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Women, science and intersectionality: an evidence map of gendered discourse in climate research

submitted by

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Abstract

We live in the age of climate solutions, both in the mitigation and adaptation arenas. Meanwhile, the people who have least contributed to the anthropogenic climate change are suffering from both the slow onset impacts and acute disasters; and the currently implemented policies only exacerbate the existing inequalities. It is thus crucial that a just approach is pursued, whereby the interests of the socially marginalised groups are made central and integral to all research and policy related to climate change mitigation and adaptation. With mounting popularity of *intersectional feminism* and *climate justice* in both academia and activism, it begs further investigation into whether increasing women participation rates in science can have broader positive effects. This paper presents a systematic review of the climate change adaptation policy scholarship, which is rooted in machine-assisted methodology for gender estimation and thematic space analysis. By applying a mixed method for gender prediction from the first name and Structural Topic Modelling (STM) approach for identifying topical trends in the text corpus, I investigate the relationship between the gender variables and topic prevalence values for topics related to the conceptual framework of *climate justice*. The results support the argument for higher representation rates and more welcoming conditions for women researchers, especially in climate science, as they reveal a positive effect of author gender being estimated as female and the topic proportion of topics such as *Pathways to Equity, Local Communities, Gender, Food Security,* and *Displacement and Mobility*. My work further highlights the gaps in climate change adaptation policy research associated with underrepresentation of the voices and interests of various minority groups. Finally, the findings presented here confirm previously outlined patterns in gender disparities in academia.

Keywords: climate science, adaptation policy, gender, minority, intersectionality, climate justice, women representation, implicit bias, structural topic modelling

Contents

1.1 Introduction: research motivation

"All human beings are born free and equal in dignity and rights. Yet, when it comes to the effects of climate change, there has been nothing but chronic injustice and the corrosion of human rights."

(Climate Justice, Mary Robinson, 2019)

This research is aimed at exploring the gendered authorship patterns in climate change adaptation policy research, or more specifically, the differences in topic prevalence for *climate justice* topics in the corpus based on the author's gender. It thus offers an insight into the topical space of the climate change adaptation policy and the systemic tendencies in topic inclusion. The specific area of climate science is selected as one where a researcher could explicitly assume a human-centred approach or rather exclude it from the agenda.

The most recent assessment report from the International Panel on Climate Change (IPCC, AR6) highlights that even a moderately successful mitigation scenario (SSP2-4.5), where anthropogenically driven emissions reach their peak in about 2050 and decrease from then onwards, sets us on a trajectory of reaching 2.1 to 3.5°C of global warming compared to pre-industrial levels by the end of this century. This would lead to an increased frequency of extreme weather events, disrupted precipitation patterns, and the breach of multiple tipping points. Taking action to mitigate these effects of climate change, however, is politically contested and building a coalition for change has proved difficult. Scientific evidence suggests that raising the public's awareness and developing mechanisms for accountability and transparency will help to build momentum and to lead to political commitment (IPCC, 2022).

While climate change poses an unprecedented global challenge, it also provides an opportunity to rethink and deconstruct the existing systems and institutions that clearly are not working for anyone apart for the most privileged. Despite the nature and scale of the climate crisis, powerful actors as represented by the economic and political elites are halting meaningful action, while the socially marginalised groups, having contributed the least to the causes of climate change, are suffering from its immediate impacts. Furthermore, in the world we live in today,

vulnerable communities are susceptible to multiple emerging and intersecting risks that exacerbate one another and reduce the adaptive capacities. Mitigation and adaptation measures also require large investments, which indicates the need for economic support from the industrialised countries to poorer ones. Once implemented, these measures create multiple reinforcing benefits, such as stimulating innovation, raising education levels, improving health and well-being, among countless others. And these can only be realised through the inclusion of grassroots communities in designing and where feasible in implementing these mitigation and adaptation project. Hence, in moving forward, climate action must assume a more equitable approach. Producing scientific evidence specific to the experiences of the most vulnerable groups is integral to that (ICRC, 2020; IPCC, 2022).

Despite a lack of political consensus, the growing environmental movement, as well as the proliferation of international climate negotiations, have put the issue of climate action front and centre of public discourse. As the scientific evidence becomes more abundant and allows for more accurate climate change impact estimations, the IPCC assessment reports play a crucial role in bridging the gap between climate science and governance. They thus allow for either reinforcement of the existing injustices or breaking down of the oppressive path dependencies through informing political decision-making. And as climate science and governance today have direct implications to people's lives worldwide, some are left in an extremely vulnerable position, while others enjoy a more privileged one. Systemic oppression mechanisms lead to a disproportionate distribution of climate change effects, with poor people, women, and racial or ethnic minorities suffering most consequences today, while the most privileged few enjoy the profits from the everlasting economic growth. The need for powerful actors in the Global North to account and compensate for the caused damage alongside preventing further harm is becoming a more prominent argument in climate research and policy contexts (Robinson, 2011; Sultana, 2021).

It is critical to ensure that the expertise and informing processes are inclusive of the socially marginalised groups; that vulnerable actors are given the chance to speak up, participate, and make their concerns not only heard, but also acted upon. And as different forms of inequality intersect and reinforce one another, tackling them requires an intersectional approach (Hillert, 2023; ICRC, 2020; Liverman et al., 2022).

Historically elitist and exclusively white male endeavour, science has no doubt contributed to the spread and persistence of discriminatory ideals ('How Nature Contributed to Science's Discriminatory Legacy', 2022). And even as we see more inclusive policies and higher women's participation rates, gender bias and other discriminatory biases persist in both natural and social sciences. Among the IPCC's contributing authors in the 6th assessment cycle, only 33% were female. Of course, this was a significant improvement from 1990, when the number was as low as 8%, or even 2013 with 21% - but is it enough? And why does this matter in the broader context of social justice? (Liverman et al., 2022)

Ensuring women's agency has proven essential in both tackling emerging crises at the grassroots level and changing the course of international climate negotiations (Robinson, 2019). It has become evident that encouraging women's participation leads to an overall fairer representation of the needs and interests across minority groups. However, while women are becoming more prominent figures in climate negotiations and activism, there is still much work to be done before gender equity can be fully realised in the climate research community, as a recent report from the IPCC Task Group on Gender highlights (Liverman et al., 2022). The survey revealed that both discussions and scientific writing are still dominated by men - even with lower disparity than in previous eras, women still feel less confident in speaking up. After the report was presented at the Panel's 49th Session in May 2019, a second task group, the Task Group on Gender Policy and Implementation Plan, was commissioned to develop a draft for the IPCC Gender Policy and Implementation Plan, that was reviewed and adopted at the Panel's 52nd Session in February 2020. The policy institutes the goals of enhancing gender equality in the IPCC processes, creating a gender-inclusive environment, and gender-sensitive training, as well as the stepwise procedures towards achieving them, thus allowing for continuous monitoring and better transparency (IPCC Task Group on Gender, 2020).

Of course, one can argue that women's agency has not always been intersectional and inclusive of all; that, in its early waves, feminism was exclusionary of racial minorities, or that today it often is exclusionary of transgender or other gender non-conforming people. However, many recent feminist authors and public figures like Nancy Fraser, bell hooks and Sara Ahmed, among others, have built a strong argument for intersectional feminism, which this study builds upon in the context of climate science and policy. There are further possible counter arguments to the case that women in climate science can also be agents for other marginalised groups.

These include, for instance, possibility of token inclusion of women researchers, or the pressure women experience to comply with dominant scientific practices, or the phenomenon of women researchers being 'ghettoed' into certain scientific domains considered 'more suitable' for them. I discuss these in more detail throughout this paper, but primarily in the subsections 2.3 and 4.5.

1.2 Introduction: theoretical framework

Discussing gender and the gendered patterns in academia and policy is heavily reliant on several concepts that lack clear and/or unique definitions, thus leading to a higher chance of misinterpretation. This section thus outlines the definitions I refer to throughout this study.

As the differences in discursive focus of academic papers are studied here in relation to the author's gender, it is necessary to cover this definition first. However, defining gender is not very straightforward as multiple scientific and social scientific disciplines are involved. And, as Annemarie Mol wrote in her article first in 1985, defining what a woman is sometimes leads to clashes between them (Mol, 2015). An obvious example would be the disagreement between social scientists and biologists on what defines a certain gender - the way we are brought up and taught to socialise, or the simple fact of which chromosomes we are born with. Of course, gender is a sensitive topic that deserves special attention and needs to be handled carefully. When studying individuals, one cannot and should not restrict gender definition to any scientific branch or focus on the binary gender definition at all. However, while the methodology of this study allows us to observe a significantly large population, it is essentially limited by the assumption of binary gender classification and the centrality of the social element. *Gender* is thus referred to as a social construct defining the typical attributes associated with being a woman or a man, as well as the norms, behaviours and roles assigned to women and men through socialisation processes (*World Health Organization*, 2023).

Having to struggle with gender inequality, even though undoubtedly in varying degrees, is a universal experience of being a woman. The production of scientific knowledge is, unfortunately, no exception to this and has the downstream consequence of making adaptation policies informed by the science also gender biased. There is abundant evidence in support of the argument that when women are excluded from science and policy making, their specific needs are ignored, leading to varying degrees of damage. This is not to claim that men purposely cut women out of the study and/or policy design, but that they tend to overlook gender-specific issues, in a similar manner that in a broader context more powerful groups fail to notice the unique needs of the socially marginalised groups (Perez, 2020; Robinson, 2019; Srinivasan, 2021). This phenomenon has been described as *gender bias* in science, or *gender blindness* in policy. Rather than intentional mistreatment of women, this refers to the complacency and unwillingness to recognise and address the differences between human experiences framed by the gender constructs, and the resulting failure to design gender-sensitive policies (UN Women Training Centre, 2016).

Along with the popularisation of the concepts of *gender bias* and *gender blindness*, significant efforts have been made in order to counter them. Thus, the concept of *gender mainstreaming* has been formulated, which entails the gender-responsive processes in legislation and policymaking across the multiplicity of areas and levels. It is a strategy that emphasises integration of women's alongside with men's concerns and experiences into the design, implementation, monitoring and evaluation of any planned action with the aim of equal distribution of political, economic and societal benefits and eradication of gender inequality (UN Economic and Social Council, 1997).

Another group of concepts fundamental to this research refer to the existing inequalities and injustices. The central concept of a *minority group* lacks a clear definition as it is deeply contextual. However, commonly applied criteria include non-dominance in terms of population and/or political power and possessing distinct ethnic, cultural, religious or linguistic characteristics (United Nations, 2010). Even referring to women as a minority has been heavily criticised. However, in the feminist literature, there exists a consensus on the status of women as a minority due to gender inequity in social, economic and political power (Ahmed, 2017; Perez, 2020; Srinivasan, 2021). Despite evident positive developments, much work remains to be done for women to experience equal comfort and access to benefits as men. While gender

equity has been fundamental to feminist activism, other oppression mechanisms sometimes have been ignored or even exacerbated. With that in mind, I propose that intersectional feminism could have significant positive implications for future sustainable development. *Intersectionality* as a multiplicity of ways in which different systems of oppression based upon gender identity, race, ethnicity, class, religion or sexual orientation, "intersect" and reinforce one another by creating uniquely disadvantageous conditions has been relatively recently formulated by theorists in the social sciences. The unanimous aspiration of these theorists is for greater inclusivity in both the analysis and tackling of the discriminatory dynamics (Fraser, 2010; Massachusetts Institute of Technology & Costanza-Chock, 2018; McCall, 2005; Ross, 2017).

This study expands on work on the dynamics of intersectionality and social justice by expanding it into the realm of climate science and policymaking. Social justice is commonly defined by absence of discrimination in the abolishment of barriers based on gender, age, race, ethnicity, religion, culture or disability and by equal distribution of economic benefits and opportunities and social progress among people around the world. In the context of climate change mitigation and adaptation, there exists a special need for fair representation and equity as climate policies can have both positive and negative spillover effects for different segments of society. The concept of *climate justice* is also fairly recent, and it generally refers to a framework that, while aimed at tackling climate change, prioritises human rights by explicitly addressing multiple intersecting injustices that are or can be made worse by the absence or delay or misguided implementation of mitigation and adaptation activities, or even by their implementation (Robinson, 2011; Sultana, 2021). The IPCC further outlines three principles fundamental to climate justice: distributive and procedural justice, and recognition. Firstly, *distributive justice* refers to how resources are allocated among individuals, nations and generations; it entails fairness in the distribution of both benefits and burdens. Secondly, *procedural justice* concerns the inclusivity of the decision-making process. And finally, *recognition* focuses on the representation of diverse cultures and perspectives in the form of either direct engagement or indirect but fair consideration (IPCC, 2022). The centrality of climate justice in the current adaptation discourse frames this research, while the concept itself enables the definition of the relevant topics among all those present in climate change adaptation scholarship. Hence, it will be repeatedly referred to throughout this paper, especially when handling research topic categorisation in section 5. Another matter related to this but

discussed rather separately is *intergenerational justice*. This concept refers to the intertemporal nature of choices on climate mitigation and adaptation, meaning that the consequences of these choices will not only be experienced by the same actors in the future, but also by the generations that will come after. Therefore, it is argued that youth must be given voice in climate policymaking, which is something they have been fighting for through climate activism (Balvin & Christie, 2020; Ursin et al., 2021).

Having provided the motivation behind this research and the conceptual framework it relies on, I must acknowledge before proceeding that climate research and policy are generally related to a high level of heterogeneity in public perceptions, which is even more the case with feminist scholarship and activism. However, I propose that tackling, or rather even approaching a complex crisis of climate change requires a certain degree of unconventional thinking and a multiplicity of perspectives. Therefore, I think that prioritising climate justice is not only our responsibility but also a key opportunity, which is a notion supported by existing literature in the field.

2. Literature review

This section of the paper presents a non-systematic literature review on the topic of intersectionality in climate science, and is thus organised in accordance with the following subtopics: (1) the uneven burden of climate change; (2) science and policy interface; (3) women in academia; (4) feminism and intersectionality; and (5) climate justice prospects. In this subsection, I firstly summarise the scientific evidence on the disproportionate exposure and vulnerability to climate change effects based on gender, race and class. Secondly, I try to highlight the interlinked nature of the risks associated with climate change impacts. After covering these, I also explore the literature on adverse effects of some recently employed or negotiated climate mitigation and adaptation policies.

2.1 Literature review: the uneven burden of climate change

The disproportionate effects of climate change impacts on women and girls around the world have been quite widely studied. And the scientific consensus indicates that women, while being more environmentally conscious, and more likely to adopt behavioural change and display progressive political views, are unduly suffering from the immediate consequences of climate change. As women are expected to assume, or are assigned, the roles of caregivers, farmers, or community leaders, the burden of a climate disaster falls on them both in relation to slow-onset events and acute disasters. For instance, research surveys conducted in 12 villages in 6 districts in India and Nepal reveal that women are responsible for most of the agriculture labour and household labour, both of which become significantly harder to perform and time-intensive due to extreme weather events (Nellemann et al., 2011). Acting upon both biophysical and social vulnerability, the effects are much more pronounced in the grassroots communities, but are also observed in the industrialised countries (Griffin Cohen, 2017). These pressures are

shown to have debilitating effects on women's physical and mental health (Huyer et al., 2020; Nagel, 2016; Robinson, 2019; World Bank, 2011). Climate change impacts also increase the risk of violence against women and girls, which is an issue much less discussed in the literature (Owren, 2021; UN Women & IUCN, 2022). A violation of human rights, gender-based violence can imply domestic or intimate partner violence, verbal, physical and sexual violence in communities, sexual exploitation and child marriage, and violence against women environmental human rights defenders. All of the above are aggravated as environmental degradation and extreme weather events incur economic decline and community breakdown (Owren, 2021). A further contributing factor is the interplay of climate and conflict risks, which intersect and exacerbate the effects of one another, while reducing the adaptive capacities (Hillert, 2023; ICRC, 2020) . And armed conflict on a par with natural disasters also stimulates gender-based violence and human trafficking (Nellemann et al., 2011; Owren, 2021; UN Women & IUCN, 2022).

Racial-ethnic and class-based discrimination have also been shown to exacerbate the impacts of climate-related risks. A comprehensive literature review published as early as 1999, suggests that racial and ethnic minorities in the US suffer from higher vulnerability to natural disasters, which is not only attributable to lower average income levels, but also language, community isolation and cultural insensitivities (Fothergill et al., 1999). More recent cases of natural disasters like the Hurricane Katrina that hit New Orleans in 2005 and the Hurricane Maria that descended onto Puerto Rico in 2017 both reveal the patterns of racial-colonial disaster capitalism. In both these examples, the US government failed to provide sufficient emergency aid. In Puerto Rico, the local populations whose lives were disrupted by the hurricane were left to wait, starve, drink rainwater or water from toxic wells, and eventually find ways to deal with the crisis on their own (Bonilla, 2020). In New Orleans and along the Gulf coast, both the preparation and recovery actions were heavily discriminatory based on race and class. A federal disaster relief package that constituted an unprecedented $5 billion, clearly disadvantaged low-income residents as the aid was only granted to homeowners with insurance (Robinson, 2019). A quantitative study based on a survey of Katrina survivors has shown that low-income households were less likely to evacuate from New Orleans in the onset of the disaster; further findings suggest that black people were 3.8 times more likely to lose their jobs after the hurricane; race, above class, was also shown to have an effect on post-disaster stress (Elliott & Pais, 2006). Further studies have supported the findings (Bolin, 2007; Spence et al., 2007). In

New Orleans and along the Gulf coast, women agency has proven instrumental in restoring local communities marginalised by the recovery procedures. Coastal women for change, a non-profit organisation initiated and led by local women activists from impoverished neighbourhoods, helped poor households with securing what available grants for household repairs, and represented the voices of the most vulnerable at the mayor's commission for finance, education, transportation, land use and affordable housing (Robinson, 2019). However, it is not only the acute disasters, the slow-onset effects of climate change also disproportionately affect the poor, as well as race and ethnic minorities. For example, recurring urban flooding in Africa is already affecting the lives of the poor who tend to occupy low-lying floodplains (Douglas et al., 2008) while warming temperatures and changing precipitation patterns are causing enormous damage to agriculture across Africa, South America and Southeast Asia (Mendelsohn, 2009).

While developing countries are already experiencing higher exposure to climate impacts due to the geography-based environmental differences and lower levels of adaptive capacities, climate governance with the power concentrated in the global North, could intensify the pressures on food security and land use among other adverse effects (Yawson, 2020). One recent example of an injustice perpetuated by climate change mitigation action is the human cost of the supply of minerals essential for "green" transition (Mills, 2020). A report was published in 2016 by Amnesty International that exposed multiple human right violations, including in particular child labour, in the cobalt production sector in the Democratic Rebulic of Congo. The response from the industry was to develop corporate social responsibility programmes, which arguably prioritise public image above human rights protection. A mapping review by Deberdt and Le Billon (2022) revealed five major limitations of currently developed and/or implemented responsible cobalt sourcing strategies, which demonstrated their incompleteness. The limitations described in this work included:

(1) *centrality of Western aid agencies in sustainable development programmes, or lack of local ownership;*

(2) *conditions spurring scepticism from the Congolese actors;*

(3) *formalisation efforts;*

(4) *tokenism of the social audit programmes; and*

(5) clashes between long-term socio-economic development goals and short-term corporate performance indicators. (Deberdt & Le Billon, 2022)

In her recent work, Meredith DeBoom developed a theoretical framework to specifically address the distribution of geo-power and reveal the potential for misuse of the cause of climate action towards extractive violence, which she conceptualised as *climate necropolitics* (DeBoom, 2021).

