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## Article

# Understanding Needs and Potentials for Gender-Balanced Empowerment and Leadership in Climate Change Adaptation and Mitigation in Africa

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**Abstract:** The past years were marked by the COVID-19 pandemic, economic downfall, the 5th anniversary of the Paris Climate Agreement, and the end of the African Women’s Decade. According to the latest projections, African countries will continue to face increasing inequalities, as well as risks to human health, water and food security, due to climate change. African countries are also struggling to reduce gender-related power imbalances in adaptation and mitigation that magnify existing vulnerabilities, particularly those of women. Therefore, any advances made in this narrative are significant. This paper investigates the needs and potential for gender-balanced leadership/empowerment in adaptation and mitigation based on climate change experts’ views on the advances made in Africa. This is complemented by a bibliometric analysis of the literature published on the topic between the years 2015 and 2022. The study suggests that although women’s influence on climate change related decisions is growing, a series of barriers need to be overcome, among which are lack of knowledge and political will. The COVID-19 pandemic is seen as having both positive and negative potentials for gender-balanced leadership/empowerment. The findings provide a premise for identifying possible directions of further actions towards gender-balanced leadership/empowerment in climate change in African countries.

**Keywords:** climate change; African women; gender; empowerment; leadership



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## 1. Introduction: Climate Change–Gender Interconnections

The continuous climate crisis poses a threat to the already fragile ecosystems, livelihoods, health, food and water security, increasing poverty and marginalization. Climate change and its related issues have been investigated in various contexts in relation to a wide range of factors. One such factor is the inclusion of a gender variable. The United Nations acknowledged climate change as a non-gender-neutral phenomenon [1] and the United Nations Framework Convention on Climate Change (UNFCCC) called “... to advance knowledge and understanding of gender-responsive climate actions ... as well as women’s full, equal and meaningful participation in its process ...” [2]. Inequalities between gender groups have economic, political and social implications regarding how and whether individuals are affected by and respond to climate change [3–5]. Therefore, it is vital to understand climate change–gender interconnections, which are characterised by their complex synergies and dynamics, continuous development, and ongoing mutual impacts across all levels and dimensions. The majority of the studies are very often evidence-based and focus on the interconnection within a specific thematic and geographical context, at the

regional, national, or community level. For instance, Mensah et al. [6] investigated gender differences in adaptation strategies and climate change perception among smallholder farmers in a semi-arid region of Africa. Bunce and Ford [7] discussed the connections between gender and adaptation, resilience, and vulnerability research. The authors pointed out that the investigations are strongly focused on women's experiences [7]. von Lander Svendsen et al. [8] investigated the mutual impact of gender and climate policies, including equality in respective decision-making processes, in the Nordic countries.

Pearse [9] analysed gender and climate change relations in a broader context. The study was focused on five dimensions: (i) vulnerability and climate change impacts; (ii) adaptations in various contexts; (iii) responsibility for greenhouse gas emissions; (iv) inequalities in climate governance; (v) knowledge and social action on climate change. The author also indicated a key role of gender in social transformation in connection to climate change [9]. Brody et al. [10] extended the scope by linking the climate change–gender interconnections to (i) health; (ii) agriculture; (iii) water; (iv) wage labour; (v) disasters and their aftermath; (vi) migration; (vii) conflict [10]. In 2016, Global Gender and Climate Alliance (GGCA) report illustrated how gender differences shape vulnerability to climate change and decisions on its adaptation, including policy issues and health impacts [11].

In the broader scope, i.e., at the meta-level, climate change–gender interconnections can be clustered into three thematic domains: vulnerability, benefits and leadership/empowerment.

Climate change **vulnerability** is subject to gender differences. Women face climate change threats and struggle to overcome *its* challenges to a greater extent, as they have fewer means and adaptive capacities than men (e.g., [12–16]). Moreover, their vulnerabilities are amplified by gender imbalances in decision-making power, land ownership rights, and access to natural and financial resources, information and knowledge [17–20]. Very often, governments delay in introducing the gender variable to adaptation and mitigation processes and national climate policies [17,21–23]. Gender-blind or gender-neutral measures and policies create additional barriers to reducing and easing women's vulnerability (e.g., [24,25]).

On the other hand, attaining a gender balance might provide a range of climate-change-related **benefits**. The effectiveness of adaptation and mitigation solutions can be significantly improved as a result of gender inclusion and the more active involvement of women, who are perceived as powerful agents of change to address climate change at scale [26–32]. Furthermore, more gender-balanced representation in decision-making positively affects the integration of climate-smart agricultural technologies, the ratification of climate treaties, the building-up of community resilience and improvements in adaptive capacities e.g., [24,33–39]. According to estimations, the 20–30% increase in productivity achieved by women farmers would reduce the number of undernourished people by 100–150 million worldwide [34].

**Leadership**, empowerment, and their associated processes are crucial in confronting and overcoming global challenges such as climate change and its impacts [40,41]. Similar to other processes, leadership/empowerment in climate change is characterised by male domination, and women have limited decision-making power from local to international levels [42]. Empowerment aims to reduce power imbalances and provides women with opportunities to increase their social, economic and political capacities and make strategic choices that, in turn, contribute to adaptation strategies and related decision-making processes [43–46].

Table 1 provides examples of specific climate change–gender interconnections for each domain: vulnerability, benefits or leadership/empowerment. Given the enormity and diversity of the works, particularly at the local level, the list of included studies is far from being exhaustive.

**Table 1.** Climate change–gender interconnections.

Domains	Interconnections (Selected)	Description	Reference
Vulnerability	Natural disasters and extreme weather events	Natural disasters: extreme weather events and their subsequent impacts might disproportionately affect different gender groups, increasing existing inequalities, and undermining their water and food security. The events also narrow the gender gap in life expectancy.	[5,47–51]
	Climate change-induced displacement/migration	Climate-induced displacement is caused by an individual's inability to adapt to the environmental and the socio-economic consequences of climate change as a result of inequalities or a lack of resources. It is triggered by direct physical harm from extreme weather events or slow-onset impacts, indirect consequences on food insecurity and conflict over natural resources and land rights. Women represent more than half of displaced people. Very often, they face an increased risk of domestic or sexual violence and deterioration in their physical, emotional and mental health, and have less access to relief resources.	[52–54]
	Unequal adaptive capacities	Gender groups have unequal adaptive capacities due to a lack of or limited decision-making powers, assigned roles and tasks, labour division, gender-biased legislation, limited access to and availability of technology, economic capital and productive resources, and gaps in literacy level, health and nutritional status.	[5,17,50,51]
	Limited or no access to information, education, knowledge	Gender inequalities in access to education and information are among the key causes of vulnerability to climate change that decrease an individual's ability to build up resilience to its impacts.	[18–20]
	Limited or no access to resources (e.g., natural, financial, etc.), ownership rights	Socio-cultural gender roles and norms that determine access to resources and (land) ownership rights influence and shape an individual's vulnerability. Very often, women have limited or no access/ rights.	[17,18,55,56]
	Gender-blind climate finance/policies/interventions	Gender-blind climate finance might reinforce climate change vulnerabilities. Very often, funding institutions lack a gender perspective in their policy frameworks. Prior to 2015, projects that address climate change and women's rights received 0.01% of worldwide funding support. The efficacy and effectiveness of mitigation and adaptation interventions might be significantly reduced due to the exclusion of gender issues from climate-related projects and policies, although, in recent years, the situation has been changing.	[24,25,57,58]
	Agents of change	Women are powerful agents of change to address climate change at scale.	[24,26]
Benefits	Gendered-balanced participation and engagement	Women's increased participation in decision-making processes at various levels of governance makes considerable contributions to natural resource management, biodiversity conservation efforts, ratification of international environmental treaties, building community resilience and responding to climate-related disasters. Their expertise and experience contribute to the reduction in adverse impacts and accelerate the development of technological innovations to address climate change.	[19,24,59,60]

Table 1. Cont.

