiving fewer citations, receiving less funding and having less international visibility as compared to their male counterparts. Sonnert and Holton (1995) define the reason for the underachievement of female researchers can be attributed to their lower presence in the research field, and the reason for the lower number of female researchers can be classified under two categories *"Difference"* and *"Deficit"* model category. The *Difference* model says that the difference in the number of male and female researchers is because of innate and social/cultural differences between men and women, i.e. men and women are created differently. Therefore, their motivation and commitment to scientific careers also differ (Kapp, 2013). On other hand, the *Deficit* model disposes of the view that men and women have different scientific achievements because of innate and cultural differences; instead, this model states that it is the indifferent attitude/towards women which leads to their lower participation and lower productivity in research areas. Women are consciously given fewer opportunities, making it difficult for them to collaborate with other scientists and raise funds for their research (Bak, 2001). Females are given less access to scarce resources, are less trained in elite groups, given limited autonomy and are promoted slowly as compared to men, giving rise to a phenomenon termed as "*Glass Ceiling",* which puts women at a disadvantage and hampers their overall productivity (Holman, Stuart-Fox & Hauser, 2018). The "Matilda effect" is also a reason for bias which is a perception that the research output by women is of low quality compared to men's. This perception leads to women researchers getting fewer citations, less funded work, and finding collaborators difficult (Lincoln, Pincus, Koster & Leboy, 2012). "*Motherhood Penalty"* is another reason for the slower growth of females in research. When a female researcher becomes pregnant or has children, she is pushed to wall, her abilities are questioned, and her opportunities start to fade. There is a notion that a women's research career will last only till she finds a husband or starts a family (Kahn, García-Manglano & Bianchi, 2014). Thus, as a result, many agencies hinder approving or funding the research proposals made by pregnant female researchers (Lutter & Schröder,2020).

Further, women in science, technology, engineering, and mathematics are only seen as women. Still, they are invisible as scientists, innovators, engineers, or mathematicians, giving rise to the "Invisible Paradox" phenomenon. Women must continuously work hard to be labeled professionals (Stoet & Geary, 2018).

However, though the majority of the studies reflect a bias in favour of men, few studies indicate that the bias is disappearing or has even disappeared in some fields of knowledge, with women being equally or more research productive, receiving equal or more citations and funding and finding no difficulty in finding a collaborating partner on national or international levels. A positive trend is apparent from the literature that despite gender differences in research women's contribution is improving, and the gender gap in research is gradually disappearing. There is a need to implement some pressing policies to eliminate gender bias from research, as studies (Yang et al., 2018) have found that mixed-gender teams create more effective research than single-gender teams.

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