In the feminist review of climate policies, concerns have been raised about the European Green Deal, a large-scale investment programme that was first presented in December 2019 and has since begun to be operationalised through the EU legislation. Apart from being now promoted as a COVID-19 pandemic recovery plan, the European Green Deal is essentially aimed at making Europe climate-neutral by 2050 through public investments in clean energy, public transportation and energy efficient buildings (European Commission, 2019, 2023). The transition is to be achieved through technical innovation and improved efficiency. Seemingly well-intended, the European Green Deal, alongside with its predecessors from other geographies like the US, Canada, and Australia, has been criticised by environmental economists (as it is still inherently a growth strategy and lacks disruptive thinking) and feminist scholars (as it carelessly only focuses on the public sector of economy and limits potential transformation to technological advances. Such emphasis leaves half of the population behind, while also missing the opportunity for truly transformative change. A critical theoretical paper on the issue (Bauhardt, 2019) outlines that care labour, which is either unpaid or underpaid and is performed predominantly by women, is completely ignored in the negotiations related to the European Green Deal; the intersectionalist outlook on gender-blindness of the Green New Deal is especially negative as drawing a clear line between paid and unpaid care work has further implications on the existing injustices - women in rich countries with higher gender parity in the paid workforce are likely to hire migrant women as help for the care work - thus enabling participation in the economy but also increasing time and mental health pressures on the women who are also likely to still hold care work responsibilities in their own households.

A further illustration of gender blindness can be found in the commonly discussed carbon tax, or carbon pricing, where the policies specifically address and in varying degrees mitigate the adverse effects on low-income households but ignore gender-based income disparities. Indeed,

a theoretical study applying a revised gender analysis of environmental taxes framework, suggests that women might be disproportionately burdened by the economic effects of a carbon tax (Chalifour, 2010). Of course, one might argue that setting off to find gender bias, a researcher is likely to design the policy assessment tool in a way that would favour gender-specific effects, and that would be a reasonable counterargument. However, it is a bigger pattern that policy design does not often favour women. A more recent modelling study (Hänsel et al., 2022) strengthens the argument that reducing distributive injustice of carbon taxation is feasible if energy-intensive households receive higher financial support compared to energy-efficient households, however, it does not apply a gender perspective to the policy analysis.

A recent study (Lau et al., 2021) summarises the unfortunately common gender assumptions hindering climate policy that would be meaningful and just to both genders. They do so by analysing previously published research that either repeats gender assumptions or critically addresses them. The gender assumptions described by this study include the following: (1) women are inherently more caring and closer to nature; (2) women are all rather similar and equally vulnerable; (3) gender equality is strictly a women's issue; and (4) women empowerment is purely a question of increasing numbers. These assumptions are intertwined and fundamental to the lack of gender-sensitive climate policy design.

The examples described above show the complexity of sustainable development and just climate action. Clearly, focusing on climate mitigation and adaptation as the ultimate panacea and allowing for the top-down decision-making from the industrialised countries to the poorer ones does not go in line with the principle of leaving no one behind. However, a significant share of the studies suggest that a human-centred approach is still feasible, and they also outline the issue-specific prerequisites for its implementation. These will be covered in more detail in section 2.5. Overall, as the scientific evidence on the uneven burden of climate change piles up, it becomes more obvious that adaptation efforts should be minority-sensitive. It is a common thread in the literature to call for research that would be sensitive to structural discrimination, and policies that would be centred around the experience and knowledge of the most affected and vulnerable (Deivanayagam et al., 2023).

2.2 Literature review: science and policy interface

In the face of multiple crises, one might wonder why we would turn to science rather than policy and activism. Scientific knowledge production, however, is central to both recognising and addressing the climate emergency. Therefore, this subsection covers the literature on the role of science in addressing climate change, different interaction frameworks for science and policy, limitations and the potential of scientific discourse.

By breaking down the climate change negotiations into three stages of development and describing the learning processes involved in each of them, Joyeeta Gupta argues that climate science informed the early climate policy making in a rather linear manner and thus resulted in a quick adoption of the UNFCCC in 1992; stage 2 of climate change negotiations saw more mistrust towards the scientific output; and in the third stage (where we are right now), the problem is regarded as lacking any structure and as being associated with very high uncertainty, creating favourable conditions for climate scepticism and lobbying of climate denial in public and policy (Gupta, 2016). A quantitative study of a sample of the U.S. population has revealed high predictive power of conservative and free market beliefs on rejection of climate science in particular, much more so than the effect on acceptance of genetically modified foods and vaccinations (however, that was a pre-COVID-19 finding) (Lewandowsky et al., 2013). Another study which relied on similar methods, found evidence that white conservative males are more prone to climate denialism than the rest of the U.S. population, highlighting the effect of system-justification by a privileged social group (McCright & Dunlap, 2011).

Climate change thus represents a unique political challenge, where action must be internationally coordinated and knowledge-based, but the public perception is highly polarised. Despite climate scepticism in the populations and governments of powerful actors (notably, the United States and Australia), the post-Paris climate policy arena creates a revised set of relevant research questions for climate science, that are aimed at policy design and assessment. The IPCC thus plays a crucial role of synthesising and representing the constantly updating knowledge base. It is described as a 'boundary organisation' between science and policy, at cognitive, socio-political and spatial levels. In the light of the insufficiency of Paris pledges,

climate scholarship post-Paris is being pressured to focus rather on solutions (Beck & Mahony, 2018). Hence, we observe how both climate science has shaped climate policy and the other way around.

The COVID-19 pandemic has made evident that unprecedented state intervention and disruption of entrenched pathways of economic production are possible in tackling a rapidly unfolding crisis. It has also once again shown the interplay of multiple oppression mechanisms (Hulme et al., 2020). The authors further argue that lessons we take from the pandemic could be applied to climate action. They point out that technical knowledge, while essential, could limit the desirability of long-term effects from the short-term fixes, unless coupled with broader social context analysis. Hence, they argue for the importance of social scientific knowledge to decision-making in view of the insights it generates into human behaviours and existing social structures.

Another important argument is for promoting *transdisciplinary* research with an emphasis on participatory research, as an augmentation of *interdisciplinarity*. Studies indicate positive prospects for subdisciplines in environmental science, as *transdisciplinarity* allows for integration of different perspectives, challenging entrenched research pathways, and higher levels of societal acceptance due to the representation of the actors immediately affected by the issue at hand. It emphasises broad participation in problem framing, with further communication during problem analysis and impact evaluation. Thus, this aims at not only the cognitive dimension, but also the emotional and social-interactional aspects (Krueger et al., 2016; Pohl et al., 2021). As climate science is particularly susceptible to extremely high levels of uncertainty and denial from the public, all of its aforementioned facets are immensely important. Moreover, participatory research frameworks are especially significant in climate research, as people at the grassroots level are suffering the immediate consequences of failure to act on climate change mitigation. Empirical studies, however, warn about the issue of *tokenism*, or illusive participation, thus emphasising the importance of multi-level inclusion for the purpose of production of best available knowledge (Nuesiri, 2018).

Generally, scientists can assume different roles in policy making, from honest brokers of policy alternatives to issue advocates (Pielke, 2007), with different frameworks described for science and policy interface specific to environmentalism (Böcher, 2016; Rose et al., 2020). However,

in any of the interaction pathways, the impact of the scientist cannot be neglected, as science allows them to implicitly exercise their value commitments, thus either reproducing existing bias or contributing to tackling it.

2.3 Literature review: women in academia

Even though both the scientific and the political community seem to agree on the importance of women's empowerment (IPCC Task Group on Gender, 2020; Liverman et al., 2022; Robinson, 2019), the transition towards inclusion and representation is lagging, as discrimination on other levels becomes more evident in hindering the process. The structures and beliefs that ultimately result in gender discrimination in academia and decision-making processes have been fundamental to our societies for so long that it now takes substantial efforts and time to change the way things work. For instance, women around the world are still facing barriers in education (Dao & Dávila, 2015), and even the women who manage to succeed professionally still tend to hit a "glass ceiling" at a certain age because of societal expectations superimposed on them (Williams et al., 2012). Thus, this chapter covers the literature on gender inequality in science, describes the underlying patterns and summarises the proposed pathways for addressing this issue.

The subject of gender mainstreaming has seen a surge in academia, with findings showing that:

- *gender disparities are pervasive in the form of underrepresentation, pay gap, employment patterns, and lack of or inadequate mentoring for women* ('Closing the Gender Gap in Authorship', 2022; Gopinathan, 2007; Liverman et al., 2022; Llorens et al., 2021; Monroe & Chiu, 2010);

- *collaboration, publication and citation patterns are discriminatory towards women scientists across disciplines (Bendels et al., 2018; Ghiasi et al., 2015; Kwiek & Roszka, 2021; Lerman et al., 2022; Misra et al., 2021; Parker et al., 2010; Sebo & Clair, 2023);*

- *gender gap is more or less evident in different subfields* (González-Márquez et al., 2023; West et al., 2013);

- *both data and data interpretation are skewed by gender bias* (Nielsen et al., 2017);

- *cultural gender constructs are naturalised in both linguistic practices and cognitive practices involved in knowledge construction* (Liverman et al., 2022);

- *and even research of gender in science is hindered by predominant scientific practices, advertising male-dominated science as gender-neutral* (Cislak et al., 2018).

Feminist authors are warning that women in Western science still feel like outsiders, and the participation rates are lower than the estimated talent pool (Monroe & Chiu, 2010). The proposition has been put forward that if we want more female researchers, it is critical to showcase success stories and make it very clear that the floor is open for them. The fundamental reasoning behind the call for higher rates of participation by women in science is that data skewed by gender bias can have major implications in practically all areas of our lives, with potentially even more adverse effects emerging with future technological developments heavily reliant on extensive data inputs (Haraway, 1988; Kohlstedt & Longino, 1997; Perez, 2020). Brown Speights et al. also highlight the issue of underrepresentation of African American women in medical research, which aligns with Caroline Criado-Perez's claim about almost complete lack of data from women representing ethnic minorities across scientific disciplines (Brown Speights et al., 2017; Perez, 2020).

Gender mainstreaming was first constituted as imperative to the UNFCCC process as an outcome of COP20 in 2014, which has since been revised and enhanced by the adoption of the Gender Action Plan at COP23 in 2017. The latter described priority action areas, key activities and indicators, timetables for implementation, estimated expenditures, and, finally, mechanisms for reviewing and monitoring success. The elements of the plan were grouped into the following 5 clusters:

a. *capacity building, knowledge sharing and communication;*

b. *gender parity, participation and women in leadership roles;*

c. coherence within the UNFCCC and with other UN agencies;

d. gender-sensitive implementation and implementation tools;

e. monitoring and reporting. (IPCC Task Group on Gender, 2020)

In 2018, a full 17 years after the issue was first raised at a UN conference, the IPCC established the Task Group on Gender to ensure that gender balance is maintained and existent gender related issues within the Panel are addressed. In their 2022 report, the IPCC Task Group on Gender emphasise that, despite recent improvements in corresponding regulations, and rising numbers of female authors in IPCC reports, women scientists are still facing significant barriers for participation (Liverman et al., 2022). They highlight the challenges female researchers face in the process of both discussion and writing - the floor is still male-dominated, and the issue is less recognised by male researchers as lower numbers report such concerns. As women are more likely to be silenced and discouraged from expressing their opinions throughout their lives, serious efforts must be made to create a safe environment, where respect predominates competitiveness, both in research work and negotiations. Another humbling and quite alarming finding from the report is that at least 8% of women have experienced sexual harassment while working for the IPCC. Liverman et al. demonstrate that we still have a long way to go to ensure proper inclusivity and representativeness in climate governance, and they finalise the report with calling for IPCC to focus on the following 6 aspects to make this possible. The six recommended priorities are summarised as:

1. *National and other contact points should consider and monitor gender balance in soliciting nominations; build diverse capacity; and share best practices.*

2. *Develop an IPCC gender policy and implementation plan and gender committee, with objectives, actions, monitoring and regular reporting.*

3. *Increase the share of women in the leadership of the IPCC; mainstream gender concerns into the selection of authors, review editors and reviewers.*

4. *Provide training on inclusive practices, gender balance and consensus decision-making, especially for those leading chapters and reports.*

5. *Undertake regular surveys and feedback.*

6. *Ensure that IPCC meetings consider travel safety, family issues and pregnancy, with support and options for remote participation.*

The inclusion of gender mainstreaming into the agenda of key international organisations in climate governance is undoubtedly an important steppingstone, however, there is clearly a lot to be done still. Some researchers are expressing concerns that gender mainstreaming action could turn into a technocratic exercise too focused on the formalities (Pearse, 2017), or that focusing on implicit bias could hinder more meaningful action towards women empowerment, which requires critique of the social, institutional and political patriarchal systems (Pritlove et al., 2019). Worryingly, the trends summarised in the report of the IPCC Task Group on Gender, might be an indication that the existing regulations could result in *token participation*, where women are included on paper, but are in fact discouraged from speaking up during negotiations (Liverman et al., 2022). Another survey-based study (Gay-Antaki & Liverman, 2018) explored the barriers participating authors face in the IPCC process and discovered that gender was regarded a major or moderate barrier for participation of others by at least 35% of the authors, with own participation being obstructed by gender only reported by around 12% of respondents reporting their own gender as an obstacle. However, another finding of the paper was that childcare or other family responsibilities and lack of time were hindering participation as a major obstacle for 32% of respondents and a minor one for 61%. It is important to note that IPCC work is uncompensated. Hence, participation of women is also conditional on the pay gap and distribution of care labour.

If we now consider a broader academic context, multiple quantitative studies analysing significantly large corpora of scientific output have explored the rates of women participation across subfields and geographies and revealed persistent patterns, which compromise recent advancements in gender equity in science. West et al. (2013) analysed over 8 million articles from JSTOR across natural and social sciences, and humanities, and found that women accounted for 27.2% of all authorships, where gender could be identified and in the timeframe from 1990 to 2011, but there were substantial differences across publication subfields and authorship positions. For instance, only 17% of single-authored papers had a female author. In a relatively gender equal field of sociology, the subfields of gender, ageing parents, sex roles, sexual activity and early childhood had higher shares of female authorships than the average 41,4% for the field. Another major bibliometric analysis (Larivière et al., 2013), which included

almost 5.5 million studies across different disciplines, revealed that globally women represent just under 30% partial authorships, whereas the first author is 1.93 times as likely to be a man. They also showed that these disparities are not even across geographies, with South American and Eastern European countries displaying lower gender inequality. However, this result could also inadvertently capture the gender bias of promotion patterns in academia, whereby men are more likely to get a more prestigious position, and rather move abroad to pursue their career. One more important takeaway from this study is that articles where women occupy leading author positions get less citations than those where men do. A further support to this argument is a finding by Lerman et al. (2020) that women get around 40% less citations throughout their academic work than men do. Based on a network analysis, the authors showed that women tend to reciprocate the citations, creating rather tight research communities. Yet, in a highly male dominated field of engineering, where women represent only 20% of authorships, the predominant pattern across both genders is for repeating cooperation with male researchers. However, around 50% of men engineers were found to collaborate exclusively with male colleagues, compared to 38% of women, which is still quite a surprising result that reveals a tendency of women engineers to reproduce the bias (Ghiasi et al., 2015). A quantitative study of internationally publishing Polish scholars and their publication records indexed on Scopus revealed that the average ratio of same-sex collaboration for men was 0,500 compared to 0,153 for women, showing a persistent tendency for all-male collaboration and not at all for all-female collaboration (Kwiek & Roszka, 2021). These results contradict previous findings that women are more likely to collaborate with women across disciplines (Boschini & Sjögren, 2007; Holman & Morandin, 2019; Jadidi et al., 2018); which is attributed by Kwiek & Roszka to the specific characteristics of the comparatively gender-balanced scientific community in an Eastern European country, as well as the uniquely interdisciplinary dataset, and by Ghiasi et al. to the existing inequalities in the engineering scientific system resulting in the compliance of female authors. Another curious finding was offered by a large-scale study of citation patterns across different scientific disciplines showing that, on average, men are citing their own work 56% more often than women do (Chawla & Schiermeier, 2016). And a shocking result from a study based on a survey of 0,1% most cited authors within ecology and environmental science revealed that only 5,5% of the total 124 surveyed researchers were women (Parker et al., 2010). The discriminatory patterns are further made evident in recent quantitative studies across scientific disciplines that show an underrepresentation of women authors in high impact journals and high citation publications (Bendels et al., 2018; Misra et

al., 2021; Sebo & Clair, 2023). Furthermore, as a bibliographic study by Cislak et al. (2018) revealed, the research on gender bias is underfunded and published in journals with a lower Impact Factor compared to equally significant research on other social discrimination instances.

An extensive study of medical scholarship (Parker et al., 2010) revealed a systematic ignorance of male scientists towards gender and sex analysis in their work. Especially crucial in medical studies, gender- and sex-sensitive approaches were shown to have a 3.14 odds ratio based on women representation in the full research groups, with the coefficients for first and last author female being 1.66 and 1.56 accordingly. Another, more recent, bibliometric study of biomedical literature (González-Márquez et al., 2023), has found further evidence of gendered thematic preferences in that specific academic field, with female authors underrepresented in such subfields as financial management and surgery and more broadly represented in healthcare, patient care, and veterinary medicine.

Apart from the normative reasons, ensuring women representation in science is also crucial from the instrumental perspective. This being said, I want to acknowledge that gender bias is not the only discriminatory pattern in science. For instance, *Nature* recently published a critical editorial, describing the legacy of colonialism in the scientific community, and acknowledging the pervasive patterns of sexism and racism, while committing to provision of inclusion and ethics criteria, and implementation of higher standards on gender and sex analysis ('Raising the Bar on Sex and Gender Reporting in Research', 2022). In the context of environmental science in particular, it has been shown that discriminatory patterns still persist, with black, indigenous and people of colour (BIPOC) feeling underrepresented and prejudiced against. The surveyed reported limited racial diversity, limited discussions of race, lack of relatability, white environmentalism, disrespect and tokenism among the negative experiences they had while pursuing environmental majors (Schusler et al., 2021). Diversity in research groups facilitates higher cognitive diversity and allows for incorporation of knowledge that could be intangible to non-minorities, resulting in more innovative and inclusive solutions. And in my mind, women empowerment goes hand in hand with the empowerment of other marginalised groups, although it has not always been the case, but this will be covered in more detail in the following subsection.

Today, one cannot argue that Western science is actively discriminatory against women, however, the patriarchal structures and traditions entrenched in most cultures worldwide still cause most women to be silenced and discouraged from self-promotion throughout their lives. Even when given the chance to speak or act, women are often forced to do so in an unwholesomely competitive environment. Thus, in the years to come we must ensure that the conditions that exist for female researchers in climate science to express themselves are nourishing instead of hostile, and these foundation principles are now embedded in the UNFCCC Gender Action Plan.

2.4 Literature review: feminism and intersectionality

Feminist activism has not always been inclusive and has contributed to discrimination of racial minorities as well as poor people in the past (Davis, 1981; hooks, 1984). However, recent mounting scholarship on feminism suggests that intersectionality should really be a starting point for any activism that aims to challenge the existing power structures (Ahmed, 2017; Biana, 2020).