Domains	Interconnections (Selected)	Description	Reference
Leadership/ Empowerment	Climate resilience and adaptive capacity	A reduction of gender imbalances is one of the most effective mechanisms in the development of climate resilience and adaptive capacity, which, in turn, improves food security.	[26,33,61]
	Paris Agreement	Support of gender equality and women’s rights is one of the most powerful ways to implement the Paris Agreement.	[26]
	Equal representation on boards/administrative and political bodies	Equal gender representation in administrative and political bodies engaged in climate change contributes to effective climate change policies. However, sometimes, having a critical number of women on these bodies does not directly lead to the development of gender-sensitive climate change policies and/or the inclusion of gender differences in climate issues.	[60,62]
	Underrepresentation	There is a gender gap in representation (women are underrepresented) in climate-change-related decision-making processes in climate governance, including in international delegations on UNFCCC bodies.	[42,63]
	Adaptation strategies and decision-making	Adaptation capacities to climate change are positively influenced by women’s empowerment and decision-making power.	[45,46]

The current work focuses only on climate change–gender interconnections in the leadership/empowerment domain in a specific geographical region. More precisely, the paper investigates the needs and potentials for gender-balanced leadership/empowerment in climate change adaptation and mitigation, based on the views and perspectives of climate change experts regarding the advances made in a number of African countries over the last five years. The study is complemented by a bibliometric analysis (i.e., keywords and terms co-occurrence analysis) of the literature on women’s leadership and empowerment in climate change in the region published between the years 2015 and 2022.

The continuously increasing role of African nations in the global climate change negotiations, a growing action on the national level, and the transformation of women’s role as an agent of change lead to the need to ensure that gender imbalances in leadership and empowerment will be thoroughly addressed and not neglected along the way. Therefore, it is essential to demonstrate the implications of the steps that have been already taken towards attaining equality, to outline additional potential benefits and reductions in risk, in addition to simple improvements in gender-disaggregated statistical data.

The work contributes to the current literature by providing initial insights on the outcomes of the advances made in recent years. The findings can form a basis to show the importance of the measures that could be taken towards more gender-balanced leadership and empowerment in the climate change adaptation and mitigation context.

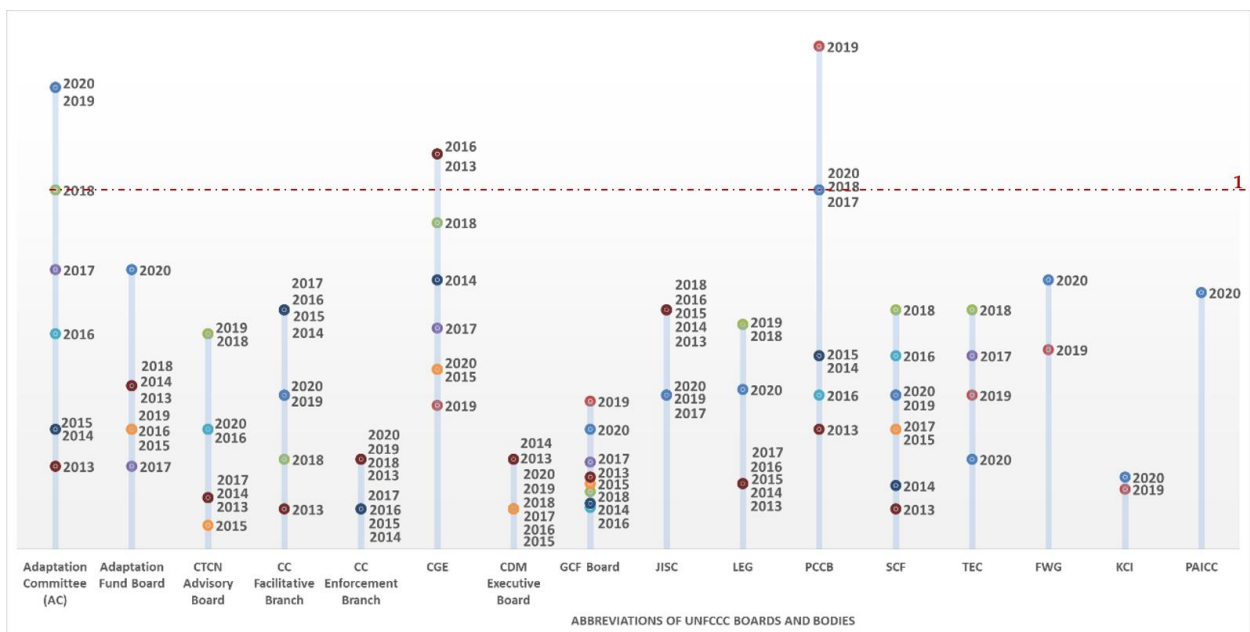
The following two sections discuss the aspects of climate change–gender leadership/empowerment interconnections and the characteristics of gender leadership/empowerment in climate change in Africa. The fourth section describes the methods used. The penultimate section presents the obtained findings and their implications for gender-balanced leadership and empowerment in climate change. The paper concludes with a summary of the findings and the study limitations.

## 2. Climate Change-Gender Interconnections in Leadership/Empowerment

Climate change leadership and empowerment with reference to gender issues at international, national or sectoral levels vary depending on a range of factors, among

which are economic development, political will, strong social rules, and beliefs. Gender imbalances in this context are perceived as one of the hindrances to more effectively addressing climate change stressors and impacts. Therefore, recent decades have been marked by initiatives to attain gender parity in climate leadership roles in governance bodies and boards across countries, sectors and levels of implementation.