In her work (1984), bell hooks recorded evidence of white bourgeois domination in the early feminist movement and highlighted the need for women to assume a pluralistic lens and oppose discriminatory structures that are not necessarily affecting them directly, preparing the stage for the term of *intersectionality*, introduced later by Kimberlé Crenshaw (Crenshaw, 1989).

Today, the concept of intersectionality has really become central to feminist scholarship. However even to this day, some self-pronounced feminists still fail to recognise and support other socially marginalised groups, most prominently, the bias is against transgender people. Even though evidence exists that lack of negative prejudice towards LGBTQ+ is positively correlated with a feminist self-identification across different geographies (Worthen et al., 2017), with a similar result replicated when transphobia was taken as a dependent variable of interest (Conlin et al., 2021); the feminist activism and scholarship are still criticised for reusing

transphobic argumentation (Upadhyay, 2021). There is also recent evidence of the elusiveness of inclusive feminism, with the black feminist activists in the US still reporting white domination of the community, and lack of a race-responsive agenda (Brewer & Dundes, 2018).

Hazel T. Biana (2020) offers a critical review of bell hooks' work representing the first wave of intersectional feminism and proposes different strategies to avoid locking postfeminist action in a narrow outlook. The general call is for the recognition of the multiplicity of oppression mechanisms and their variability across geographies and nationalities. Feminist solidarity, she argues, can only become attainable when women from developing countries, as well as differently-able women and other minority groups are recognised, and their needs represented. Another quality that is outlined as central to the kind of 'critical awakening' is explicit self-reflection and critique. Nancy Fraser, in her work, also supports the argument towards the integration of socialist-feminism with more recent frameworks of postcolonialism and environmentalism. She builds a strong critique of capitalism through highlighting its inadequacy in the recognition of care labour, which not only perpetuates gender inequality in paid labour but also injustices towards racial/ethnic minorities and people from lower classes.

The literature covered so far in this chapter has been mostly theoretical and conceptual, but if we turn to empirical evidence, the results are no less thought-provoking. Multiple qualitative studies show that women in academia feel very isolated and put additional pressure on their mental health by trying to outperform their male colleagues to gain any credibility at all. This also results in increased competitiveness towards other female researchers, thus undermining the concept of inclusive empowerment. Women are silenced when expressing their identity as a minority and when speaking up for other socially marginalised groups, too (Ahmed, 2021; Aiston & Fo, 2021; Bagilhole, 1993).

Drawing again on the results from the West et al. (2013), which described the patterns of women representation across scientific fields and subfields. For instance, we observe less than average female authorships in the subfield of racial segregation (21,6% compared to 41,4% for sociology in general). Exploring the output of this study further, one might see that there is some pattern of preference of female researchers towards topics on social justice (poverty and income inequality has 15% women, whereas migration and unemployment is at 17,8% compared to the average 13,7% for economics). However, women representation in each

subfield could be capturing the hostility or welcomeness of the research community in this field, with another possible limitation to interpreting the results being that women might feel higher risk of being discredited or not taken seriously if they were to pursue research topics which could be potentially regarded 'less scientific', meaning that in a perfect world of no gender bias women could display different patterns of research field selection.

Examples from climate activism further support the argument that women empowerment can in fact have overarching positive implications for poor people and racial and ethnic minorities (Robinson, 2019). Thus, climate justice as a central normative framework is discussed in more detail in the following subsection.

2.5 Literature review: towards climate justice

With theorists arguing that saving the planet is only feasible if the global institutes of discrimination are called into question (Buller, 2022; Fraser, 2010; Robinson, 2011; Sultana, 2021), the body of literature provides quite a lot of inspiration for addressing intersectionality in the context of climate science.

Climate justice, as a human-centred approach to the complex crisis, is aimed at the amplification of the voices of those benefiting least from the economic growth made feasible by the fossil economy and suffering most from climate change impacts today. Gender equity is a key factor in climate justice, but the framework is overarching and must be inclusive of people who identify or are identified as BIPOC, low income, differently abled and/or LGBTQ+. And the growing knowledge base, not only theoretical but also aimed at informing policy, suggests that climate justice is 'our best hope', mainly as it allows us to address the persisting fragmentality of knowledge and policy, and move on 'from vulnerability to resilience' (Robinson, 2011; Sultana, 2021).

Literature further suggests that climate justice and intersectionality scholarship share multiple theoretical and methodological similarities. Both originate from radical theory, emphasise the interests and agency of marginalised populations, challenge predominant structures and focus on political action as means for change. Thus, intersectionality could have positive implications for research on climate justice. A recent study by Mikulewicz et al. suggests climate justice scholarship be analysed for the existing links with intersectionality and remaining potential for the inclusion of the critical lens of intersectionality (Mikulewicz et al., 2023). Furthermore, Amorim-Maia et al., develop a framework specifically for climate adaptation scholarship, advocating it incorporates the following principles:

(1) to tackle underlying reinforcers of racial and gender inequalities;

(2) to redress drivers of differential vulnerabilities;

(3) to take politics and ethics of care seriously;

(4) to adopt place-based and place-making approaches; and

(5) *to promote cross-identity forms of activism and community resilience building.*

(Amorim-Maia et al., 2022)

As Donna Haraway frames it, environmental justice requires *staying with the trouble*, or thinking with the multiplicity of actors and the complexity of systems, where knowledge making is central to survival and opposed to ignorance and one-dimensional theorising (Haraway, 2018). Hence, the way forward must be paved around intersectionality and a nourishing environment needs to be established for representatives of socially marginalised groups, especially in climate science, on par with climate governance. Specifically, this study focuses on women representation in climate change adaptation policy science, and whether that is associated with the inclusion of social justice topics into research agenda. However, as the empowerment of women in science itself poses a challenge due to the added pressures of being engaged in care labour and/or struggling to be taken seriously in academia, the analysis proves to be complex and associated with several limitations for interpretation, which are discussed in detail in the section 4.5 of this paper.

3. Research Questions and Hypotheses

While the levels of women's representation in science have been shown to vary based on the geography and the scientific field, the participation, collaboration and citation patterns clearly disadvantage women in academia. However, the different ways in which scientific discourse can be gendered, and what broader implications this could have, has not been explicitly addressed. Furthermore, a systematic analysis on the subject of women's representation specific to the field of climate science is missing, with existing research focusing on qualitative methods and different outcome variables. Thus, the key objective of this study is to analyse the gender-differentiated patterns in the topical output of scientific research in the climate change adaptation policy in a systematic way and to describe the differences in research agenda according to the authors gender composition, if any become evident.

Based on the review of the existing literature, the following research questions have been formulated:

RQ1: Do women in the position of the first author tend to include a topic related to climate justice in their research more often than men in the same position?

RQ2: Are women in the position of the last author more likely to include a topic related to climate justice in their research compared to men in the same position?

RQ3: Are research groups where the majority of authors are women more likely to include a topic related to climate justice in their research compared to the research groups composed mostly of men?

This study follows previous work on gender composition in research teams and thus differentiates between first author, last author, and majority authors as the variables of interest (González-Márquez et al., 2023; Larivière et al., 2013; Nielsen et al., 2017; West et al., 2013).

This analysis thus addresses a previously described research gap on the ways in which climate justice research could benefit from the progress in allied movements, or more specifically, whether women empowerment in climate science has any potential to strengthen intersectionality-informed climate justice scholarship (Mikulewicz et al., 2023). The methods applied in this study also allow the exploration of whose interests and needs have been favoured or neglected through analysing the output of the topic modelling exercise.

The null hypothesis is formulated as typical to a statistical analysis (Bluman, 2009):

H0: There is no statistically significant difference in topic prevalence regarding climate justice topics between female and male researchers.

Representing a minority in terms of social and economic power, women are believed to be more responsive to the needs of other underprivileged communities, and more likely to recognise areas of knowledge invisible to non-marginalised groups. The countertendency is a phenomenon referred to as *implicit bias*, which has been shown to be widespread in publications across scientific disciplines (Perez, 2020). Here, I talk about implicit bias as a lack of consciousness about other's troubles, lack of recognition or, simply, complacency. As Sara Ahmed summarised in her work based on interviews with women academics, speaking up about what makes you uncomfortable as a woman, and particularly as a woman of colour, may exacerbate the isolation of the scholar further. Unaffected groups simply prefer not to notice the issue (Ahmed, 2021).

Based on the theoretical literature on the complacency of non-marginalised groups, as well as the evidence from empirical studies that address gender disparities across subfields of scholarship and intersectionality in climate governance, the following hypotheses have been formulated:

H1: Female researchers in the position of the first author include social justice topics in their research on climate change adaptation policy more often than male researchers in the same position.

H2: Female supervisors favour climate justice topics more than male supervisors.

H3: Research groups composed predominantly of female researchers include topics on social justice more often than those dominated by male researchers.

This research contributes to the existing literature by analysing topic prevalence in climate adaptation scholarship in relation to author gender on a large set of publications. Investigating the research questions presented in this chapter is carried out through a mixed methodology approach, which is described in detail in the following section.

4. Methodology

Climate science has seen an abundant growth of publications especially post-Paris, making meaningful interpretation more and more challenging. This has spurred research that applied computer-assisted methodologies to evidence synthesis. I build on this work and follow a somewhat similar research design but tailor it to incorporate author gender prediction and target social justice topic prevalence. This chapter covers each step in the analysis. The code is made available at an online public repository (https://github.com/di-danilenko/gender_climate_justice). Most of the data manipulation is performed in `Jupyter Notebook` (version 6.3.0) in `Python 3`, through the application of standard functions from `pandas` and `numpy`, unless it is explicitly stated otherwise. Visualisations are created in `RStudio` (version 4.2.2) with the help of the `ggplot2` package.

4.1 Methodology: description of data and key variables

The unique dynamic of climate literature as explained by both the unravelling nature of the climate crisis, and non-linear advancements in climate governance illustrates the special need for easily replicable study designs in the evidence review field. And this gap has been addressed by recent work on systematic evidence synthesis. Generally, large text corpora analyses can be categorised into *systematic reviews* and *systematic maps*, with the key distinction between the two being that the former aims to aggregate existing evidence into a single output, whereas the latter pursues a more descriptive approach (Haddaway et al., 2018). Systematic maps allow us to gather most of the available scientific output and describe, for instance, how climate impacts vary based on geography (M. Callaghan et al., 2021), or what is the state of research on climate change adaptation policy (Sietsma et al., 2021). As the objective of this study is to describe structural preferences for social justice topics in climate scholarship, a systematic mapping

methodology is applied, and the guidelines for high quality evidence synthesis are followed (Haddaway et al., 2018, 2020).

First, I describe here the dataset compilation procedure. In this study, I apply a query previously designed by Sietsma et al. for a related project on climate change adaptation policy (Sietsma et al., 2022) to search for the literature. The query is recorded in the Supplementary Table 1. Reusing an existing query allows for work savings associated with query design, testing and fine-tuning. I believe the scope of this query as it covers climate change adaptation policy research perfectly suits the research questions formulated at the beginning of this work. Climate governance specific to adaptation is particularly vulnerable to reinforcing implicit bias and thus reproducing existing injustices. It is also the area of climate science most closely related to human beings. It thus creates a unique topical space, where one could either include a social justice dimension in the research agenda, or rather ignore it. It is also a sentiment expressed in existing research that adaptation policies must be assessed for justice considerations (Juhola et al., 2022). That being said, mitigation policies as discussed in chapter 2.1 can also cause detrimental effects to the livelihoods of socially marginalised groups. Hence, there is a possibility of extending this work and analysing the latter for similar patterns.

The query is implemented on both Scopus and Web of Science to ensure broader coverage, and the data on the 70 319 resulting documents is drawn through the platform especially designed for systematic literature review work, which is called NACSOS: NLP Assisted Classification, Synthesis and Online Screening (M. Callaghan et al., 2020). Apart from the built-in deduplication algorithm for articles pulled from different databases, the platform allows for extraction of numerous variables per document and author.

At the step of pre-processing, I restrict the dataset to only include the variables relevant to this study. These are summarised in the Supplementary Table 2. The metadata variable 'id' solely serves the purpose of document identification, and the values are simply imported from the NACSOS platform without further processing. Likewise, author names, titles, keywords, and abstracts are drawn from NACSOS, however, these require some processing before gender prediction and topic modelling can be carried out. The cleaning of these variables is described in detail in the corresponding subsections. Control variables in this study include publication year, gender inequality index (GII) of the country of the first or the last author institution, and

journal ranking. The latter two are both derived through *fuzzy matching* from the institution name and journal records using python packages `pycountry` and `impact-factor` respectively. Fuzzy matching in this case simply means that the names of countries and journals might be recorded slightly differently in the datasets that are being matched, but we will still be able to find a match. For instance, the United Kingdom as recorded in the GII dataset could be recorded as 'UK' in the institutional affiliation, and fuzzy matching would allow for identifying it as the United Kingdom anyway. A python function is applied to split the documents into quartiles based on the GII. These specific controls are implemented in the analysis so that a predictive effect of author gender on topic prevalence could be estimated and differentiated from the interfering factors. Controlling for publication year eliminates the effect of time-responsive change in research topic and gender compilation of the scientific field. Gender inequality index as a composite of health, empowerment and labour market indicators (Gaye et al., 2010), allows to approximate to a degree the ease of participation in academia for women, as well as the level of acceptance or encouragement towards equality topics. Both advantages and shortcomings of GII have been described (Berik, 2022). A recent study by Andrijevic et al. has also relied on GII as a gender inequality assessment in the context of climate change mitigation and adaptation, with findings suggesting high compatibility of better gender equality and climate resilient development (Andrijevic et al., 2020). Journal impact factor is also assumed to have a link to both author gender and topic preference as it has been shown higher impact journals favour male researchers and discourage gender bias research (Bendels et al., 2018; Cislak et al., 2018; Misra et al., 2021; Sebo & Clair, 2023). The expected links between variables included in the study are plotted with a web version of DAGitty software, commonly used for drawing and analysing causal graphs, or directed acyclic graphs (DAG) (Textor et al., 2017), and are depicted in Figure 1.

As seen in the Supplementary Table 3, the full dataset of articles that the query implementation resulted in was copied and further treated as three separate datasets to minimise data point loss. Supplementary Table 3 also shows how many documents were excluded from the analysis at each stage of data cleaning. Further deduplication and exclusion of titles where full author names were missing has resulted in a dataset of 43 278 and 43 735 articles for first and last authors, and 41 175 for majority author. The numbers vary here due to either incomplete reporting within a given article, where one author has specified their first name and another have only provided their initials, or the imperfections in the procedure for initials exclusion as

discussed in more detail in the next section. I will thus refer from now on to the datasets capturing the first author information, last author information and all group author information as the first, second, and third dataset respectively. For the purpose of extracting descriptive statistics, however, I refer to the first dataset as the most comprehensive one.
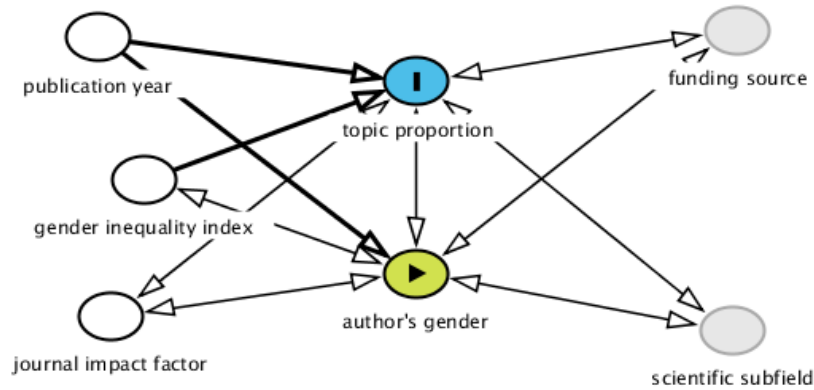

Figure 1. Causal diagram of the expected dependencies in the observed and unobserved variables. Author gender is the predictor variable, while topic proportion is the outcome variable. Gender inequality index, publication year and funding source represent covariates with effects on both author gender and topic proportion. And journal impact factor represents a covariate where dependencies on topic proportion and author gender are reciprocal. **Note:** the variable corresponding to the funding source is not included in this study due to the lack of publicly available and comprehensive data. Hence, it is captured in the graph as a covariate that is not adjusted for.
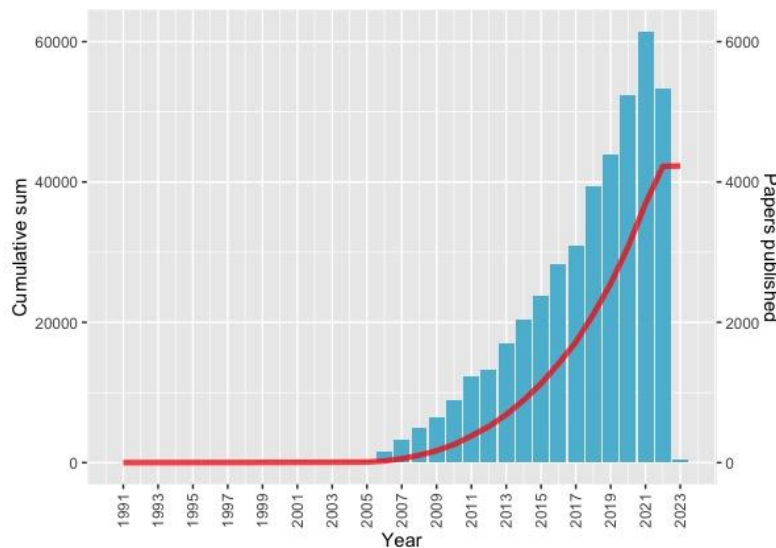

Figure 2. Temporal dynamics in publications corresponding to the climate change adaptation policy query. The left-side y-axis shows the cumulative sum of publications, whereas the right-side y-axis displays papers published each year.

Figure 2 shows the temporal dynamics in the number of yearly publications, as well as the cumulative publications matching the query results. There is a consistent upward trend, which indicates an ever-growing body of research in this area, with the only exception of the year 2022, where there were slightly fewer publications. This could be explained by the COVID-19 pandemic, and the fact that the query was implemented in January 2023, leaving a chance that some of the articles dated 2022 had not been included in the Web of Science and Scopus databases yet. Additionally, Figure 3 shows the geographic distribution of the articles matching the query on climate change adaptation policy based on the institutional affiliation of the first author. As the query is aimed at English-indexed literature, it is understandable why the English-speaking countries are most represented, apart from China. Furthermore, Table 1 captures the distribution of records analysed per gender inequality index quartile, whereby one can clearly see that the less equal countries are far less represented than the more equal ones. There is only slight variation in country-specific records based on the author position. Hence, a similar figure and a table displaying the data in reference to the institutional affiliation of the last author can be found at the public repository, the link to which is provided above. Finally, Table 2 summarises the journal impact factor distribution in the dataset by quartiles. Here, one can see that most documents were pulled from high quality journals, corresponding to quartile 1 and 2 of the journal impact factor.
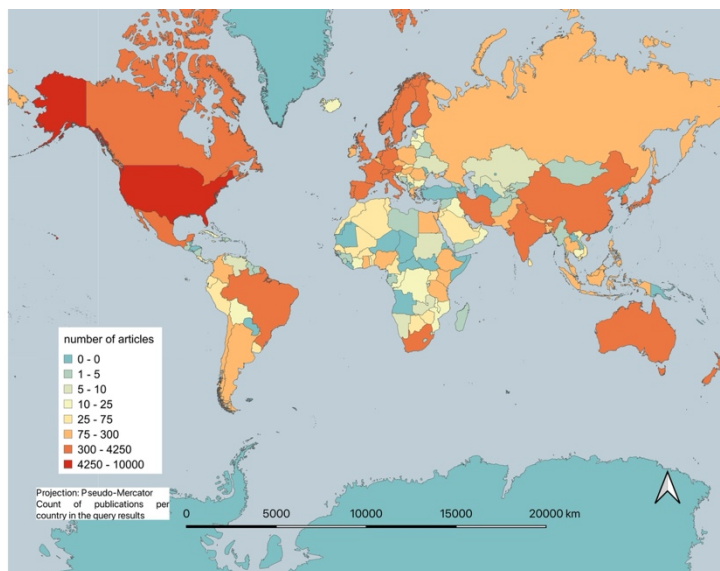

Figure 3. Geographical distribution of the articles matching the query designed to capture climate change adaptation policy research based on the institutional affiliation of the first author.