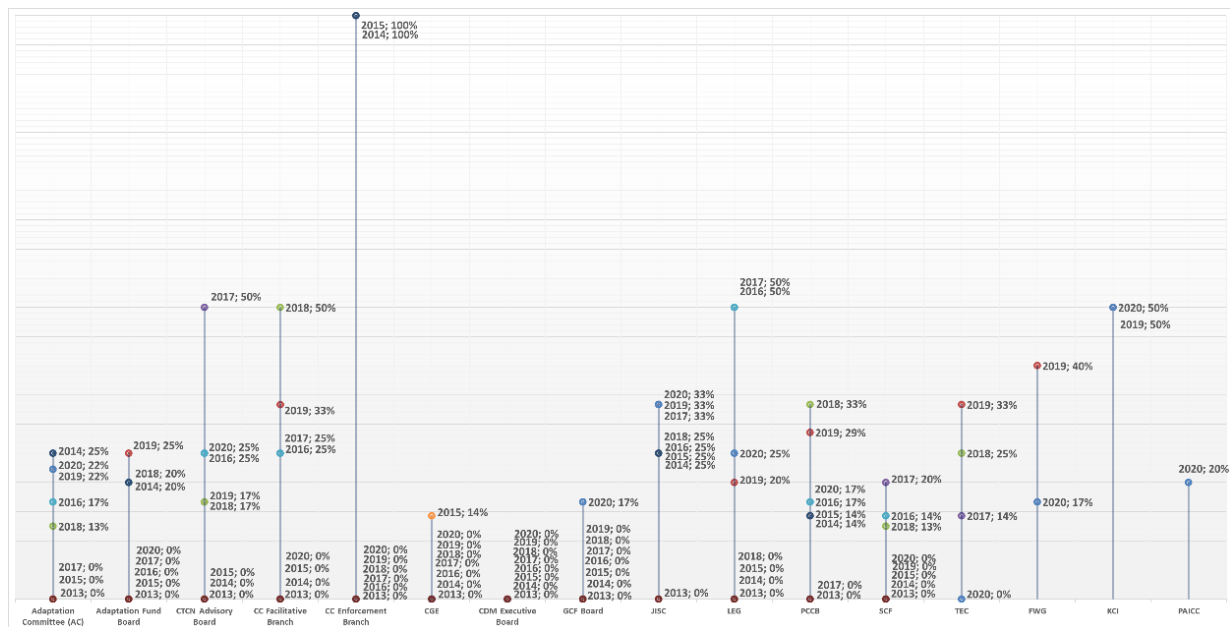
The intermediate analysis of the progress made by the United Nations Framework Convention on Climate Change (UNFCCC) demonstrated that equal or female-dominated representation was only reached in the Adaptation Committee (AC) in 2018–2020, Consultative Group of Experts (CGE) in 2013 and 2016, and Paris Committee on Capacity-Building (PCCB) in 2017–2020. Figure 1 shows the female/male ratio of the representatives on UNFCCC boards and bodies during the period 2013–2020. Values below 1 signify the prevalence of male representatives on a board or body in a particular year. Figure 2 presents the share of women who occupied the leadership position of Chair, Co-Chair or Vice Chair on these boards and bodies from 2013 to 2020. The percentage value is calculated based on the total number of female representatives on a board or body in that year. The results indicate that even the bodies/boards with a prevalence of female representatives are often male-chaired, such as the Consultative Group of Experts (CGE) in 2013 and 2016 (Figures 1 and 2). Both figures exemplify the challenging nature and complexity of the processes to achieve a significant reduction of gender gaps and attain gender parity in leadership positions in climate change related bodies. Thus, it can be assumed that similar processes at lower (e.g., regional, national and community) levels might be characterised by even larger barriers, hindrances, and complexity.



**Figure 1.** Female/male ratio of the number of the representatives on UNFCCC boards and bodies between the years 2013 and 2020, except TEC; the data have been available since 2017, FWG and KCI—since 2019, PAICC—since 2020 (based on Gender Climate Tracker); full body names are listed in Appendix A.

At the national level, according to the National Adaptation Plan (NAP) Global Network Synthesis Report, only a few nations place women as stakeholders or as agents of change rather than victims and indicate their empowerment as a priority in adaptation measures [64]. Holvoet and Inberg [65] suggested that having a woman lead the governmental agency responsible for drafting a National Adaptation Programme of Action (NAPA) does not always actively contribute to gender inclusion, women's participation, or expertise on gender in the programme or its related decision-making processes and evalua-

tion. However, Mavisakalyan and Tarverdi [66] suggested that women’s representation in national parliaments significantly contributes to the acceptance of more rigorous climate change policies across countries. Such contrary findings might exemplify not only the topic’s complexity but also the *still* low number of studies, and inconsistencies in research methodology or estimation approaches. Nevertheless, these factors do not oppose the need to reduce gender imbalances in climate change leadership and empowerment. Similarly to the situation at the international level, these processes are hindered by a range of economic, political, and cultural aspects, among which are societal resistance, lack of education, insufficient knowledge, lack of motivation or confidence, mainly among women [67,68]. Numerous case studies demonstrate diverse solutions and approaches to overcoming some of these barriers. For instance, in India, local women leaders created their own groups to adapt to the effects of climate change, increase resilience, and receive access to international sources of income and capacity-building [69]. The BSR’s Business Action for Women offered the cluster “Empowering Women to Lead through Climate Resilience”, which supports women’s empowerment in climate-resilient agriculture in the private sector by promoting gender-sensitive climate resilience methods and strategies [70].



**Figure 2.** Percentage of Female Chair, Co-Chair or Vice Chair out of the total number of female representatives on UNFCCC boards/bodies between the years 2013 and 2020, except TEC; the data have been available since 2017, FWG and KCI—since 2019, PAICC—since 2020 (based on Gender Climate Tracker); full body names are listed in Appendix A.

In the business sector, the gender discrepancies in leadership are about two times larger than they are in labour-force participation [71]. As of January 2022, only 6.6% of CEO positions in the companies listed in the S&P 500 list are occupied by women [72]. In 2021, 31% of senior leadership roles were held by women globally and 90% of firms had at least one woman in senior management [73].

In the United States, the energy sector is mainly characterised by the overrepresentation of male leaders [74], although female leadership plays a significant role in advancing energy system transformations [75]. Increasing investments in renewable energy, and companies’ more effective commitment to climate change management, including the implementation of climate policies and carbon performance, have been linked with gender diversity in companies’ leadership [74–76], and particularly with having a critical number of women in top management teams [77,78].

### 3. Gender Leadership/Empowerment in Climate Change in the African Context

Characteristics of gender leadership/empowerment in climate change in the region have been continuously changing as a result of the efforts to reduce the imbalances and transform of women's position. Nevertheless, the role of women in African countries remains dependent on geographical location and their belonging to a specific religious or ethnic group [79]. These factors create further challenges and complexities in terms of gender dynamics when shaping leadership/empowerment in climate change at every level. According to the Global Gender Gap Index, the gender-based gap that needs to be closed in the Political Empowerment dimension in African countries ranges between 44.7% (Rwanda), 50.7% (Mozambique), 95.3% (Nigeria), and 99.9% (Yemen) [80]. The studies also demonstrate men's overrepresentation in decision-making processes in the sectors sensitive to climate change [81].

Addressing gender gaps in leadership and empowerment significantly contributes to reducing vulnerability and building resilience while the continent faces high exposure to climate change and its impacts, with low adaptive capacities [82]. National governments, with the support of international organisations, introduced and implemented a set of programs (e.g., Africa Adaptation Programme (AAP)) aimed at women's empowerment, more active engagement in decision-making processes and capacity-building. The ratification of key international documents, such as the Convention on the Elimination of All Forms of Discrimination Against Women and the African Union's Protocol on the Rights of Women in Africa, paves the road for more women to enter the labour market and be promoted to managers and leaders [79]. The McKinsey Global Institute study found that if North Africa, the Middle East and sub-Saharan African countries reached their fastest-moving neighbour gender parity performance, they would contribute about USD 0.9 trillion to the global gross domestic product (GDP) in 2025 [83].