Gender Inequality Index Quartile (first author affiliation)	Count
Q1	20657
Q2	14156
Q3	3866
Q4	1840

Table 1. Representation of articles per quartile of the gender inequality index based on the country of the first author's institutional affiliation. Here, Q1 corresponds to the lowest GII values, and Q4 corresponds to the highest GII values. The quartiles were calculated internally for the range of values represented in the dataset.

Journal Impact Quartile	Count
Q1	20886
Q2	10674
Q3	3869
Q4	2033

Table 2. Representation of articles per quartile of the journal impact factor, where Q1 correpsonds to the highest impact factors, and Q4 corresponds to the lowest impact factors. The quartiles were calculated internally for the range of values represented in the dataset.

Previously, queries had been designed with more specific wording for practical reasons of limiting the scope of the included literature. However, implementation of machine-learning algorithms for relevance prediction now allows for high work savings and higher quality evidence synthesis that employs a broader query at the start (M. W. Callaghan & Müller-Hansen, 2020; Haddaway et al., 2020). But unlike some of the recent systematic literature maps, this study does not rely on a machine learning classifier for predicting relevant documents, and rather explores the entirety of the query results. This is done in order to observe a broader topical space with an acknowledged limitation to granularity.

It is worth mentioning, however, that in the process of conducting this analysis further steps of gender identification and topic modelling were first tested on a dataset of predicted relevant documents. This was made possible through the application of a deep-learning language model BERT (Bidirectional Encoder Representations from Transformers). The classifier was designed to predict relevance of the articles from the query results based on a sample of manually performed ratings. The supervised machine learning process implemented here is described in more detail by Callaghan & Müller-Hansen (2020) in their work on statistical stopping criteria for machine-prioritised screening in evidence reviews. In this case, the model was trained on a subset of previously rated documents for a related project on climate change

adaptation policy scholarship. These studies were drawn from the results of the same query but had been limited to the time of when the query was initially run, which was November 2021. Using the subset of 1 772 previously rated documents allowed for significant savings of time, as those had been manually reviewed at abstract level. Furthermore, applying this approach should not have negatively affected the classifier performance compared to the case where the manually screened subset would have been drawn from the last query run. The time gap between the two query implementations was only one year. Hence, one cannot expect significant changes in the vocabulary of the scientific discourse within quite a specific field of climate change adaptation policy, that had presumably seen major developments in the years just after the Paris agreement but must have been conceptualised before the beginning of the aforementioned project. Implementing the classifier resulted in a subset of 2 863 documents that had relevance prediction above the threshold of 0.5. As mentioned above, this subset of data was used for initial testing of the methods implemented in this study. Although acclaimed as a state-of-the-art natural language processing (NLP) model (Devlin et al., 2019; Subakti et al., 2022), BERT has a limitation common to ML algorithms - limited intelligence of a machine. As no part of this study involves human coding of the literature, the favour is towards using a broader dataset of the full query results, which comprise approximately 41-43 thousand articles after deduplication and first processing.

Still, natural language processing and unsupervised machine learning are integral to this analysis and allow it to perform at the scale of roughly 43 thousand documents. In-depth description of the tools I use follows in sections 4.2 and 4.3.

4.2 Methodology: gender prediction

Machine-assisted gender prediction has been widely used to study datasets that do not feature explicit gender data and due to their size would not be feasible for human processing (González-Márquez et al., 2023; Larivière et al., 2013; Nielsen et al., 2017; West et al., 2013). Of course, one must keep in mind the limited accuracy of such tools, which is why it is

generally recommended to only refer to them when studying populations at large rather than individuals (Wais, 2016). The other limiting factor here is of course the reductionist assumption of binary gender identity, which I discuss along the other limitations of this analysis in a bit more length in the section 4.5 of this study.

In their recent article, Sebo compared the performance of different available gender prediction tools, including both partial (`Gender API, NamSor` and `genderize.io`) and completely free (`Wiki-Gendersort`) ones. The gender assigned through these tools was measured against four real-life physician datasets with pre-recorded gender values. Intuitively, paid tools have shown higher performance, although not unanimously. Based on both misclassifications and missing values, `Gender API` got an error score of 1.8%, `NamSor` 2.0%, `Wiki-Gendersort` 6.6%, and `genderize.io` 17.7% (Sebo, 2021). However, it has to be said that the partially free tools only offer very limited capacity without requiring payment. A rather similar work from Santamaria & Mihaljevic, had reported weighted errors of 5.6%, 6.13%, 7%, 6.72% and 7.31% for `Gender API`, `NamSor`, `genderize.io`, `NameAPI` and `gender-guesser` respectively. Higher errors reported in this study are most likely related to the characteristics of the dataset the tools were tested on. While Sebo relied on the dataset largely composed of Western first names, whereas Santamaria & Mihaljevic constructed a dataset where approximately 34% first names originated from Asia and 5% from Africa. The highest weighted errors were reported for Asian names. Meanwhile first names associated originating from Africa were more often mis- or un-classified compared to those of European origin, but far less than the Asian (Mihaljević et al., 2019).

As for specific use cases of machine-assisted gender prediction tools, in their study of the JSTOR corpus, West *et al*. match the authors' first names to the US Social Security Administration (SSA) records and assume an unambiguous gender identification if a name matches the same gender record at least 95% of the times. This approach admittedly underestimates women authorships in the sample as unisex names are reported to be given to girls more often rather than boys (Lieberson et al., 2000), but allows the authors to assign a gender to 73.3 % of 2.8 million authorship instances. Another limitation of relying exclusively on the records from the US Social Security Administration is associated with the possibility of misclassifying names that are more commonly associated with a different gender in the country of author's origin compared to the United States. This shortcoming is tackled by Larivière *et*

al. in their study of gender disparities in scientific output worldwide. Like West *et al.*, they first use the data from the US Census for gender prediction, but then they also apply the Wikipedia database for names unclassified after the first step. Across the dataset, they further apply country-specific name lists deriving the country from the author's institutional affiliation, which allows them to classify 86.1% of the dataset after exclusion of authorship instances where only initials were provided. However, I believe the assumption of country of origin from one's institutional affiliation to be rather far-fetched, which could have interfered with the accuracy of prediction. Nielsen *et al.*, in their more recent work, rely on `Gender API` for gender estimation in the sample, which allows for gender inference of 61.4% of the authorship instances. Two of the latter studies perform manual checks of randomly selected 1,000 and 500 authors respectively and report on the precision metrics of the tools they utilise for gender prediction, which is something I provide here as well. In a very up-to-date study of the biomedical literature corpus, Gonzàlez-Màrquez *et al.* inferred author gender from the first name using an R package `gender`, which allowed to assign a gender estimate to 40.7% of the records. However, neither of the latter two studies report the percentage of the dataset post cleaning for records with initials instead of first names that has gender estimates.

I build on the existing work and offer a slightly updated gender prediction method, which for the purpose of replicability, scalability and availability, relies solely on fully open access tools. That being said, I acknowledge the limitations to reporting associated with no available uncertainty measurements and bounded performance of open-source tools. Hence, in the future, the methods described here can easily be replicated with application of a different gender prediction tool, which would not cause any disruption to further analysis.

Following the example of Nielsen *et al.*, I include first author gender, last author gender and full author team gender compilation as variables of interest. The names are cleaned in the same manner as in the Larivière *et al.* study, the process including the following steps:

- *identifying initials (by length strictly below 2 characters or, for the records containing '.', by length strictly below 3 times the count of '.' in the name record);*

- *replacing all hyphens with spaces;*

- *keeping only the first part of the compound names, where a gender estimate could not be assigned otherwise.*

In this analysis I apply a mix of fully free tools and databases available online for author gender prediction. These include, firstly, an R package **gender**, which allows one to look up the gender estimates from multiple underlying historical databases (Mullen et al., 2021). This package has shown performance at 95.35% recognition across authorships with full first names and a 3.79% coded error rate without missing value (Wais, 2016). I refer specifically to SSA (**method='ssa'**) as other databases do not yield significant results. I further pull gender estimates from the **Wiki-Gendersort** Python package, which relies on publicly available data from Wikipedia pages and recognises over 130 000 full first names, or a 91.7% recognition of such records from Web of Science (Bérubé et al., 2020). An available error metric for this package is 6.6% as mentioned above. The third implemented tool is also a Python package, called **gender-guesser**, which contains data on over 40 000 names, and as described above performs relatively at the same level as other available tools (Elmas, 2016). An additional point of reference for me in the gender estimation was the database of IPCC AR6 authors across the three working groups. This is justified as the dataset of articles is thematically similar to the IPCC work, meaning that some authors represented in the dataset could quite possibly be featured in the IPCC reports. Summarising the IPCC records has resulted in 800 records featuring 207 unique names; hence, an average gender prediction was derived for each unique name in the dataset.

The gender value pulled from each of these databases was given the same weight, and an average gender prediction was thus calculated, with the value of '1.0' designating 'female' and the value of '0.0' designating 'male'. As all of the featured tools had a special output category 'andy' or 'uni' for the names that were commonly associated with both genders, these values were taken as '0.5'. Hence, if there was no sufficient and homogeneous evidence from other databases, they would be excluded at the next stage. The binary prediction was derived from the average as 1 if the prediction value was above 0.7 and 0 if the prediction value was below 0.3. This was done to eliminate ambiguity in gender prediction across the applied datasets.

In this manner, 37 482 authorship instances in the position of the first author and 38 090 authorship instances in the position of the last author are identified, comprising respectively

86.93% and 88.36% of the dataset after exclusion of data points featuring initials only. Of course, the computerised cleaning for initials is imperfect as one must keep names with the length of 2 or 3 symbols, but will thus get some instances of initials blended in. For the dataset of full author groups, the percentage is understandably lower as one must exclude every article where at least one author did not get an unambiguous gender estimate. Here, the final sample size is 25 876 articles, or 62.87% of the dataset after excluding initials. The levels of data point exclusion and corresponding publication numbers are documented in the Supplementary Table 3.

These values for female authorships are admittedly higher than in any of the previously described datasets, and even higher than the percentage of female authors in the IPCC AR6. But rather than a solely positive trend in time, this could be explained by (a) characteristics of the specific scientific field, or (b) a slightly upward estimation of 'female' gender assignment due to the limitations of the applied method.

As a composite of multiple datasets, this method does not offer a clear uncertainty measure. However, I perform a manual test of a random sample of 500 authors to offer precision metrics instead, following the template of Larivière *et al.*, whereby one locates in the best-case scenario a website explicitly mentioning pronouns, or biographical information, or a photo of the author. This exercise is possible as each author is associated in the dataset with a full name and a specific institution. The random check is performed on the dataset containing first author information and is not repeated for the two remaining datasets as the tools applied do not vary across the datasets.

	Female (predicted)	Male (predicted)	Unknown (predicted)
Female (actual)	148	5	28
Male (actual)	12	261	31

Table 3. Confusion matrix showing all the possible classification outcomes and results of machine-assisted gender inference. A manual check was carried out on 500 randomly assigned authorship instances. In this table, fifteen authorship instances are excluded as manual check did not result in gender identification.

Error	Error without NA (misclassifications)	NA	Error Gender Bias
0,1567	0,0399	0,1216	0,0164

Table 4. Performance metrics for the gender prediction tool based on the manual check of 500 randomly assigned authorship instances. Note: A similar approach for performance assessment of gender identification tools was described by Sebo (2021), which is where the formulas can be found for each of the error types I calculated here.

The precision metrics are recorded in the Tables 3 and 4. Here, I follow an evaluation process described by Sebo (2021), which allows to capture (1) error rate that penalises both false classifications and missing values (NAs), (2) error rate specific to misclassifications, (3) error rate specific to NAs, and (4) error rate that estimates gender bias. The latter captures the relative occurrence of false predictions of 'female' compared to false predictions of 'male'. In other words, the value of 0,0164 indicates a slight overestimation of 'female' in the population.

For further reference, Supplementary Table 4 contains country composition of authorship instances that were misclassified or could not be assigned an unambiguous gender estimation with the use of the described tool.

4.3 Methodology: structural topic modelling

Structural topic modelling (STM), a kind of unsupervised machine-based text corpora modelling, was selected as the main methodology for this analysis due to its scalability and relevant advantages in comparison to previously developed topic models. Namely, structural topic modelling allows for integration of metadata into the process of topic model construction (Roberts et al., 2019). This is an essential criterion for this work as not only the predictor variables but also the crucial control variables represent some kind of metadata associated with each document in the corpus. Topic modelling variations, such as Latent Dirichlet Allocation (LDA), Correlated Topic Modelling (CTM) and STM have been widely applied to perform evidence mapping at a scale. Previous work on the datasets thematically similar to this (in varying degrees) have implemented STM to identify temporal and geographical trends in

climate change adaptation scholarship (Sietsma et al., 2021); CTM to analyse sentiment in mass media discourse on climate change (Rabitz et al., 2021); LDA to determine research gaps in research on human mobility and drought or heat (Zander et al., 2023).

By parsing the text of each document and identifying huddles of words that recurringly appear in the same articles and form topics, the topic modelling algorithm searches for a suitable model and outputs a matrix of topic proportions for each document and topic combination. STM is unique in that it also incorporates the metadata associated with each document and thus allows to estimate the effects on topic prevalence of each variable of interest as discussed in-depth in the following subsection. The text input in this case consists of the title, abstract, and keywords, which are cleaned and put together. The cleaning steps include transforming all text to lower case, removing special symbols, and removing copyright information. And the variables of interest for topic prevalence estimation, as captured in the Supplementary Table 2, include author gender, year, GII quartile and journal impact factor. All of the above apart from the author gender are implemented as controls to exclude capturing interfering effects.

The topic modelling here is implemented using the R `stm` package, which allows one to specify several parameters for topic generation. Most importantly, one can decide on the number of topics (K). For the first dataset, containing among other variables, information on the gender of the first author, STM was tested at 70, 80, 90, 100, 110 and 125 topics. After a thorough examination of each of the model outputs, it was decided to use the model generated with the number of topics equal to 90 for further analysis, as it contained the least number of vague or inconsequential topics, but also allowed one to observe and define meaningful topics. Different approaches towards STM output exploration and K definition have been described in the literature, with no consensus on a universal quantitative assessment tool. Hence, the assessment here is rather qualitative. As suggested by Müller-Hansen *et al.*, when the question one pursues to answer with the support of a topic model is qualitative in nature, the decision on the final number of topics should be based on the sought-after level of granularity and the intelligibility of the model outputs (Müller-Hansen et al., 2020). Comparing the topic models with different numbers of topics as described above, I was trying to answer the following questions:

(1) Are the topics coherent?

(2) Are there obvious contradictions in the within-topic vocabulary?

(3) Do we observe repetition of themes across generated topics?

(4) Are any topics present that would address and/or represent socially marginalised groups' interests?

As the variation in the number of documents among the studied datasets is negligible, and there should not be any meaningful topic variability as the documents had been pulled from the same initial query run, all further datasets were only modelled at 90 and 100 topics to minimise the computing time. However, the models produced for the last author gender dataset and majority author gender datasets were as thoroughly examined as the models produced for the first dataset. This was done before initiating further analysis steps to ensure consistency and intelligibility of the results. For the last author gender dataset, the model specification with '`K = 100`' was picked, and for the all-group gender dataset - the model with '`K = 90`'. The slight variation in the STM results among the dataset can be explained by the underlying differences in the values of the GII index as a control variable, as well as the gender variables and the number of documents. All these variables have an effect on how the topics are generated. The first dataset thus varies somewhat from the other two as they share the GII index values (following the example of Nielsen *et al.*, I use the institutional affiliation of the last author for identifying the country and the gender inequality metric for the full author group as well as for the last authorship instance) (Nielsen et al., 2017). Furthermore, the dataset containing the information on the full group of authors is significantly smaller in size (22 266 compared to 31 422 and 32 873 documents), which can also result in a slightly different topic definition. Still, after testing `K = 90` and `K = 100` for datasets #2 and #3, there was no apparent reason to conduct additional topic model simulations at varying K values, as again most topics were clear and easily labelled. A summary of the topics identified in the climate change adaptation policy literature across the datasets is provided in the Supplementary Table 5. The topics are arranged into broader categories for the ease of interpretation.

As the dependent variable of interest in this study is inclusion of *climate justice* topics in the research agenda, special attention was placed onto topic categorisation into 'climate justice'

and 'other', which was performed manually for each dataset. This categorisation is qualitative and based on the relevant literature described in the introduction to this paper and the literature review (IPCC, 2022; Robinson, 2011; Sultana, 2021). The most common terms for each of the topics labelled 'climate justice' are presented in the Supplementary Figures 1-3 arranged by the dataset. The only topic related to the framework of climate justice that was not observed as a separate topic in the dataset on the first authorship instances was *Displacement and Mobility*, with most common terms associated with this topic in the datasets #2 and #3 observed partly in relation to the following topics: *Island Territories, Developing Countries, Gender,* and *Local communities*. Other than that, the topics are consistent across the datasets. However, both topic proportions and term frequencies vary slightly due to the variation in the sample size and the specific features of topic configuration.

These are the topics I focus on for the quantitative part of this analysis as described in the following subsection. However, all the remaining topics are treated equally as carefully, and all topics in each dataset are manually assigned a label based on the most frequent terms associated with them. In this process, I only disregard trivial topics such as ones containing copyright vocabulary or generic measurement terms, which across datasets amounts to 5 to 6 topics. Of course, further testing and a different approach could result in a different topic configuration. However, I believe that the transparency of reporting as advocated by Müller-Hansen *et al*. makes the results of this work replicable and interpretable, which is why I make the code and the supplementary materials, including among others the topic vocabulary and definition tables, available (Müller-Hansen et al., 2020).

It is important to note that, despite thorough testing of the STM outputs at multiple configurations, only some of the expected social justice topics have appeared in the output topics, while some others have not. I discuss this as well as the general patterns observed in the analysed literature in the section 5.2 of this paper.

4.4 Methodology: effect estimation and further analysis

This subsection delves further into the methodology of this work and describes specifically how its different parts come together. As a probabilistic model, STM allows, among its other features, to calculate topic proportions for each document and topic combination and estimate the effects of metadata variables that were implemented for topic prevalence definition.