In 2013–2014, the African Working Group on Gender and Climate Change (AWGGCC) and Women and Gender Programme on Climate Change were established to support the engagement of African countries in global and regional climate change-gender processes, as well as the participation of women negotiators in climate action [84]. At the national level, 85% of the submitted Nationally Determined Contribution (NDC) reports referenced gender [85]. Furthermore, countries supported by the international community introduced a range of initiatives with the inclusion of the gender variable. For instance, in Niger, the gender dimension was included in the Climate Risk Management Technical Assistance Project (CRM/TASP). A gender intervention approach, "Transformative Adaptation-Prioritizing the Adaptation Needs of Women in the AAP", focused on climate change adaptation, was presented in Nigeria. In Kenya, steps were taken to mainstream gender into the country's climate change response strategy and to improve women's ability to adapt to climate change impacts through their empowerment [22].

Despite the growing trend of this type of action, the majority of studies at present focus on or refer to one of these two issues: (i) gender imbalance, its causes, and associated impacts, (e.g., [65,86–88]); (ii) actions taken to reduce these, (e.g., [89–92]).

### 4. Materials and Methods

The study used two methods: a bibliometric analysis and an online questionnaire.

#### 4.1. Bibliometric Analysis

Bibliometric analysis has attracted growing attention among scholars as a tool to evaluate the relevant scientific literature and identify publication trends and research elements. This analysis was performed to outline prominent themes in the climate change–gender domain in leadership/empowerment in selected African countries. The datasets used included peer-reviewed and grey literature, retrieved from the Web of Science (WoS) core collection, Scopus, and Google Scholar (GS) databases. These three databases represent the largest collections of scientific and scholarly publications published worldwide. The downloaded datasets included such variables as publication title, keywords, abstract, au-



thors' name, year of publication, and journal name. However, only the first three variables were used for analysis and the rest were used for cross-checking and the elimination of duplicates.

Table 2 the search data range was limited to the years 2015–2022 and specific geographical locations. The datasets were retrieved in February 2022. Only publications in English were selected.

**Table 2.** Selection criteria.

Criteria	Description
Data range	2015–2022
Language	English
Type of publication	All types available in the collections
Databases	Scopus, Web of Science, Google Scholar
Geographical focus	Selected African countries

The search query returned publications where the defined key terms appeared in titles and abstracts or as keywords. The main key terms were 'climate change', terms associated with 'leadership' and 'empowerment', and names of the online questionnaire respondents' countries. It is worth mentioning that, in this article, the terms 'gender' and 'women' were used as synonyms.

The set of the Google Scholar publications was retrieved using the Publish or Perish software program [93] based on the appearance of indicated keywords similar to those used for the Scopus and WoS search. The full search strings included the following key terms, attributes, and Boolean operators:

Web of Science:

TS = ((wom\*n OR gender) AND ("climat\* chang\*" OR "climat\* adapt\*" OR "climat\* mitigat\*") AND (leader\* OR empower\* OR "decision-making" OR negotiat\*) AND (afric\* OR tanzan\* OR niger\* OR kenya OR cameroon OR gambia OR eswatini OR congo OR uganda OR ethiopia OR tunis\*)) Data range: 1 January 2015 to 26 January 2022.

Scopus:

TITLE-ABS-KEY ((wom\*n OR gender) AND ("climat\* chang\*" OR "climat\* adapt\*" OR "climat\* mitigat\*") AND (leader\* OR empower\* OR "decision-making" OR negotiat\*) AND (afric\* OR tanzan\* OR niger\* OR kenya OR cameroon OR gambia OR eswatini OR congo OR uganda OR ethiopia OR tunis\*)) AND (PUBYEAR > 2014)

Google Scholar:

Keywords: (women OR gender) AND ("climate change" OR "climat\* adaptation" OR "climate mitigation") AND (leader OR empowerment OR "decision-making" OR negotiation) AND (africa OR tanzania OR niger\* OR kenya OR cameroon OR gambia OR eswatini OR congo OR uganda OR ethiopia OR tunisia) Years: 2015 to 2022; Other options: exclude citations; exclude patents.

Both the joined Scopus/WoS and Google Scholar (GS) datasets were used as the input data for co-occurrence analysis. This was based on keywords and terms that appeared in the titles and abstracts of the publications included in each dataset [94]. Titles, keywords, and abstracts were considered to effectively describe and reflect papers' contents [95]. This type of analysis is a favourable tool to identify prominent topic clusters. The VOSviewer software [96] was used to conduct the analysis and visualise its results in the form of network maps. Each node in a network represents a term or keyword. The size of the node indicates the occurrence of the term/keyword; the larger the node, the higher the occurrence of the term/keyword. All nodes are divided into thematic clusters, which are differentiated by colours.

#### 4.2. Online Questionnaire

The online questionnaire was developed to collect the opinions of experts who are engaged in climate-change-related field(s) in African countries on the advances made to attain gender-balanced leadership/empowerment in climate change adaptation and mitigation.

The set of 40 questions was characterised by several different types of question, including closed and open-ended questions. The Likert scale was used to assess respondents' agreement/disagreement with a particular situation, state, or achievement. A relatively large number of open questions was included to provide respondents with more opportunities to share their experiences and comments, rather than limiting their responses to already provided specific answers. This questionnaire structure was chosen to reduce authors' biases, which might affect the range and direction of close answers. Consequently, it was expected that this may result in a lower-than-usual number of questionnaire respondents. The responses were collected anonymously, and respondents were asked for their consent. The questions referred to the period of the last five years.

Thematically, the questions were divided into several blocks: (i) questions on respondents' characteristics (e.g., country, experience and engagement in *climate change* related field(s), etc.), (ii) questions focused on women's/men's situation regarding climate change in their country, (iii) questions focused on advances made in the field over the last five years, and (iv) questions asking the respondents to share their comments on possible solutions.

The initial set of questions was reviewed by external experts from related fields. The latest version of the questionnaire was adjusted based on their comments and recommendations. The MS Excel software was used to conduct the statistical analysis and visualise the obtained findings. The invitation to participate in the questionnaire was distributed via a number of thematic expert networks and mailing lists. The voluntary nature of participation reduced the number of respondents to those who expressed their interest in sharing their opinion and views on the matter based on their experience. The participants were not necessarily gender experts, nor did they all participate in gender mainstreaming activities. The type of expertise and geographical diversity of the respondents were not predefined, and the instrument was open to experts engaged in *climate change* related fields from any African country.

### 5. Results and Discussion

#### 5.1. Bibliometric Analysis

The results of the bibliometric analysis based on the joined (Scopus/WoS) dataset of 137 publications and the GS dataset of 995 publications outlined the following characteristics of the overall thematic structure of the climate change–gender domain in leadership/empowerment in the selected African countries. The large difference in the number of retrieved publications demonstrated a significant prevalence of the grey literature. This leads to the conclusion that topics relevant to this domain are of more interest among civil society and international development organisations compared to the scientific community. It might also imply that the respective literature mainly discusses the applied rather than the theoretical aspects.