The output of topic modelling is a Document-Topic Matrix (DTM), which contains topic proportions (or frequency of occurrences of terms associated with each given topic) for each document in the dataset. Hence, the dimensions of the matrix are equal to `n x K,` where `n` is the number of documents in the dataset and `K` is the specified number of topics in the model output. In this analysis, DTM1 has dimensions 31 422 x 90, DTM2 - 32 872 x 100, and DTM3 - 22 266 x 90. Thus, any meaningful visualisation of the topical space requires dimension reduction. This is done, as previously illustrated by Sietsma *et al*. and Gonzàlez-Màrquez *et al.,* through *t*-SNE, or t-Distributed Stochastic Neighbour Embedding, a commonly applied approach for visualising data of high dimensionality in a low-dimensional space (González-Márquez et al., 2023; Sietsma et al., 2021). The general concept is to optimise pairwise distance preservation (van der Maaten & Hinton, 2008). I use a Python *t*-SNE implementation from the **sklearn.manifold** package (function name is **TSNE**) to reduce dimensionality from 90 and 100 to 2 (Pedregosa et al., 2011). The parameters that are central for *t*-SNE implementation are the desired resulting number of dimensions (**n_components = 2**); and the type of initialisation of embedding (**init = "pca"**). While the former is a bit more straightforward, the latter refers to the technique applied to initialise embedding, or create an initial low-dimensionality embedding, as a starting point for the *t*-SNE algorithm. PCA initialisation relies on the principal component analysis and allows to preserve linear relationships in the data, as opposed to random initialisation, which intuitively suggests a random embedding at the first step and thus usually requires more reiterations than PCA. Specifying a different initialisation type as well as a different randomness seed will result in different results.

In the same line of work, I also compute a 'climate justice score' for each document in each of the three datasets as a simple sum of topic proportions for the topics that were manually

categorised as 'climate justice' topics in the previous step of the analysis. Furthermore, I determine the most prominent topic for each document and introduce clustering for more coherent visualisation with topic labels per cluster. Clusters of data points are defined with the help of **kmeans** function in **R**, which attempts to split the data into **k** clusters by minimising the sum of distance squares from points to the assigned cluster centres. Thereafter, I assign the most common dominant topic per cluster for creating labels.

The **R** package **stm** includes the **estimateEffect()** function, which is central for any quantitative analysis of the STM outputs. The function is used to estimate the effect of covariates on the proportion of each given topic in the text corpus. It does so by performing a regression with topic proportions as the dependent variable, where the default uncertainty calculation approach allows for incorporating the underlying uncertainty associated with topic prevalence definition in the model. The formulas I pass to the function for each of the datasets are the same apart from the predictor variable, and represent linear regression specifications:

```
(1)     effect1 <- estimateEffect(~s(year) + first_author_female +
    gii_quartile + impact_quartile + first_author_female*gii_quartile +
    first_author_female*impact_quartile)

(2)     effect2 <- estimateEffect(~s(year) + last_author_female +
    gii_quartile + impact_quartile + last_author_female*gii_quartile +
    last_author_female*impact_quartile)

(3)     effect3 <- estimateEffect(~s(year) + majority_author_female +
    gii_quartile + impact_quartile + majority_author_female*gii_quartile +
    majority_author_female*impact_quartile)
```

Here, the dependent variables correspond to topic proportions, so the effects are calculated separately for each of the topics in the output of the model. For the categorical variables, namely, gender inequality index quartile and journal impact factor quartile, dummy variables are created for each category and the effects of each category are measured against the first category. Consequently, I estimate differences in topic proportions based on the variable of interest with the help of **get_effects()** function, which is part of the **stminsights R** package, where **type = 'difference'**. In each of these cases, I inspect both the coefficient of the predictor variable, as well as the coefficients of the control variables, and the

interactions of the independent variable with GII and journal impact factor variables. The analysis includes the interaction terms alongside the predictor variables as both gender inequality index of the country of the author's institutional affiliation and the impact factor of the journal where the paper is published are assumed to moderate the relationship between author gender and the thematic focus of the article. All the results derived from this analysis are described in the following chapter.

4.5 Methodology: limitations

Before proceeding with describing and interpreting the results of this study, I would like to acknowledge that the methods I apply here have certain limitations that I as the author am aware of. Some of these limitations, once recognised, can be handled and their effect on the validity of the results minimised, while others are more systemic and harder to address within the scope of this research. As most available data and research are skewed towards Western, Educated, Industrialised, Rich and Democratic (WEIRD) populations (Henrich et al., 2010), the biases are inevitably reproduced in machine-learning algorithms through the training data. Hence, both taking the existing scientific output as the key source of data and relying on machine-assisted tools for further data generation and analysis, are related to systemic biases and limited validity. However. it is worth mentioning that the methods applied in this study were designed with the ease of replicability in mind. Once implemented, the analysis would be straightforward to reproduce with different data. In this manner, one could apply the methods developed here to analyse another category of climate literature such as climate mitigation policy, for example, or to explore a different scientific field altogether. The same is true for answering a different research question. In this case, the output of topic modelling would have to be investigated with different topics of interest in mind. The research design described here also allows for a quantitative assessment of topical trends, which is not always the case with variations of topic modelling other than STM. Finally, any tool used in this work, be it for gender prediction or topic definition, or the analysis of interactions, can easily be substituted with a different one without major disruptions to the study design.

First, let us discuss the limitations linked to the dataset of choice. Pursuing a quantitative analysis of a large corpus of scientific publications naturally involves a trade-off in the depth of the analysis for the size of the dataset. In applying the query (Supplementary Table 1), I am aware of the bias introduced through focusing on English-denominated literature only and ignoring grey literature. Furthermore, focusing on published literature could reproduce implicit biases towards women, indigenous peoples and people of colour, and poor people with no access to academia. These tendencies are exacerbated as research on the intersecting and persistent inequalities is unappreciated (Cislak et al., 2018). Women especially tend to experience high pressure at work and are sometimes unable to pursue certain research topics due to the pressure of a male-dominated environment to stick to 'more scientific' agenda and not challenge the status quo (Ahmed, 2021; Gneezy et al., 2003; Liverman et al., 2022; Reskin & Roos, Patricia A., 1991). Unfortunately, these disparities are systemic and tacit. Hence, related limitations can only be made known, and results thus interpreted with caution. Furthermore, despite implementing a comprehensive search query and a systematic literature search, as well as documenting the process, there is still a possibility of missing some potentially relevant papers.

Limiting the scope of this research to adaptation policy in climate science is sensible as my goal is to focus specifically on the literature that could follow the climate justice framework or ignore it altogether. Hence, the broader climate change literature, which is still largely focused on developments in earthly ecosystems rather than social facets of climate change, as well as mitigation literature, are unattended to in this work. This is also a necessary measure due to time limitations and limitations in computing power. However, considering a broader dataset or a different subfield of scholarship could yield novel results. Hence, there is possibility for further research, for example, in a field where gender parity is lower than that captured here for climate change adaptation policy research.

Apart from the limited performance levels as discussed in the section 4.2 of this paper, I am also aware of the possibility of introducing further bias by applying a machine-assisted procedure for predicting each author's gender based on their first name. The automated gender estimation tools, as they are largely based on the US Census data, have been reported to be of particularly limited capacity for non-Western names (Mihaljević et al., 2019). We are thus

facing a higher probability of misclassifying or not classifying authors from ethnic minorities, and/or poorer countries, alongside with the authors holding rare names or names not necessarily associated with a specific gender. This issue is addressed with the manual random check of the tool's performance and reporting the precision metrics in the section 4.2. Further potential limitations include a likely underestimation of women authorships due to exclusion of initials and inherently ambiguous names (González-Márquez et al., 2023; Larivière et al., 2013; Nielsen et al., 2017; West et al., 2013). The latter is partly handled through the inclusion of ambiguous estimations at the first step of gender prediction, which, if supported by further evidence from databases would result in a unambiguous gender prediction.

A fundamental limitation to the methodology applied in this work is the assumption of state-imposed binary gender classification, which leaves out the perspective on the *genderqueer* persons and their contribution to the body of academic work (Dembroff, 2020; Hyde et al., 2019), and is unfortunately impossible to handle at this scale of analysis. A qualitative study that is centred around individuals rather than a population, and explores intersectionality in climate science, could be useful to address this shortcoming.

Machine-assisted natural language processing for topic modelling is also inevitably associated with a certain level of crudeness. As an unsupervised machine learning tool, STM is associated with a limited capacity for meaningfully identifying underlying topics in the text corpora. Certain terms can be linked to multiple topics or be entirely inconsequential, which the machine would be unable to recognise. Another limitation related to this approach is the subjectiveness of evaluation of the model's outputs (Grimmer & Stewart, 2013). These are partially tackled through manual qualitative testing of topic model outputs at different values of the number of topics, human encoding of topics as 'climate justice' and 'other', and conceivably transparent reporting.

Dimensionality reduction with t-SNE is likewise associated with certain caveats, most importantly, the global structure of the data is likely to be disrupted in its two-dimensional representation (Kobak & Berens, 2019). However, the maps I produce in this way are helpful to identify clusters of documents related to rather specific topics and get a general idea of the topical space within climate change adaptation policy scholarship.

In assessing the quantitative effects of author's gender on topic proportion one risks inadvertently capturing the effects of interfering variables instead. For example, possible factors could be (a) how high the gender inequality of the country where the author is based is; (b) how prestigious the journal the work is being published in is; (c) how conservative the specific scientific field is; (d) what the funding source is, and so on. All of these could affect both the gender composition of a research project, as well as the thematic output. The characteristics of the scientific field at large should not intervene too much here as the study focuses on a rather specific subject. Still, variation is possible across subfields of studies identified as relevant for climate change adaptation policy. However, this is not addressed within the scope of this analysis due to perceived insignificance regarding the specific dataset at hand. The projects' funding sources are likewise not considered in this study due to unavailability of public data, but the importance of this factor should not be underestimated. For instance, another study that applied STM to investigate thematic patterns in climate discourse, has found that organisations with corporate funding tend to produce texts that are aimed at polarising the debate (Farrell, 2016).

Another possible limitation to the interpretability of the results is *tokenism* in both author gender compilation and social justice in research agenda. Token participation refers to the case when an individual or group is only nominally included in a process - in this case, in research. The issue is partly addressed in this study by considering multiple independent variables which include first author gender (first author in social and natural sciences mostly being the author initiating and conceptualising a research idea), last author gender (last author in social and natural sciences mostly being a working group lead, a project manager or a supervisor), and the gender of the full research group. By tokenism of social justice in the research agenda I mean here the case when an article includes keywords that could imply inclusion of certain social justice topics, without properly addressing them in the project. This could happen, for example, during editing, as an afterthought or formal obligation (Lau et al., 2021), and is impossible to account for at this scale of data processing. An implementation of a machine-learning prioritisation algorithm for article screening could help in identifying relevant articles specifically for this research question and would allow for qualitative assessment of the centrality of social justice concepts in the relevant literature, which again presents an opportunity for further research in this area.

As captured above, my theorising on the limitations of the methods described in the paper is supported and augmented by the sentiments expressed in the related literature. Nevertheless, the methods applied in this study appear to be adequate for the purpose of investigating and presenting the patterns from a large text corpus, as well as studying an entire population of academics rather than individuals.

5. Description of the results

The analysis described in this paper consisted essentially of three distinct parts: gender prediction, topic modelling and analysis of the relationship between an author's gender and the topical output of a research paper. Hence, this section presents the results of the analysis arranged in a similar manner, where I first describe the gender composition of the chosen scientific subfield, then its thematic landscape, and finally, the causal links present between the two.

5.1 Description of the results: gender composition

In line with previous findings from different academic subfields (González-Márquez et al., 2023; Larivière et al., 2013; Nielsen et al., 2017; West et al., 2013), I find climate change adaptation policy scholarship to be male-dominated, as depicted in Figure 4. In reality, the numbers could be slightly worse due to the upward bias of the tool used for gender estimation towards prediction of 'female' authorship instances as described in the subsection 4.2 of this paper; or slightly better, if names disregarded due to ambiguous gender estimations do indeed more often belong to women researchers, similarly to the records of initials instead of full first names; or rather comparable to the ones captured here if the described effects cancel each other out.

Particularly, I find the last author position to be largely held by men researchers - 70.27%, compared to 29.73% of women. As the last authorship in natural and social sciences usually corresponds to the project supervisor or the head of the working group, this finding illustrates once again the 'leaky pipeline' problem, where gender parity is lower in higher career stages. One potential caveat of this judgement is that in some scientific fields such as economics, it is common practice to list the authors in the alphabetical order. However, if the query did in fact

match documents from such disciplines, the number 29,73% for women in leading academic positions is even lower in reality. Among the first authorship instances, representing the authors who often contribute most to the conceptualisation and assume most of the work for the project, 39.04% are predicted to be women, and 61.96% men. This is a higher women participation rate than for the majority of the scientific disciplines described before, with the exception of, for instance, the subfields in medical research related to 'care' and veterinary medicine or, in sociology, - those related to sociology of the family and gender (González-Márquez et al., 2023; West et al., 2013). It is also higher than the share of women contributing authors in the IPCC AR6, which was equal to 33%. As the IPCC assessment reports synthesise knowledge from 3 major areas (corresponding to the 3 working groups): science, impacts, and mitigation; women are least represented in science (27%), most represented in impacts (40%), and quite poorly represented in mitigation (31%) (Liverman et al., 2022). Considering that the field of climate change adaptation policy falls under the umbrella of 'impacts', the subset of documents I am working with, and the estimated authors' genders seem to be in harmony with the levels of women participation in the broader context of climate scholarship. Intuitively, the relative number of papers where most authors are predicted to be female is even lower, at only 23.34%. This is a worrying number as it indicates a possibility of *token participation* of women researchers in a lot of projects. A situation where female researchers are part of the process but are indeed discouraged from expressing their opinions or are facing additional pressure in the form of increased competitiveness is not uncommon in a male-dominated environment as men are reported to be more oblivious to the challenges that women are facing and oftentimes fail to adjust the processes in an appropriate way (Liverman et al., 2022).
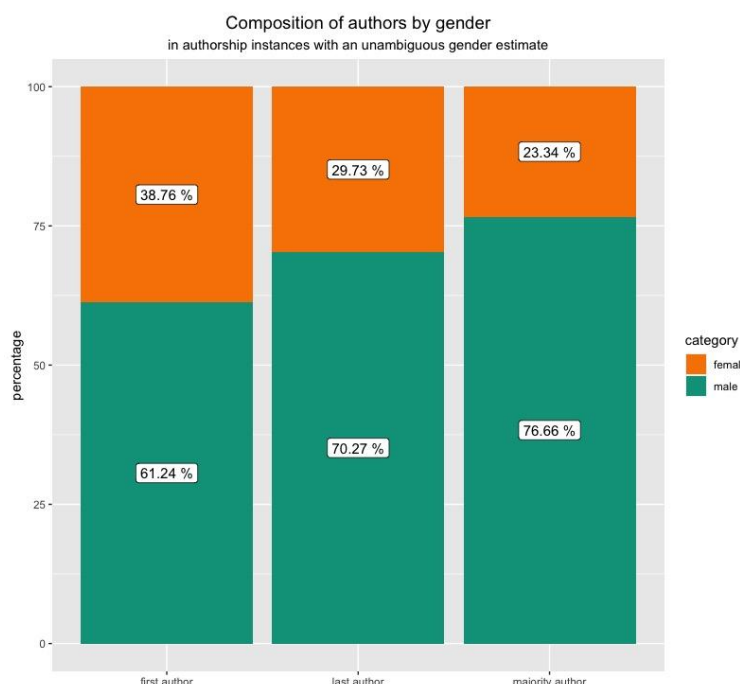

Figure 4. Relative representation of female and male authors for the first and last authorship instances, as well as for the majority in a research group for the climate change adaptation policy scholarship. The numbers are provided as percentages from the authorship instances where an unambiguous gender estimate could be assigned.

These results appear in a more alarming light when one also considers the dominant collaboration patterns. The previous evidence on women participation and collaboration practice in science has been heterogeneous and field-specific (Boschini & Sjögren, 2007; Ghiasi et al., 2015; Holman & Morandin, 2019; Jadidi et al., 2018; Kwiek & Roszka, 2021). Hence, I asked myself the following exploratory and supplementary questions:

(a) *Are women in climate change adaptation policy research more likely to lead a paper under a woman's supervision?*

(b) *Do male research project supervisors tend to work in majority male groups?*

I attempt to answer them in reference to the descriptive statistics of the dataset. As these did not focus on the predictive power of author gender for topic definition, they were studied in much less detail, with no implementation of controls. However, a simple investigation of the numbers has revealed that among the women first publishing authors, 41,75% published with a female supervisor. Inversely, 54,09% of female supervisors worked with a female first author, whereas only 32,70% of male supervisors published with a female first author. And among the men first authors, only 22,85% published with a female supervisor. Furthermore, only 7,32% of male supervisors publish with research teams where the majority of authors are women, compared to 58,68% of female supervisors. Of course, these numbers do not necessarily speak of the preference of men to work with men in academia, as they are skewed by the general underrepresentation of women both in the first, and, especially, in the last author position. However, they do underline discriminatory tendencies ever-present in the academic field. Previous studies have shown that men do indeed tend to be less mindful of the gender gap and of the implications of a male-dominated working environment on women's ability to express themselves; and that women academics particularly lack sufficient and healthy supervision from senior colleagues (Gopinathan, 2007; Liverman et al., 2022). With the reality being that men still occupy most of the senior positions in academia, they should be driving positive change rather than reinforcing the implicit bias.

Overall, these results show a slightly more positive picture than those described before and corresponding to different time periods and scientific fields. However, they also provide further evidence of the persistent gender gaps and highlight the importance of further work towards

tackling this issue. In other words, these findings are a confirmation of that we are not quite there yet in achieving gender equity in science. The need for continued efforts towards tackling gender-based discrimination is especially pronounced for developing countries, as women there are more likely to experience intersecting discriminating pressures.

5.2 Description of the results: STM outputs

Topic modelling is often applied to explore general trends in textual data. Here, I ran topic modelling on titles, abstracts and keywords, which is common for analyses on large corpora (González-Márquez et al., 2023; Sietsma et al., 2021). This could potentially result in omitting more nuanced topics but, at the same time, it allows us to consider specifically the topics dominant in the research agenda of each project. I applied structural topic modelling to investigate dominant themes in the climate change adaptation policy literature, identify topics responsive to one or more of the concepts central to the climate justice approach, and the publications closely associated with these.

In line with previous findings indicating a recent increase in social scientific research within the climate adaptation literature and a lag in 'solutions' - oriented research (Sietsma et al., 2021), I find the thematic landscape of the climate change adaptation policy scholarship is quite heavily technical and 'problem'- rather than 'solution'- focused. However, several prominent topics are formed that can be seen as corresponding to 'enabling' responses. These include *Urban Planning, Water Management, Climate Strategy, Resource Management, Pathways to Equity, Adaptation, Carbon Capture and Storage (CCS), Climate Finance* and *Green Energy*, as can be seen in the Supplementary Table 5. Social sciences are mostly represented by the following topics: *Socio-Economic Vulnerability, Pathways to Equity, Adaptation, Climate Finance, Governance, Decision-Making, Policy, Public Perception, Displacement and Mobility, Economic Analysis, Local Communities, Gender, Tourism* and *Culture*. Several topics are harder to classify as they correspond to interdisciplinary areas, such as *Climate Risks, Climate Strategy, Resource Management, Mitigation* and *Knowledge*. That being said, I do not

analyse temporal or geographic trends in topic prevalence in this work as these are very well summarised in a recent paper on global developments in adaptation research (Sietsma et al., 2021).

The literature that deals with disproportionate climate vulnerability can potentially be both about climate impacts and how they are currently being distributed or about strategic approaches towards eliminating the systems of oppression or at least avoiding their reinforcement in the climate governance arena. Hence, these aspects can also be brought up in technical literature or literature from natural sciences, and publications describing the 'problems' rather than 'solutions'. However, they largely correspond to the thematic course of social sciences and literature on *enablers*. Overall, I was able to identify 7 and 8 topics depending on the dataset, that were related to distributive, or procedural justice, or recognition, in the light of climate adaptation governance. Topic labels corresponding to these are the following, in the order of their prevalence in the text corpus: *Pathways to Equity, Socio-Economic Vulnerability, Local Communities, Food Security, Gender, Displacement and Mobility, Developing Countries,* and *Island Territories*. The most frequent terms for each of these topics are captured in the Supplementary Tables 1,3 and 5. As described above, *Displacement and Mobility* was not identified as a separate topic in the dataset with inferred gender of the first author, and the keywords associated with the topic in two other cases were observed as associated with such topics as *Island Territories, Developing Countries, Gender,* and *Local Communities*.

Thus, I observed some of the expected topics in the corpus, but far from all. For instance, there was no topic that would clearly focus on racial injustices in the context of climate change adaptation, which quite possibly indicates a gap in this field of research. While indigenous peoples and grassroots communities have been explicitly covered, alongside general socio-economic vulnerability topics, this was not the case for specific issues related to racial injustices within developed/developing countries. Another topic that seems to be omitted altogether, at least at this level of granularity, is *intergenerational justice*. Despite the centrality of the concept to climate discourse, it does not appear to hold a steady position among the scientific publications on climate change adaptation governance. Other socially marginalised groups that have not found prominent representation in climate change policy adaptation research were the LGBTQ+ community, differently abled persons and caregivers. It is quite

possibly still unclear how climate adaptation policies could particularly disadvantage these minority groups. Another reason for omission of these topics could be the pursued level of granularity for this work. In other words, this could be an indication that these topics are significantly less prominent, but not necessarily non-existent.

5.3 Description of the results: effects of metadata

The novelty of this work lies primarily in the quantitative analysis of the effects of an author's gender on the topical output of their research. In a recent work that followed rather similar methods but investigated biomedical scholarship, Gonzàlez-Màrquez et al. have shown that women researchers are more represented in research on nursing, education and psychology, but are severely under-represented in disciplines related to engineering and, for example, surgery (González-Márquez et al., 2023). However, to my current knowledge, a similar investigation into climate literature does not exist up to the present date.

Of course, there are multiple factors at play in choosing one's specialisation or a specific research topic. This means the effects of an author's gender on the research agenda they pursue could easily be overestimated. Namely, there are varying levels of gender discrimination or the "hostility" of certain academic fields towards women researchers, as well as there are certainly inherent social pressures on women to be involved more in 'care' - related domains. However, with the implementation of controls, I believe, I can estimate the specific effects of an author's gender on the topical content of their publications conceivably accurately. It is important to mention, nevertheless, that this work does not aim to argue that men and women possess any inherent qualities that make them more or less likely to choose any topic. Rather, that the patriarchal structures have made it easier for men to ignore tackling persistent injustices compared to women. Potential limitations to the validity of these findings are discussed in more detail in the subsection 4.5 of this paper.

Here, I applied the built-in functionality of the `R` package for STM to estimate the effects of the author's gender, the gender inequality index of the country of their affiliation, and the impact factor of the journal where the study was published, on the topic proportions for each of the topics considered relevant for *climate justice*. Hence, this subsection successively presents the results corresponding to each of these variables, as well as to their interactions.
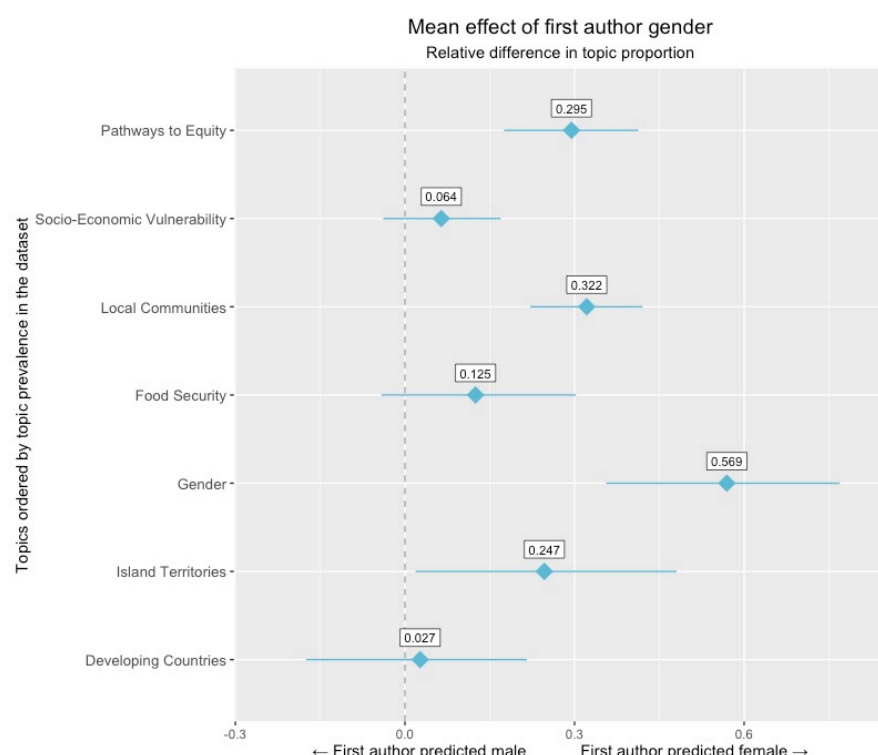

Figure 5. Mean effect of the first author gender on the topic proportion relative to the mean topic prevalence in the corpus with 95% confidence interval. The topics are arranged by topic prevalence in the corpus.

Intuitively, the effects of the author's gender on topic prevalence in their publication vary in size based on the topic we are investigating and the author's position. Generally, the topic proportions in the dataset are quite different for each of the topics, hence, the results are presented as relative differences rather than absolute changes in topic proportions. For the first author gender, Figure 5 presents the mean difference in topic proportion, while the Supplementary Figure 2 shows the topical space reduced to 2 dimensions. For most of the topics, I observe statistically significant differences in topic proportions based on the gender of the first author at the level 95% confidence, with higher topic proportions associated with women authorship instances. These include, namely, *Pathways to Equity, Local Communities, Gender* and *Island Territories*. Furthermore, topics such as *Socio-Economic Vulnerability* and *Food Security* also appear to be positively correlated with female authorship, but the confidence interval reaches 0, meaning that the effect could be insignificant at the 95% level of confidence; whereas the topic labelled *Developing Countries* does not seem to be affected by the gender of

the first author. With the first author usually being the conceptual mind behind the project, these results support the notion of that women initiate more research projects that include *climate justice* topics. The null hypothesis is rejected for 4 of the 7 topics at the confidence level of 95%; and *H1* that female researchers in the position of the first author include *justice* topics in their research on climate change adaptation policy more often than male researchers in the same position is accepted.

Figure 6. Mean effect of the last author gender on the topic proportion relative to the mean topic prevalence in the corpus with 95% confidence interval. The topics are arranged by topic prevalence in the corpus.

If we now turn to the last author gender, Figure 6 and the Supplementary Figure 4 tell a slightly different story. Here, I observe a significant positive effect of the last author's gender being estimated as female on the topic proportions of the topics labelled *Pathways to Equity, Socio-Economic Vulnerability, Local Communities, Gender, Displacement and Mobility*, and *Island Territories*. The effects on topics associated with *Food Security* and *Developing Countries* are insignificant at the confidence level of 95%. Notably, the effect on *Pathways to Equity* topic prevalence is even higher for the last author's gender compared to the first author's gender. Hence, the null hypothesis is rejected for 6 out of 8 topics at the 95% confidence level; and *H2* that female researchers in the position of the last author tend to include *justice* topics in their research on climate change adaptation policy more often than male researchers in the same position is accepted.
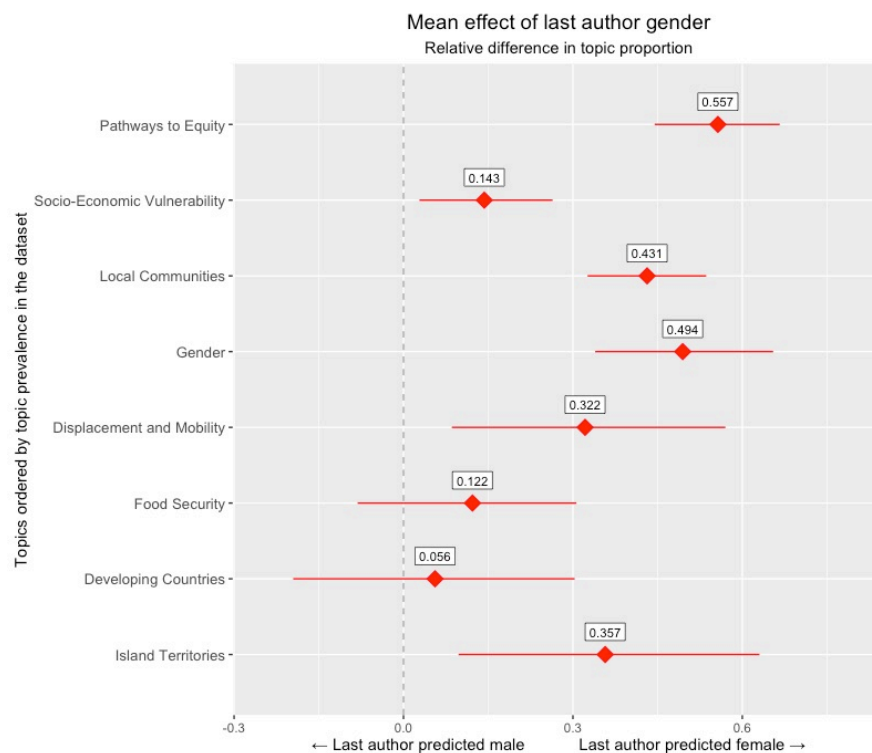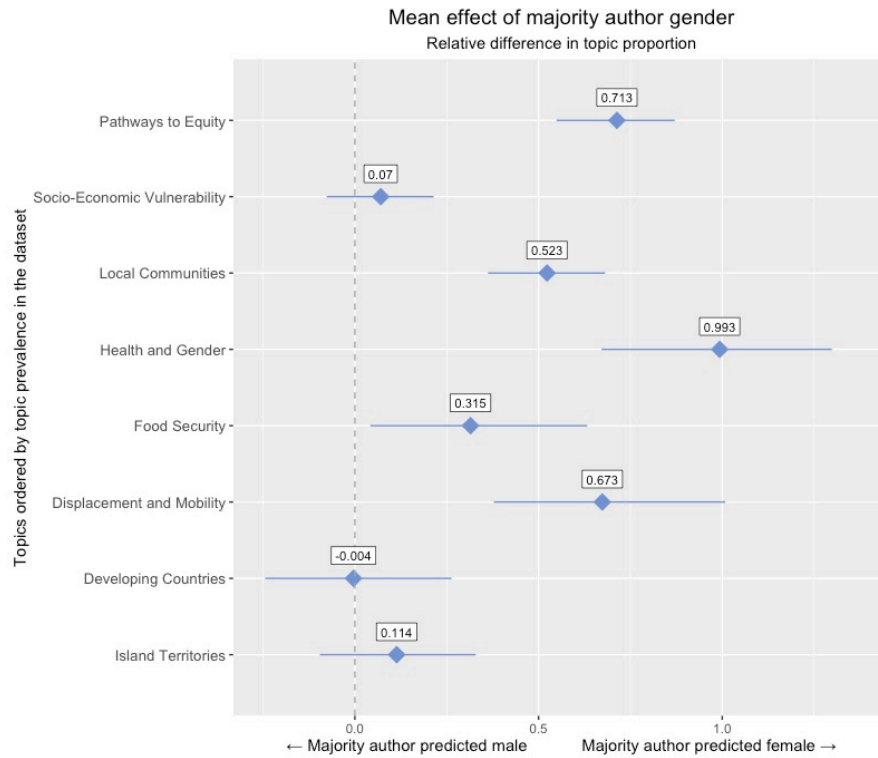
Figure 7. Mean effect of the last author gender on the topic proportion relative to the mean topic prevalence in the corpus with 95% confidence interval. The topics are arranged by topic prevalence in the corpus.

With reference to the gender composition of the full author group, the mean effects on topic proportions of the relevant topics are depicted in Figure 7, whereas the topical space reduced in dimensionality to 2 dimensions is shown in the Supplementary Figure 6. Therein, the mean positive difference in topic proportion for the topic *Pathways to Equity* is even larger compared to the effects of the first or the last author's genders. Rather similarly to what was described above, I also observe positive significant effects of the majority author gender being predicted as female on the topic prevalence of *Local Communities, Health and Gender, Food Security,* and *Displacement and Mobility* at the 95% confidence interval. On the other hand, *Socio-Economic Vulnerability, Developing Countries* and *Island Territories* do not appear to be significantly positively correlated to the gender of the majority of the research group being estimated as female. Thus, the null hypothesis is rejected at the 95% confidence interval for 5 out of 8 topics; and *H3* that research groups predominantly comprised of women researchers pursue *climate justice* topics more often than those comprised predominantly of men is accepted.

From the images of the topical spaces, one can infer that the *climate justice* topics are rather tightly related. In this manner, document clusters associated with *Pathways to Equity, Gender, Socio-Economic Vulnerability,* and *Island Territories* appear close to one another in all three visualisations. In the Supplementary Figure 2, the evidently higher saturation of female-

authored articles in the part of the graph covering *climate justice* topics is a visual representation of the quantitative results described above. In the Supplementary Figures 4 and 6, however, the trend is less obvious due to general underrepresentation of women in the last author positions and as majority of the group. Still, where female authorships do occur is more often in the same topical space. The representations of the topical spaces can also be found in a higher resolution in the public repository as described above.

For each of the datasets, I also calculated the effects on topic proportions of the control variables, such as GII and journal impact factor, before analysing their interactions with the gender variables. Both the gender inequality index and the journal impact factor values were split into quartiles and further treated as categorical variables, whereby in the regression calculation each category got a dummy variable, and the effects of each category were measured against the first category, or Q1. As described above, for the GII data, Q1 represented the lowest GII values; and for the journal impact factor data, Q1 represented the highest journal impact factors. The quartiles had been calculated specifically for the values present in the dataset. Across the datasets, lower GII is unanimously associated with a significantly higher topic proportion for *Pathways to Equity*, and lower topic proportions for *Socio-Economic Vulnerability*, *Food Security*, *Developing Countries* and *Gender*. The effects on other relevant topic proportions are statistically insignificant. By contrast, higher journal impact factor values are associated with lower topic proportions for *Local Communities*, *Gender* and *Island Territories*, which again highlights previous findings on bias against research on gender bias (Cislak et al., 2018). The effects on other topic proportions are negligible. The effects of control variables across the studied datasets are presented in the figures that can be found in the public repository.

In order to isolate the effects of author gender from other interfering factors, such as in this case the gender inequality in the country of the institutional affiliation, and the journal impact factor of the publication, I further examined the interaction coefficients for the gender variables with GII quartiles and journal impact factor quartiles. Here, the patterns I observe are only somewhat similar across the three studied datasets. Generally, introducing interactions with lower GII values (Q3 and Q4) significantly reduced the positive effects of gender variables on representation proportions of topics associated with *climate justice*, and increased the uncertainty intervals. However, for the first author gender, the interaction with the Q4 of the

gender inequality index effectively eliminated any positive effects of female authorship, whereas the effect persisted for topics on *Pathways to Equity* and *Gender* for the variables representing the last and majority author genders. The interactions between the gender variables and the highest GII values are depicted in the Supplementary Tables 7-9. Interactions of the gender variables with the journal impact factor values introduce virtually no variability to the results, apart from the increased uncertainty intervals.

Overall, the results, even if not entirely homogenous, indicate a positive statistically significant effect between conceptual and supervising author being a woman, as well as the majority of the research group being women, and the inclusion of climate justice topics into their agenda. The variation in the results is attributed to the level of authority or effective power different authorship positions are associated with.

6. Discussion

The omnipresence of implicit bias in social structures makes it particularly difficult to disentangle specific causal effects of the author's gender on topic preference. Hence, as its author, I acknowledge that the results put forward in this paper may inherit the implicit biases present in academia. In other words, one must interpret the results of this analysis with caution, and keep in mind the limitations described above, as well as the precision metrics of the implemented tools.

As has been demonstrated, the rate of women participation in research on climate change adaptation policy at approximately 39% is higher than for other previously analysed scientific areas. However, it drops significantly with a higher status - only roughly 30% of project supervisors in the field are predicted to be female; and the observed collaboration patterns further highlight the gender gap persistent in climate science. Furthermore, with some topic-specific variability, justice considerations appear to dominate the agenda mostly for articles authored by women, as hypotheses suggest. Hence, this analysis supports the centrality of intersectional feminism to the adoption of *climate justice* framework in related research.

I am aware of the possibility that the findings presented here could be misinterpreted and misused to support the argument that the level of scientific expertise somehow varies by gender or that the gender of an author of a scientific article in any way affects its validity. On the other hand, as set out in the beginning of the paper, I firmly believe that encouraging diversity in research teams as well as in policymaking processes ensures higher cognitive ability, inventiveness and fairness of the procedures and outputs. Furthermore, I completely disagree with the idea of evaluating any scholarly work, or any work for that matter, based on the person's gender.

I would also like to highlight that a qualitative analysis is recommended to assess causal links between author's gender identity and the topical output of their research. An in-depth review of the articles associated with *climate justice* topics would be necessary to be able to say to which degree these are representative of the interests of the socially marginalised groups.

Another interesting aspect of this relationship, which is not covered in this analysis, is the funding source and its causality on the topical contents and research group characteristics. Regarding the methods described here, they can be replicated and applied to different datasets, as well as enhanced through implementation of a different gender estimation tool or further machine-assisted topical classification as described in previous literature.

Finally, unless an in-depth qualitative study is conducted, one cannot judge whether the effect on topic proportion does indeed relate to the author's gender and associated levels of awareness towards the needs of the socially marginalised groups, or to the phenomenon of being 'ghettoed' to 'more' or 'less' scientific subfields based on the scholar's gender by the dominant practices.

Overall, this study presents a first insight into the topical space of the climate change adaptation policy literature, where links between the author's gender and prevalence of topics related to the *climate justice* framework are outlined.

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Supplementary Materials

Supplementary Table 1.

Global climate adaptation policy query.