The co-occurrence analysis demonstrated that, thematically, the domain is divided into five major clusters based on keywords (Figure 3a,b), and into four (Scopus/WoS dataset) and six (GS dataset) clusters based on terms (Figure 3c,d). The maps of terms are more comprehensive and complement the co-occurrence maps of keywords. By analysing all clusters, the thematic structure of the domain could be outlined as follows. The key topics discussed that pertained to climate change–gender in leadership/empowerment were those related to agriculture, food security, vulnerability, adaptation mechanisms, resilience, gender gaps and differences. The prominence of 'agriculture' and related issues is apparent, due to the multiple threats that climate change poses to the sector, including threats to wellbeing, livelihood and food security [97–100]. Furthermore, the rural population, which comprises, on average, about 52% of the total population in Africa [101] and mainly relies on agricultural activities, is becoming more vulnerable, particularly women who are poorer

and have less access to, e.g., financial and natural resources, knowledge and information, limited or no land ownership rights, and lower adaptive and coping capacities [45,102,103]. On the other hand, the effectiveness of adaptation mechanisms depends not only on their gender sensitivity but also on women’s inclusion in decision-making processes and their presence in leadership positions on relevant boards and bodies, due to the significant positive contributions that women make to climate change solutions (e.g., [22,32,66,91,104]).

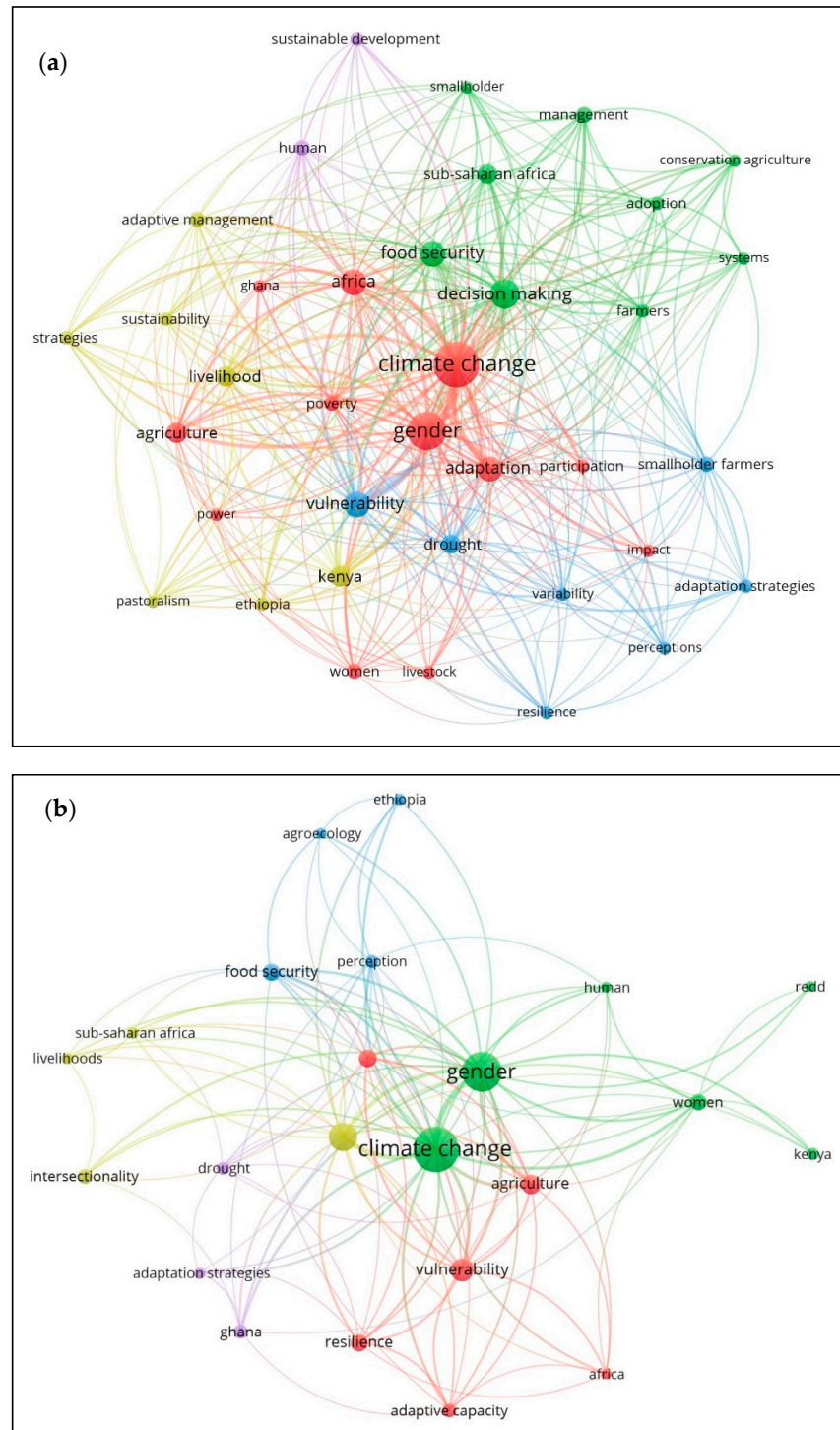


Figure 3. Cont.



to the COVID-19 pandemic is still significantly low, even though there are works on climate change–gender without connection to leadership/empowerment, e.g., [105–107].

## 5.2. Online Questionnaire

### 5.2.1. Respondents' Characteristics

Thirty experts from South Africa, Tunisia, Uganda, Nigeria, Niger, Cameroon, DR Congo, Kenya, Gambia, Tanzania, Ethiopia, and Swaziland participated in the online questionnaire (Figure 4).

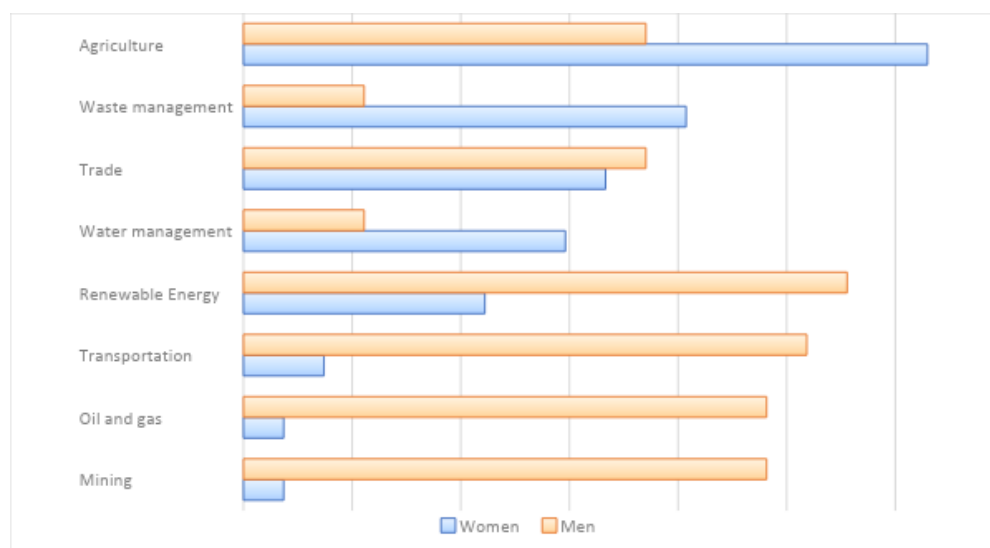


**Figure 4.** Countries of the respondents participated in the online questionnaire (created with Datawrapper).

The respondents were representatives of academia, business, international, governmental, and non-profit organisations, working in one or more of the following fields: climate change assessment, climate change impacts, climate projections, climate change and conservation, climate change mitigation, climate change adaptation and resilience, climate education and climate change governance. Their international, regional, national or community working experience in the field(s) ranged from less than five years (7% of the respondents) to more than five (50% of the respondents), ten, and more (43% of the respondents) years.

### 5.2.2. Women's Leadership/Empowerment in Climate Change

The dynamics between the economic sectors and climate change is characterised, among others, by the gendered support received by individuals engaged in the sector. The respondents were asked to compare and indicate sectors in which women are better-supported than men and vice versa. Based on their assessment, women are supported best in agriculture, followed by water and waste management (Figure 5). The attention paid to the agricultural sector is explained by its large share in total employment, i.e., 43.8% as of 2020 [108]. Being on the frontline of the sector, women's participation in the labour force varies, on average, between 40 and 43% depending on the country, crop, and type of activity [109,110]. Agriculture is characterised by gender imbalances in decision-making power and leadership, as well as by gaps in adaptive capacities to climate change [56].

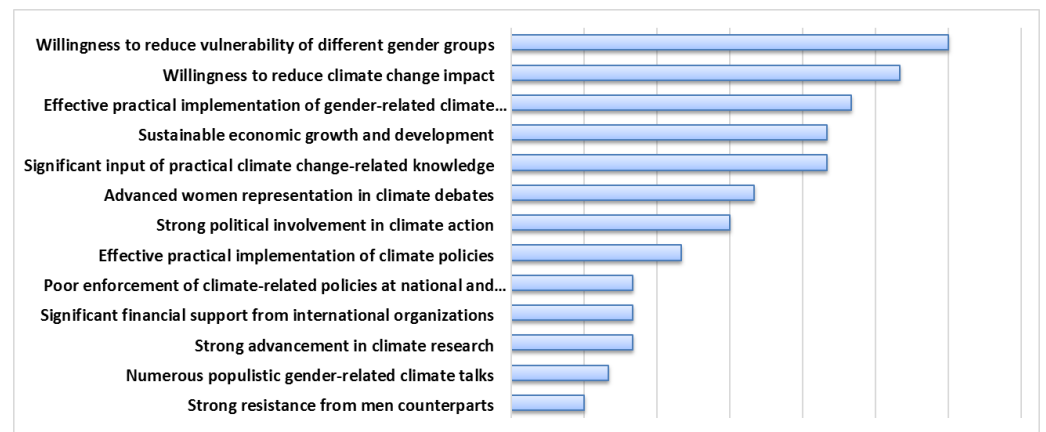


**Figure 5.** Sectors with better support.

It is worth mentioning that the respondents named renewable energy, transportation, oil, gas, and mining as the sectors in which men receive better support than women (Figure 5). This opinion might be expected regarding oil, gas and mining, since these are often considered male-dominated industries [111,112]. However, renewable energy has often been positioned as an industry that provides a substantial opportunity for women's empowerment through their inclusion in decision-making processes and the energy-value chain because the continent has significant potential for clean energy [113]. Since the countries are challenging to design and implement gender-sensitive climate programmes and policies with reference to the energy sector [113], it might be assumed that the support provided for women in renewables has low visibility or is still not sufficient enough to be noted by the outer audience.

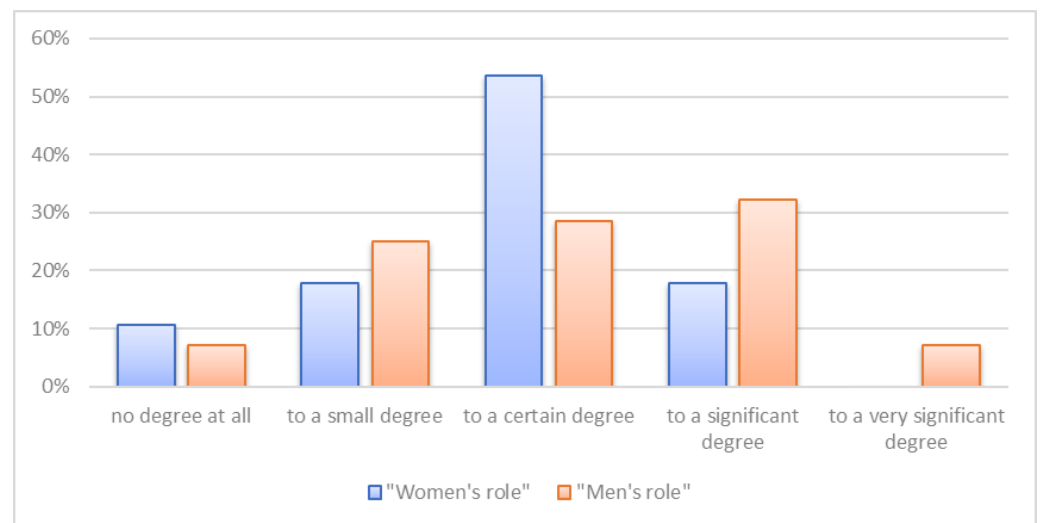
When defining the characteristics of women's leadership in climate change, the majority of respondents indicated factors such as willingness to reduce climate change impact and the vulnerability of different gender groups, the effective, practical implementation of gender-related climate decisions, sustainable economic growth and development (Figure 6). These responses come along with studies that posture women leaders as contributors to more rigorous climate action and resilience, successful adaptation and mitigation strategies, and innovative and sustainable solutions [114–116]. They also take the lead in advocating for behavioral changes to reduce climate change impacts and improve the wellbeing of disadvantaged and marginalized groups [114–116].

It is worth mentioning that, despite the widespread notion of male domination in decision-making power and their overrepresentation in leadership positions [15,63,117], only a few respondents saw strong resistance from male counterparts as a characteristic of women's leadership. Several assumptions could be made based on these results. Firstly, if this type of resistance does exist, it is hardly identified or is not visible, particularly to those whose climate-change-related working area is not directly interconnected with 'gender/women' issues. Secondly, the significance of other factors affecting women's leadership in climate change is so large that it eliminates even the need for such resistance to develop. Among these factors are the economic and social gender inequalities that exist in societies that lock women's leadership potential away. The majority of these inequalities refer to legal rights, access to education, resources, power, opportunities to build social capital, etc. (e.g., [114,118]).