(Generic climate change terminology	((((TS= ("climat* change*" OR "climate crisis" OR "warming climat*" OR "changing climat*" OR "climat* warming" OR "global heating" OR "chang* in climat*" OR "climate emergency" OR "global warming" OR "greenhouse effect" OR "greenhouse gas*" OR "changes of the climate" OR "changes in the climate") OR TS=("climat* variability" OR "climat* dynamic*" OR "climat* proxies" OR "climat* proxy" OR "climat* sensitivity" OR "coupled ocean-climat*" OR "early climat*" OR "future climat*" OR "historical climat*" OR "past climat*" OR "climat* shift*" OR "shift* climat*" OR "shift in climat*" OR dendroclimatolog* OR "radiative forcing" OR "transient climate response") OR TS=("UNFCCC" OR "Kyoto Protocol" OR "climat* policies" OR "climat* policy" OR IPCC OR "clean development mechanism") OR (TS="Paris Agreement" AND PY=(2014-2021)) OR TS = ((climat* OR CO2 OR carbon OR "greenhouse gas" OR GHG) NEAR/2 legislati*) OR (TS=("global climate model" OR "regional climate model" OR "local climate model" OR "general circulation model" OR (climat* NEAR/5 scenario$)) NOT WC="Astronomy & Astrophysics"))
	... **OR** ...
Risk, Impact and Vulnerability)	(TS=((climat* NEAR/2 (impact* OR vulnerab* OR hazard* OR exposure OR sensitiv*)) NOT ("safety climate")) OR TS =(climat* NEAR/2 (risk$ OR resilien* OR cope OR coping)) OR TS =((("sea level") NEAR/2 (rise OR rising)) OR "extreme water level$" OR "extreme tide level" OR "extreme* high water" OR "extreme* low water" OR (tropic* AND (cyclon* NEAR/2 (activit* OR intensity OR frequenc* OR duration))) OR "heat wave$" OR (("extreme heat" OR (high NEAR/2 temperature*)) AND ("long-term trend*" OR "prolonged period$")) OR "mean rainfall" OR "mean precipitation" OR ((heavy OR intens* OR extreme) NEAR/2 (rainfall OR precipitation)) OR ("drought* condition$") OR ((retreat* OR thaw*) NEAR/2 (ice OR glacier OR perma$frost))) OR TS=((climat* OR "weather" OR ((chang* OR increas* OR decreas* OR reduction OR reduce* OR reducing OR enhanc* OR extreme OR rise OR rising OR trend*) NEAR/2 (temperature$ OR "sea level" OR tide OR heat OR cold OR precipitation OR rainfall OR wind OR storm$ OR cyclone$ OR hurricane$ OR drought$ OR snow* OR ice* OR permafrost OR glacier))) AND (((phenolog* OR "ecosystem structure$") NEAR/2 (chang* OR shift*)) OR ((loss OR decreas* OR reduction OR reduce* OR bleach*) NEAR/2 (coral OR "species range" OR "water security" OR "kelp forest" OR macro$economic OR "crop yield$")) OR ((hazard* OR fatal* OR mortalit* death$ OR damage$) AND (flood$ OR flooding)) OR "water$borne diseas*" OR "water borne disease" OR ((displacement OR displaced OR migration) AND (human OR *national OR person)) OR refugee$ OR (increas* NEAR/2 (inequalit* OR unequal* OR "crop price$")) OR ((fatal* OR mortalit* death$) AND heat*) OR malnutrition OR malnourish*))))

... **AND** ...	
(Adaptation)	(TS = (adaptation OR (climat* NEAR/3 adapt*)) OR TS = ((increas* OR decreas* OR improve* OR enhanc* OR reduction OR reduce* OR reducing OR mitigat* OR influence$ OR development OR avoid* OR build* OR "more" OR "less") NEAR/1 (impact* OR vulnerab* OR hazard* OR exposure OR capacit* OR risk$ OR resilien* OR cope OR coping)) OR TS=((climat* OR "weather" OR ((chang* OR increas* OR decreas* OR reduction OR reduce* OR reducing OR extreme OR rise OR rising OR trend*) NEAR/2 (temperature$ OR "sea level" OR tide OR heat OR cold OR precipitation OR rainfall OR wind OR storm$ OR cyclone$ OR hurricane$ OR drought$ OR snow* OR ice* OR permafrost OR glacier))) AND (("water use efficiency" OR irrigation OR "water resource management" OR "sustainable water management" OR "coastal defence*" OR "coastal flood defence*" OR "coastal hardening" OR "sustainable aquaculture" OR "coastal zone management" OR ICZM OR ((wetland$ OR mangrove$ OR floodplain$) NEAR/2 (conservation OR restoration OR rehabilitation OR protection OR replant*)) OR "biodiversity management" OR reforestation OR afforestation OR (("wild area$" OR forest) NEAR/2 conservation) OR "ecosystem connectivity" OR "cropland management" OR "integrated soil management" OR "conservation agriculture" OR "efficien* livestock" OR agroforestry OR "livelihood diversification" OR "green infrastructure" OR "urban green space$" OR "blue* infrastructure" OR "disaster risk management" OR "disaster risk reduction" OR "health system$" OR "risk sharing" OR "risk insurance" OR resettlement) OR ("water use efficiency" OR irrigation OR "water resource management" OR "sustainable water management" OR "coastal defence*" OR "coastal flood defence*" OR "coastal hardening" OR "sustainable aquaculture" OR "coastal zone management" OR ICZM OR ((wetland$ OR mangrove$ OR floodplain$) NEAR/2 (conservation OR restoration OR rehabilitation OR protection OR replant*)) OR "biodiversity management" OR reforestation OR afforestation OR (("wild area$" OR forest) NEAR/2 conservation) OR "ecosystem connectivity" OR "cropland management" OR "integrated soil management" OR "conservation agriculture" OR "efficien* livestock" OR agroforestry OR "livelihood diversification" OR "green infrastructure" OR "urban green space$" OR "blue* infrastructure" OR "disaster risk management" OR "disaster risk reduction" OR "health system$" OR "risk sharing" OR "risk insurance" OR resettlement) OR ("sea wall*" OR "coastal protection" OR (("levee*" OR "culvert*") NEAR/2 flood*) OR ((water OR pump) NEAR/1 (storing OR storage)) OR "improv* drainage" OR "beach nourishment" OR ((flood* OR cyclone) NEAR/2 shelter) OR "building code*" OR "storm water management" OR "waste water management" OR "floating house*" OR "floating home*"OR ((variet* OR GMO OR resistant) NEAR/1 (crop* OR livestock)) OR "rainwater harvest*" OR "hazard map*" OR "hazard monitor*" OR "early warning system$" OR (building$ NEAR/1 insulation) OR (("passive cooling" OR "mechanical cooling" OR "air condition*") NEAR/2 ("residential" OR house OR housing OR home*)) OR "prescribed fire" OR "green roof$" OR (shad* NEAR/2 tree$) OR (co-manag* AND fisher*) OR "social safety net$" OR "social protection" OR "emergency medical") OR ("extension service$" OR "local knowledge" OR "traditional knowledge" OR "indigenous knowledge" OR "vulnerability map*" OR "slum upgrad*" OR "evacuation plan*") OR ((("insur*" OR "risk pool*"OR "risk sharing") NEAR/2 (crop$ OR flood* OR "index$based")) OR "catastroph* bond$" OR "water tarif$" OR "cash transfer$" OR "zoning law$" or "zoning polic*" OR "building standard$" OR "protected area" OR "protected marine area" OR "patent pool$" OR "patent pool$" OR "technology transfer" OR"disaster plan*" OR "disaster prepare*" OR "watershed management" OR "landscape

	management" OR "adaptive management" OR "sustainable forest management"))))
... **AND** ...	
(Governance)	(TS =(policy OR policies OR government* OR governance OR governing OR bureaucra* OR administration$ OR law$ OR (legal NEAR/2 require*) OR regulation$ OR rule$) OR TS = (guideline$ OR program$ OR programme$ OR scheme$ OR committee OR commitment OR committed OR institution* OR "tax" OR taxes OR taxation OR pricing OR quota OR code) OR TS=((framework OR manage* OR strateg* OR guideline OR procedure$ OR system$ OR goal$ OR plan OR plans OR planning OR planned OR decision*) NEAR/2 (adaptation OR federal OR *national OR regional OR countr* OR central OR municip* OR sate* OR provinc* OR urban OR local OR city OR cities OR firm$ OR business* OR company OR companies OR corporation$)) OR TS = (UNFCCC OR "united nations framework convention" OR COP$ OR NAPA$ OR NAP$ OR GCF OR "green climate fund" OR GEF OR "global environment facility" OR "kyoto protocol" OR "clean development mechanism" OR ((rio OR marrakesh OR marrakech OR paris OR cancun) NEAR/1 (accord$ OR agreement$ OR convention)) OR "nairobi framework" OR "nairobi work program*" OR "doha amendment")))
Note: Adaptaed from Sietsma *et al*. pre-publication protocol (Feb 8th 2022). Here, the query is presented in the Web of Science syntax. MEDLINE database was excluded from this implementation due to access restrictions.	

Supplementary Table 2.

Variables included in the study.

variable name in the data-set	description	variable type (scale)
Metadata		
`id`	the study identification number	text
`authors`	full names of authors involved in a study	text
STM inputs		
`title`	the title of the document	text
`keywords`	the keywords associated with the article (both journal and author keywords depending on availability)	text
`abstract`	the abstract of the paper	text
Independent variables		
`first_author_female`	the first author of the paper is identified as female	binary $(1, 0)$
`last_author_female`	the last author of the paper is identified as female	binary $(1, 0)$
`majority_female`	the majority of the authors of the paper are identified as female	binary $(1, 0)$
Control variables		
`first_country_gii quartile`	Gender Inequality Index quartile of the country of the first author's institutional affiliation	categorical $(1, 2, 3, 4)$
`last_country_gii quartile`	Gender Inequality Index quartile of the country of the last author's institutional affiliation	categorical $(1, 2, 3, 4)$
`year`	publication year	integer
`journal_impact _factor`	Journal Impact Factor quartile	categorical $(1, 2, 3, 4)$
Dependent variables		
`topic_prevalence`	calculated as part of the STM implementation, constitutes a score per document per topic	continuous (0-1)
`climate_justice_score`	calculated as the sum of scores per topic from the STM outputs, where all the topics are manually rated as either "social justice" topic or "other"	continuous (0-1)

Supplementary Table 3.

General outline of the steps involved in the research process.

	step / resulting N unique documents	`df_first`	`df_last`	`df_maj`
Dataset compilation				
1	implement query on Web of Science	44 685		
2	implement query on Scopus	54 140		
3	remove duplicates	70 319		
Gender prediction				
4	remove rows with missing author names and duplicates (by `'id'` AND `'author_name'`, for `df_maj`)	50 172	50 172	49 422
5	remove rows with a missing first names and initials	49 189	49 834	49 233
6	remove rows with initials	43 115	43 107	41 157
7	estimate gender and remove rows with an ambiguous gender prediction	37 482 (86,93%)	38 090 (88,36%)	25 876 (62,87%)
Evidence mapping				
8	remove rows with empty year data	36 702	37 305	25 348
9	remove rows with empty GII quartile	34 488	36 003	24 493
10	remove rows with empty journal ranking	31 422	32 873	22 266
11	configure and evaluate STM at different K values	-	-	-
12	extract topic prevalence matrices	-	-	-
Analysis & Interpretation				
13	reduce dimensionality with t-SNE	-	-	-
14	calculate effects on topic proportions	-	-	-
15	calculate differences on topic proportions	.	-	-

Supplementary Table 4.

Country-specific counts of misclassified and unclassified names after application of the gender prediction tool. As country is derived from the institutuional affiliation, it does not necessarily represent the country of origin. False and missing classifications are derived from the comparison to the manual verification of 500 authorship records.

Country	No. unclassified	No. misclassified
China	21	12
United States	10	2
Netherlands	3	0
Australia	3	1
Taiwan	2	1
South Korea	2	0
Malaysia	2	0
Belgium	2	0
Canada	2	1
Finland	1	1
Kenya	1	0
Cambodia	1	0
Morocco	1	0
Thaliand	1	0
Ethiopia	1	0
French Guiana	1	0
Italy	1	0
United Kingdom	1	0
Pakistan	0	2
Vietnam	0	1
Mexico	0	1
Egypt	0	1
Brazil	0	1
France	0	1

Supplementary Table 5.

Overview of the topics identified in the corpus of climate change adaptation policy literature with topic modelling. The topics are presented as overarching across the three analysed datasets and as arranged in broader categories for the ease of reading. There was only slight variation in topic configuration, which is described in the section 4.3 of this paper. I follow the same topic categorisation here as offered in a previous work on adaptation research (Sietsma et al., 2021).

Topic label	Associated keywords
Meteorology	
Temperatures	temperatur thermal respons plastic toler physiolog size warm rate bodi
Precipitation	variabl precipit rainfal forecast trend season period observ meteorolog dri
Seasons	season winter time summer period spring site declin record phenolog
Heat Death	air mortal exposur pollut associ increas effect death 95 temperatur
Heat Stress	heat stress cool wave hot temperatur effect worker day summer
Global Warming	global temperatur warm degre increas centuri region 1.5 mean level
Modelling and Mapping	
Impact Asessment	impact impact_chang climat_impact chang region assess climat effect impact_climat chang_impact
Modelling	model simul use predict forecast estim use_model data dynam paramet
Climate Simulation	project futur climat scenario model increas chang use simul region
Methods and Methodology	
Evaluation	perform optim oper effici propos alloc method rule design result
Spatial Data	data spatial map use area analysi region method studi base
Knowledge	research sustain review scienc challeng literatur develop address knowledg paper

Physical Environment	
Coral Reefs	resili coral reef recoveri stressor enhanc resist climate-chang disturb recov
Sea-Level	coastal rise sea level sea-level sea_rise storm coast eros beach
Ice Caps	canada arctic observ region sea snow ice glacier ocean northern
Forests	forest tree densiti stand composit structur regener plot canopi boreal
Sediment Dynamics	delta sediment salin marsh salt estuari tidal bay mekong subsid
Air Quality	qualiti air pollut concentr ozon matter sourc exposur particul quantiti
Atmospheric CO2	co2 elev atmospher concentr respons effect increas ocean acidif growth
Nature Degradation	ecolog restor mangrov blue project degrad nature-bas natur seagrass success
Land Cover	cover land surfac use area remot sens veget satellit data
Deforestation	forest deforest tropic forestri redd brazil degrad amazon reforest brazilian
Ecosystem Services	ecosystem servic provid function benefit provis valu regul trade-off biodivers
Biology	
Plant Response	gene stress express protein respons plant genom mechan regul adapt
Biodiversity	conserv biodivers habitat area connect threat threaten loss current prioriti
Plant Adaptability	popul genet local seed differenti adapt variat select among structur
Species Distribution	speci distribut habitat rang invas shift abund ecolog predict nich
Protected Areas	protect area park monitor nation manag recreat design effect within
Breeding	breed genotyp genet trait select toler varieti hybrid program use
Urban and Infrastructure	

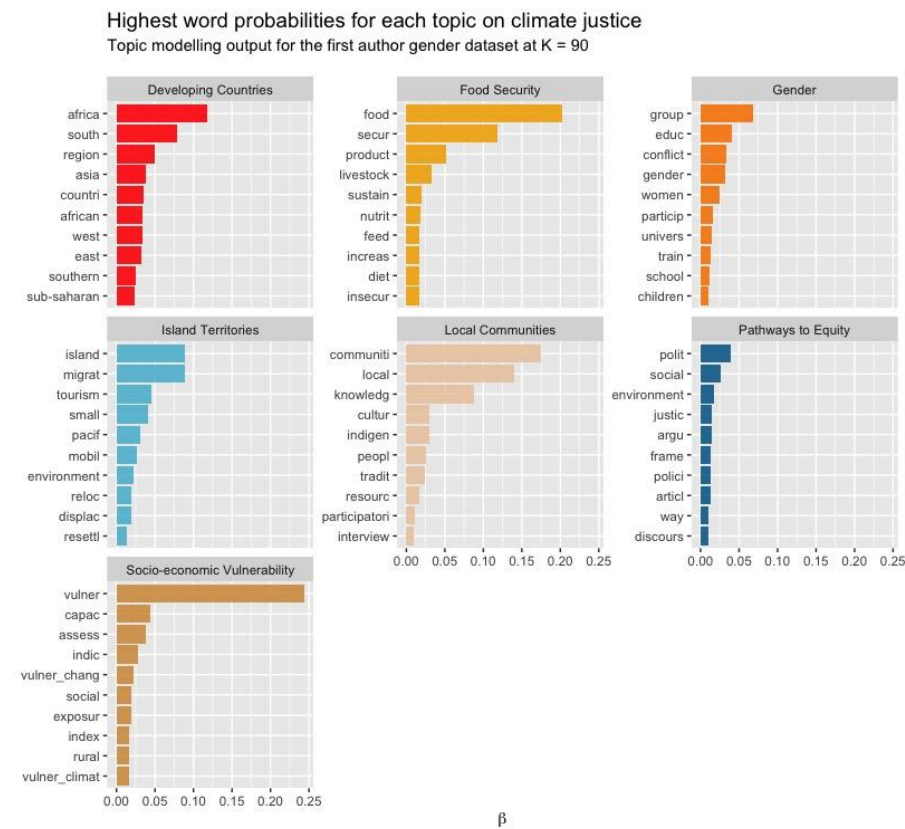|	
Urban Planning	urban citi plan green infrastructur space area develop municip sustain
Buildings	build design hous uk residenti thermal comfort built perform construct
Infrastructure	network infrastructur transport engin road vehicl travel facil safeti rout
Food and Agriculture	
Farmer Livelihood	farmer household livelihood strategi percept smallhold incom rural farm cope
Crop Production	crop product rice cultiv improv seed varieti rotat potato produc
Food Security	food secur product livestock sustain nutrit feed increas diet insecur
Coffee	suitabl america coffe north pest area shade american fruit region
Soil Fertility	soil fertil organ nitrogen moistur eros increas effect tillag field
Agriculture	agricultur farm practic adopt technolog farmer climat_agricultur sustain product intensif
Crop Yield	yield wheat maiz crop grain increas cultivar product soybean growth
Fisheries	marin fish fisheri ocean manag aquacultur social-ecolog resourc chang fisher
Nutrient Leaching	salin contamin chemic concentr sampl increas metal bloom nutrient exposur
Livestock	farm livestock incom profit diversif econom dairi increas cattl product
Water and Water Management	
Water Management	water resourc manag suppli demand water_water avail water_manag scarciti chang_water
Drainage Systems	watersh runoff drainag stormwat rainfal manag hydrolog volum control impact
Hydrology	river basin hydrolog lake reservoir catchment streamflow flow dam runoff
Irrigation	irrig effici use evapotranspir requir water area increas crop deficit
Freshwater	wetland flow freshwat stream aquat riparian river habitat floodplain salmon

Lake Euthrophication	lake nutrient contamin load level aquat phosphorus bloom eutroph isotop

Extreme Events	
Flood	flood damag loss hazard increas measur risk area mitig caus
Wildfire	fire wildfir disturb regim forest burn increas western sever fuel
Drought	drought plant water stress leaf root effici growth condit respons
Extreme Weather	extrem event weather frequenc extrem_event intens increas sever cyclon condit