**Figure 6.** Characteristics of women's leadership in climate change.

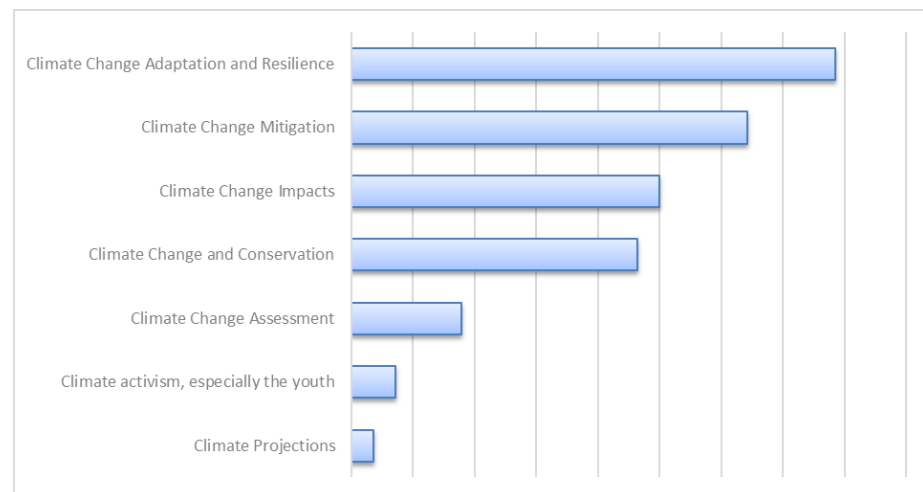
When assessing the change in women's and men's roles in climate action over the investigated period (Figure 7), the respondents indicated a range from no degree at all to a very significant degree for both roles. Women's roles have changed to a certain degree, while men's roles have changed to small, significant and very significant degrees. These changes might reflect the measures taken regarding the countries' international and national gender-related obligations in climate change. It is worth mentioning that even if the assessment based on the respondents' experience and observations is subjective, in some cases, this might paint a better picture of the actual and visible outcomes of the progress that has been made on this matter than available, statistical, gender-disaggregated data.



**Figure 7.** Change in women's and men's roles in climate action.

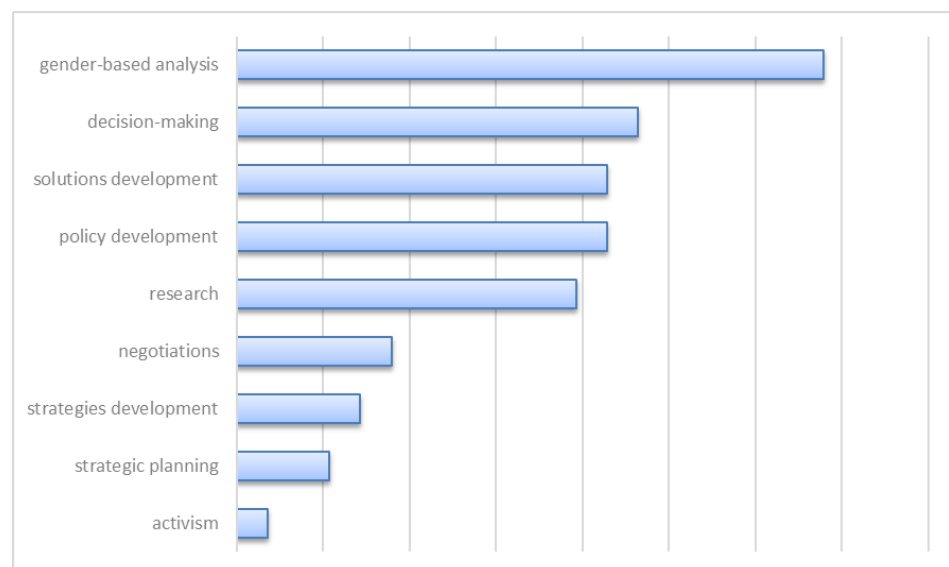
The change in women's roles is associated among others with advances in their empowerment and engagement in climate change related processes.

When identifying the areas in which women have become more empowered, the majority of respondents named climate change adaptation, resilience, mitigation, impacts, and conservation (Figure 8). Considering the extent of African women's vulnerability to climate change stressors [119], the named areas represent key targets for relevant measures to be applied. The obtained results are not only expected to significantly reduce vulnerability and improve livelihood, but also to have positive impacts on other climate change and gender-related areas.



**Figure 8.** Areas where women's empowerment has most increased.

During the past five years, the advances in women's engagement in climate change related processes have been associated with their larger involvement in gender-based analysis, decision-making, solutions and policy development and research (Figure 9). The predominance of the first two processes reflects the greater attention given to, and effectiveness of, measures to include the gender variable in climate change. The gender-based analysis helps to identify inequalities, provides information on women's and men's different roles, and considers policies and legislation in terms of gender outcomes or potential differential impacts [120]. Respondents listed adaptation, mitigation, emission and disaster risk reduction, as well as financial resources and education, as areas that require further intervention due to the still-significant unequal gender representation in leadership positions and poor levels of women's empowerment.

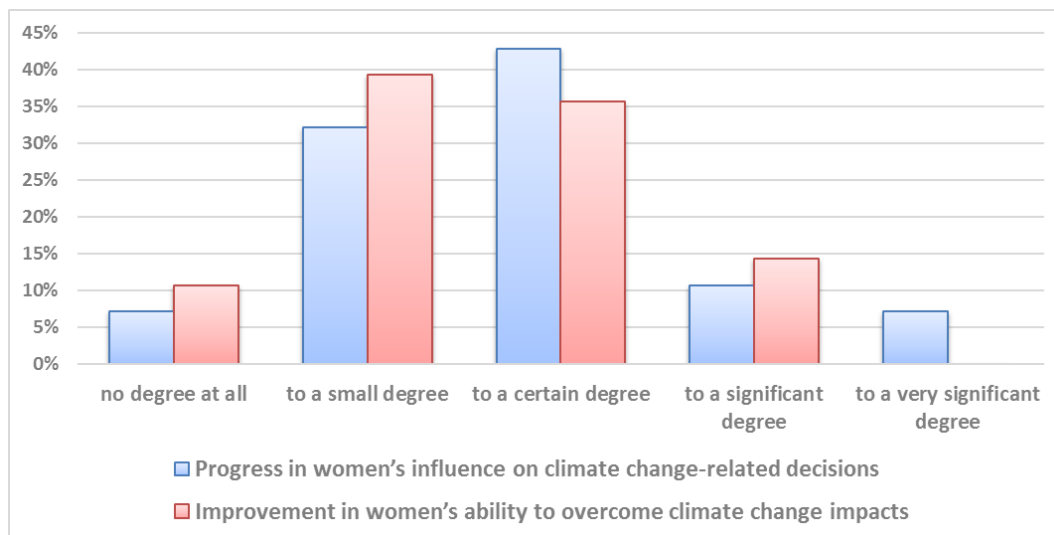


**Figure 9.** The extent of women's engagement in climate-change-related processes.

However, the increase in women's participation in climate change related processes does not always directly correlate with their influence on decision-making. Often, women's engagement signifies only their presence, without their opinions being taken into account by male colleagues. The respondents assessed the progress in women's influence, and rating it from no degree at all to a very significant degree, with the majority of responses referring to a small or certain degree (Figure 10). They also noted the change in women's



ability to overcome the impacts of climate change, which is unequivocally interconnected with their growing influence (Figure 10). To ensure that women's inclusion in decision-making attains its objectives, it is necessary to assign the smallest weight to quantitative indicators of their presence when assessing the effectiveness of the respective measures. Undoubtedly, this will significantly increase the complexity of the process, but diminish the formal nature of the 'gender' requirement.