Adaptation-Related Concepts	
Climate Risks	risk disast hazard reduct natur climat_risk risk_climat risk_chang chang_risk disast_reduct
Climate Strategy	climat chang climat_climat strategi chang_climat chang_chang climat_chang effect_chang respons climat_studi
Resource Management	manag land use landscap chang land-us resourc manag_chang manag_climat chang_manag
Socio-Economic Vulnerability	vulner capac assess indic vulner_chang social exposur index rural vulner_climat
Pathways to Equity	polit social environment justic argu frame polici articl way discours
Adaptation	adapt climat_adapt adapt_chang adapt_climat strategi chang_adapt plan capac chang climat
CCS	carbon sequestr storag mitig potenti net bioenergi offset remov dioxid
Climate Finance	social insur financi capit privat invest financ transfer asset shock
Green Energy	generat power wind hydropow electr capac storag speed nuclear load

Governance and Programmes	
Governance	govern institut capac learn transform actor process collabor organ challeng
Decision-Making	approach framework inform decis assess tool plan process use integr
Policy	polici develop countri nation intern implement goal climat_polici sector agreement

Health	
Health	health public care intervent includ mental outcom well-b human popul
Disease Control	diseas control covid-19 pathogen pandem infect vector transmiss outbreak host
Socioeconomic Factors	
Public Perception	percept public survey behavior communic perceiv experi awar individu respond
Displacement and Mobility	migrat conflict mobil crisi peopl displac covid-19 environment pandem social
Economic Analysis	econom cost price benefit market invest trade growth valu reduc
Local Communities	communiti local knowledg cultur indigen peopl tradit resourc participatori interview
Gender	group educ conflict gender women particip univers train school children
Tourism	mountain tourism snow region glacier alpin tourist himalaya chang destin
Culture	cultur histor past histori centuri record site reconstruct rangeland heritag
Countries and Places	
Australia	australia australian south region korea england sic new murray-darl queensland
South America	de el la chile oscil enso nino peru andes los
Mexico	divers mexico wild garden diversif relat resourc situ conserv rich
United States	state unit program us california agenc u. law feder counti
Island Territories	state island small pacif territori caribbean sid develop northwest fiji
Europe	region europ european mediterranean main area central southern northern spain
Developing Countries	africa south conflict african asia west east sub-saharan poverti countri
China	china veget region area grassland increas plateau chang arid decreas

Other/mixed	
Anthropogenic Activity	human activ natur interact environ effect anthropogen direct pressur driver
Mitigation	mitig global climat chang nan world climat_mitig need issu mani
LCA	environment impact assess cycl life use wast product treatment wastewat
Green Energy	power electr generat wind solar plant hydropow capac storag speed
Industry	econom industri sector growth economi china impact trade domest mine
GHG Emissions	emiss greenhous gas greenhous_emiss ghg reduct reduc co2 gase mitig
SSPs	futur scenario uncertainti pathway differ assess develop current combin climat_scenario
Technology	develop project technolog mechan innov transfer countri programm climat_develop chang_develop

Note: Inconsequential topics are excluded from the presentation of results. These included, for example, copyright text and measurements.
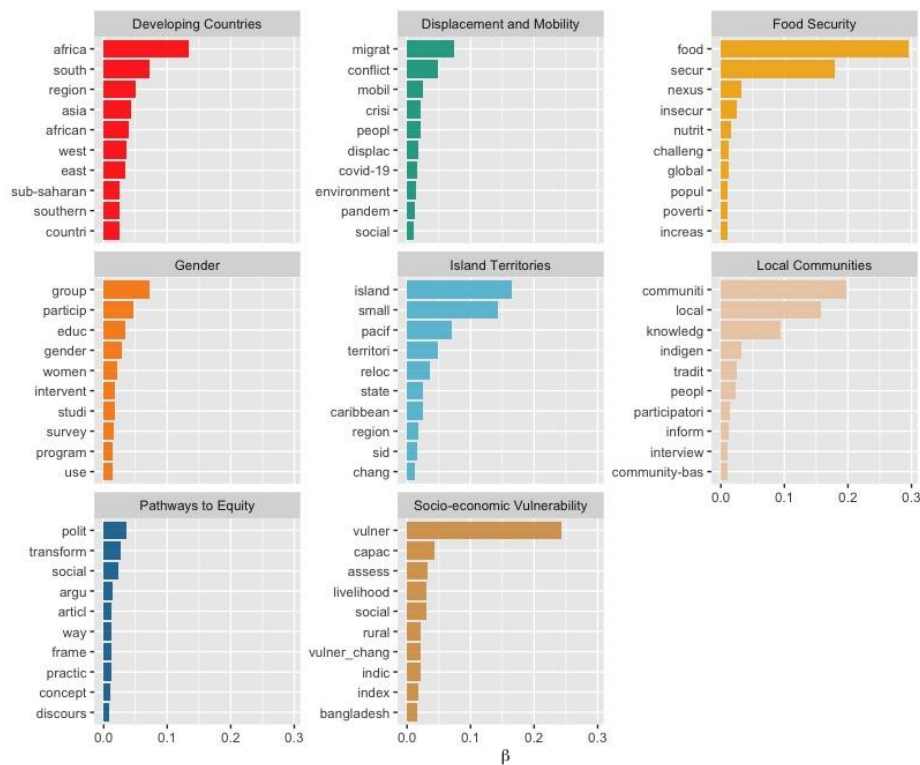
Supplementary Figure 1.

Highest word probabilities for each topic on climate justice
Topic modelling output for the first author gender dataset at K = 90

Supplementary Figure 2.

Topical space and gender of the first author
a t-SNE visualisation of the structural topic modelling output

Supplementary Figure 3.

Highest word probabilities for each topic on climate justice
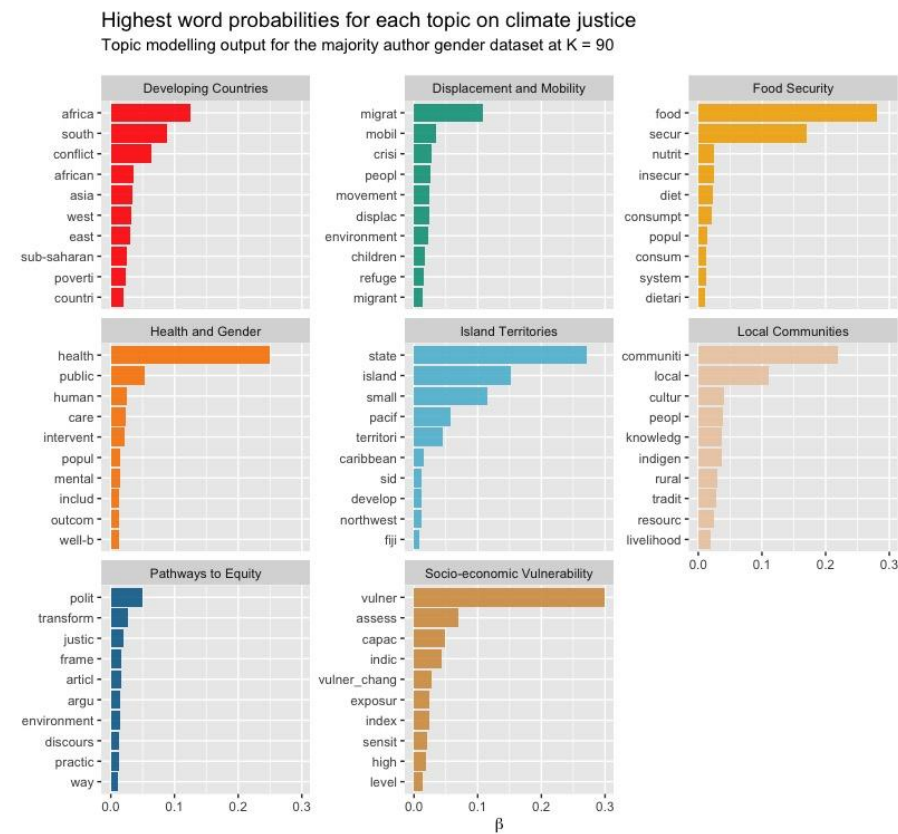Topic modelling output for the last author gender dataset at K = 100
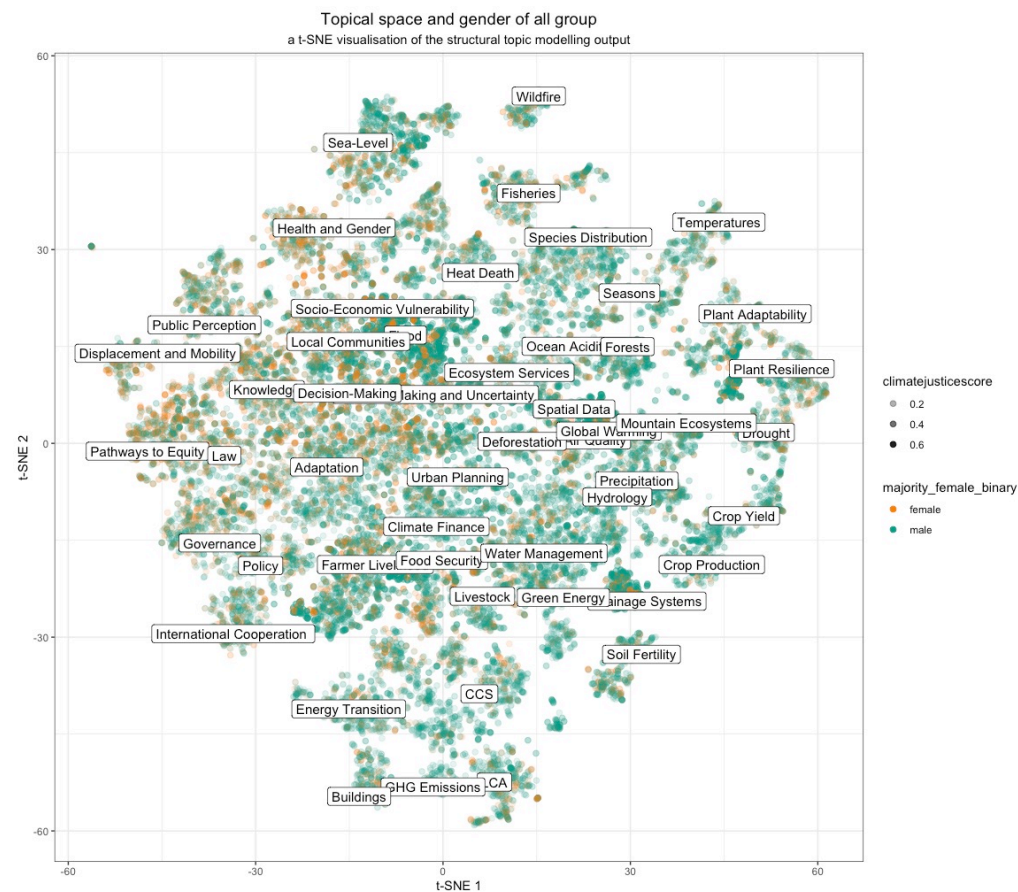

Supplementary Figure 4.

Topical space and gender of the last author
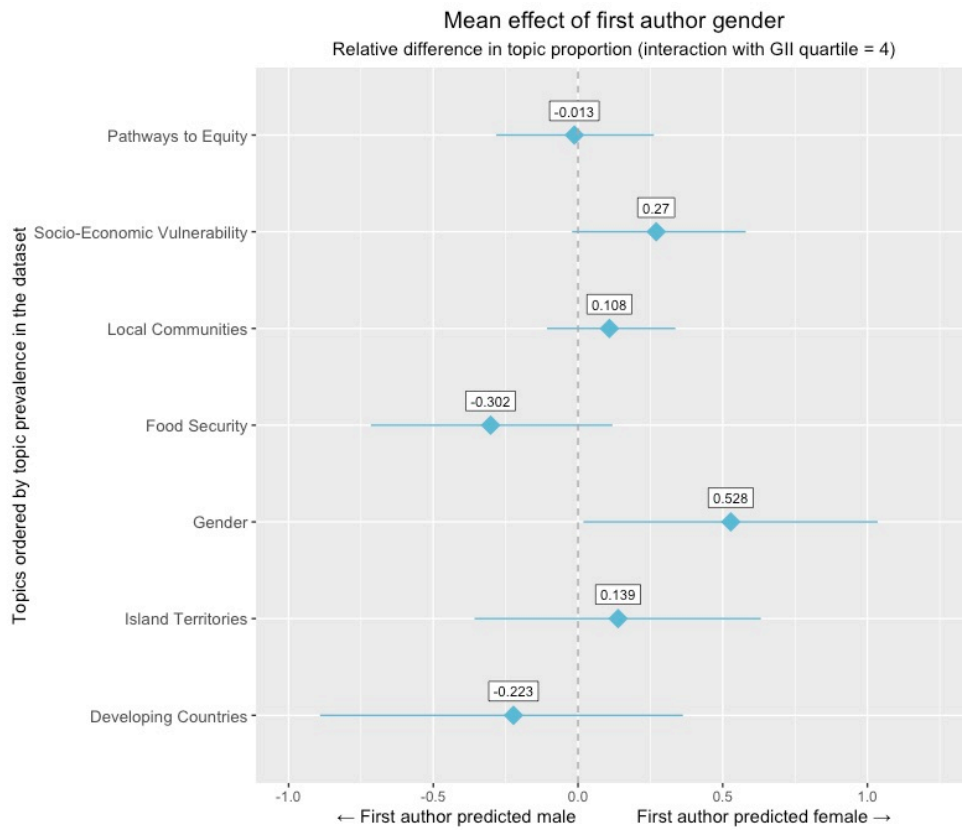a t-SNE visualisation of the structural topic modelling output
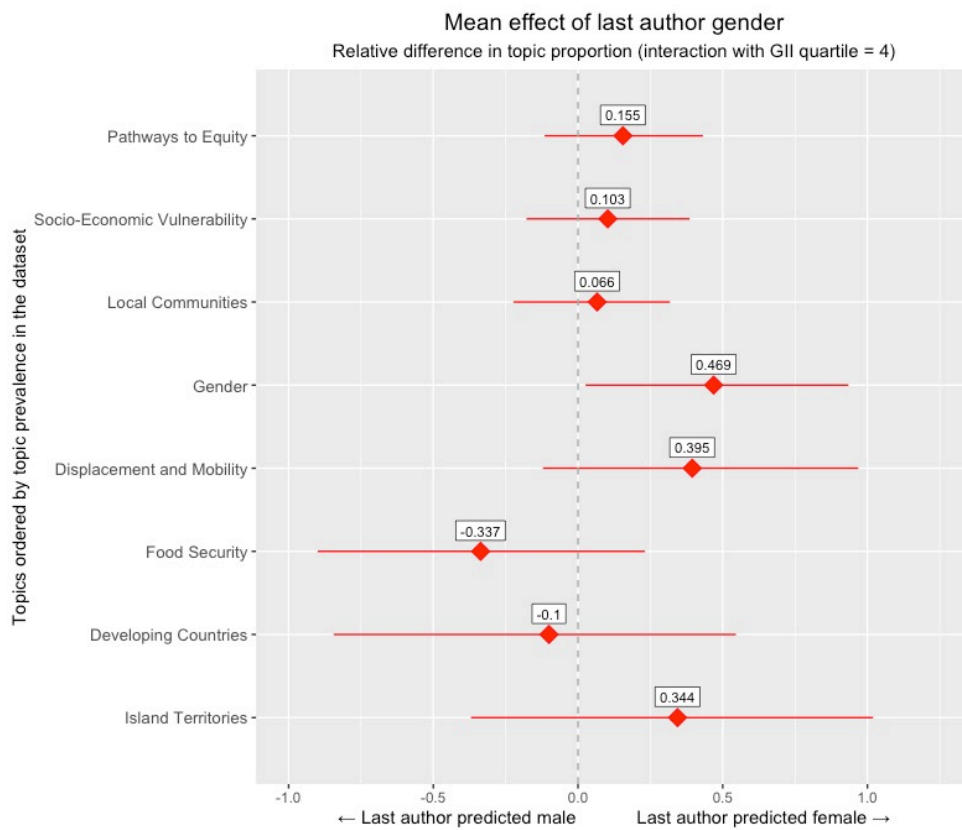
Supplementary Figure 5.

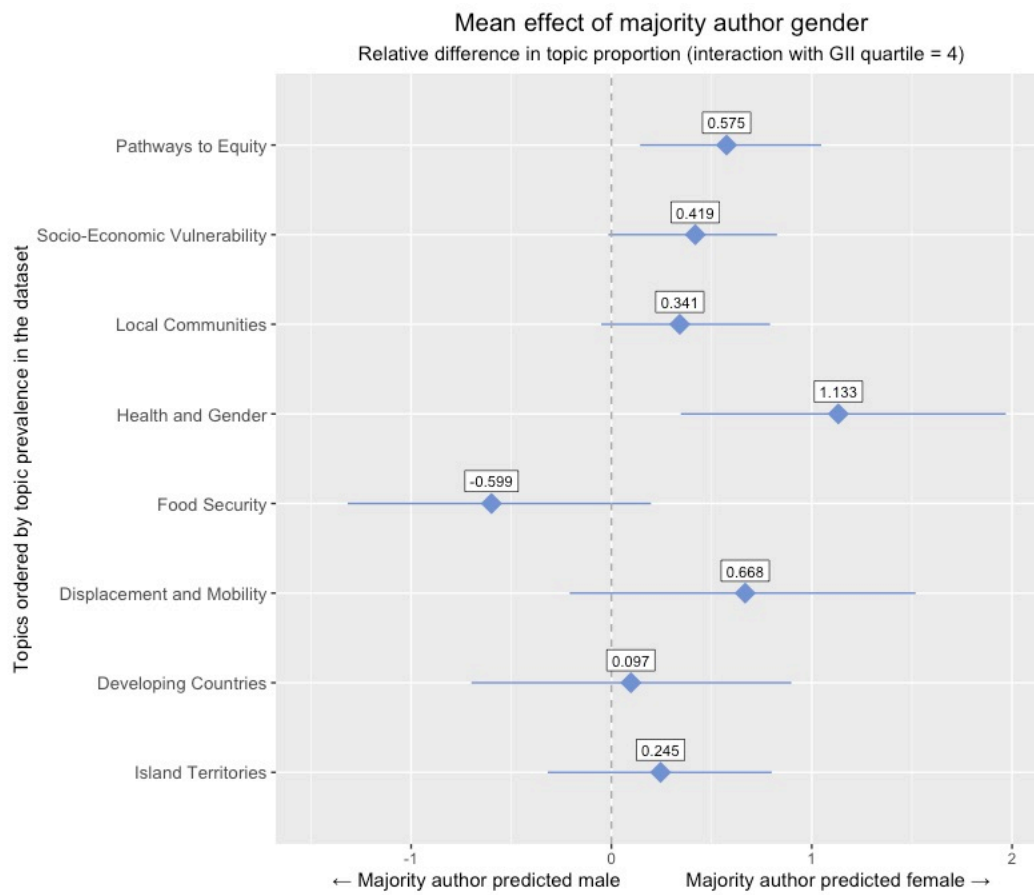Highest word probabilities for each topic on climate justice
Topic modelling output for the majority author gender dataset at K = 90

Supplementary Figure 6.

Topical space and gender of all group
a t-SNE visualisation of the structural topic modelling output

Supplementary Figure 7.

Mean effect of first author gender
Relative difference in topic proportion (interaction with GII quartile = 4)

Supplementary Figure 8.

Mean effect of last author gender
Relative difference in topic proportion (interaction with GII quartile = 4)

Supplementary Figure 9.

Mean effect of majority author gender
Relative difference in topic proportion (interaction with GII quartile = 4)

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Berlin, 17.05.2023