**Figure 10.** Progress in women's influence on climate-change-related decisions and improvements in their ability to overcome the impacts of climate change.





















Indicating potential hindrances to women's representation in climate-related leadership positions, the majority of respondents agreed on the lack of factors such as women's confidence in their ability to participate, social and professional experience, accumulated career capital, networks and contacts, as well as referencing women's low socio-economic status (Table 3). These factors are not specific to the climate change domain. Some of these barriers are also indicated in studies on women's potential and abilities to attain leadership positions in other areas, for instance, academia, business sectors, health care, and public sectors [121–123]. However, the respondents do not consider the women's lack of leadership ambitions or a negative attitude towards this type of activity as being among these barriers (Table 3).

Assessing the overall outcomes of changes in women's and men's roles in climate action, the majority of respondents indicated their positive rather than negative character (Table 4). More than half of respondents also suggested a positive correlation between the number of women in climate-related leadership positions and the number of national gender-responsive climate policies, plans and programmes. These results follow earlier studies on the link between the number of women in leadership positions and the introduction of climate-related measures [66,124], supported by the works that indicate women's essential contribution to climate action [45,46,60]. However, there are no works focusing solely on the change in men's role in climate action and its outcomes. Therefore, the specific characteristics of the 'new' roles of both women and men, and scale and effectiveness assessments of their positive and negative outcomes, require further, more rigorous investigation that lies beyond the scope of this work.

**Table 3.** Barriers to women’s representation in climate-related leadership positions.

	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
Lack of women’s leadership ambitions					
Lack of women’s confidence in their ability to participate					
Lack of knowledge and expertise					
Lack of social and professional experience					
Lack of accumulated career capital					
Lack of qualities and skills					
Lack of political will in the country despite international gender equality commitments					
Women’s negative attitude towards leadership activities					
Low socio-economic status of women					
Lack of role models of women leaders					
Lack of the networks and contacts					

**Table 4.** Outcomes of the change in women’s and men’s roles in climate action.

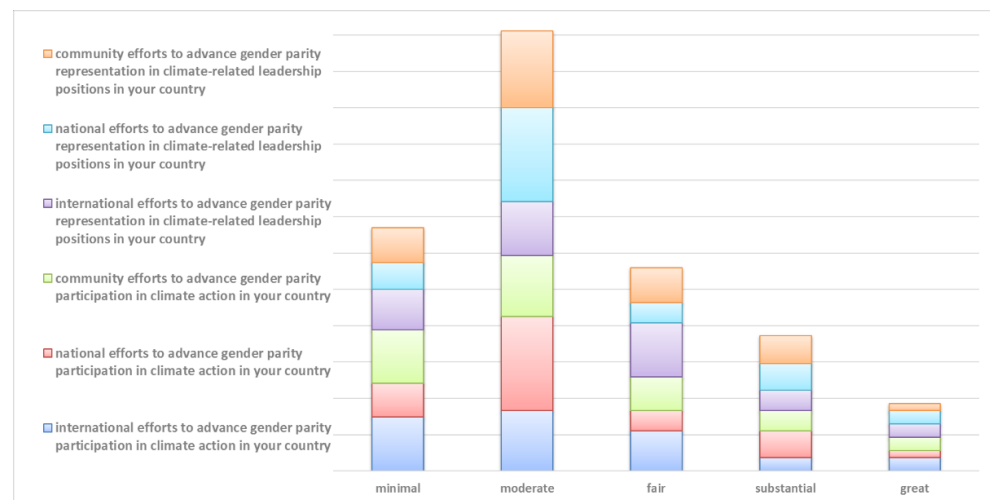
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A change in women’s role in climate action over the last five years, if any, has led to positive outcomes					
A change in men’s role in climate action over the last five years, if any, has led to positive outcomes					
A change in women’s role in climate action over the last five years, if any, has led to negative outcomes					
A change in men’s role in climate action over the last five years, if any, has led to negative outcomes					

To consolidate and strengthen the positive results that have already been achieved in the reduction of gender imbalances in climate-related leadership positions, the factors perceived as hindrances should continue to be addressed. Among the possible measures, the respondents suggested improving climate change knowledge-sharing, additional training and the development of capacity-building, the introduction of a gender quota system and a reduction in corruption in recruitment processes. However, they expressed concern that the prioritisation of gender-based over merit-based opportunities might lead to negative consequences, including the amplification of stereotypes in case of women’s failure.

Other issues that were raised included the need to guide *particularly* male leaders on ways to include women in climate action and demonstrate how their behaviour could affect women’s engagement. Often, climate change–gender studies are women-centric [7], discussing their vulnerabilities, empowerment and leadership, adaptation and mitigation. There is a very little investigation on men’s attitudes, perceptions and opinions with respect to female leadership, empowerment and their roles as potential agents of change for climate change solutions.

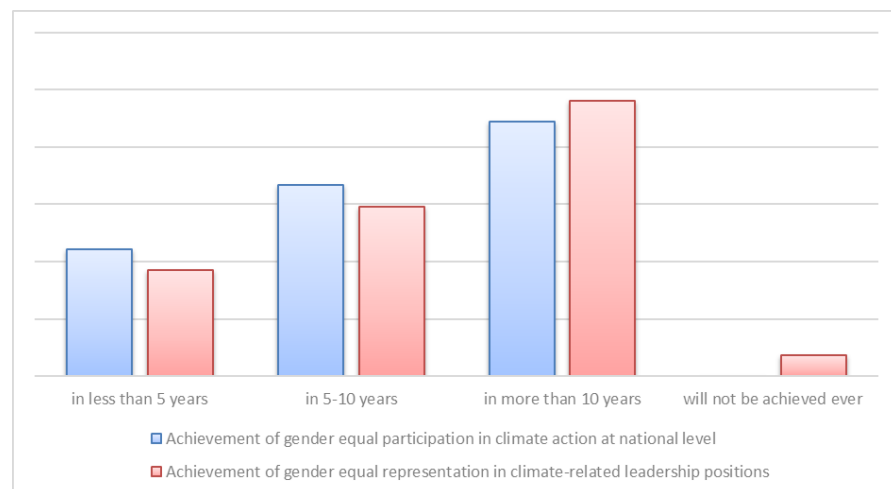
It is worth mentioning that, even after overcoming the barriers to leadership positions, women continue to face a range of challenges. In this respect, the respondents outlined factors including insufficient education, training, skills, expertise, or experience, lack of political will and governmental support, and weak institutional linkages. It is important to note that some of these challenges are similar to the aforementioned causes of women’s under-representation in leadership positions. Other factors include cultural and societal barriers and stereotypes, lack of or insufficient financial resources, and the corruption and non-transparency of selection processes.

The development, introduction and implementation of measures to overcome these challenges require the active involvement of different actors. The respondents outlined the role of national governments and experienced civil servants in encouraging women’s advancement to leadership positions. However, the international, national and community efforts that have been taken to advance gender-equal participation in climate action and representation in climate-related positions in recent years were mainly assessed as being moderate (Figure 11). These results are in line with the global concern over the slow pace of progress towards reductions of gender imbalances in leadership and empowerment in climate change [63].



**Figure 11.** Efforts to advance gender-equal participation and representation in climate action and leadership positions.

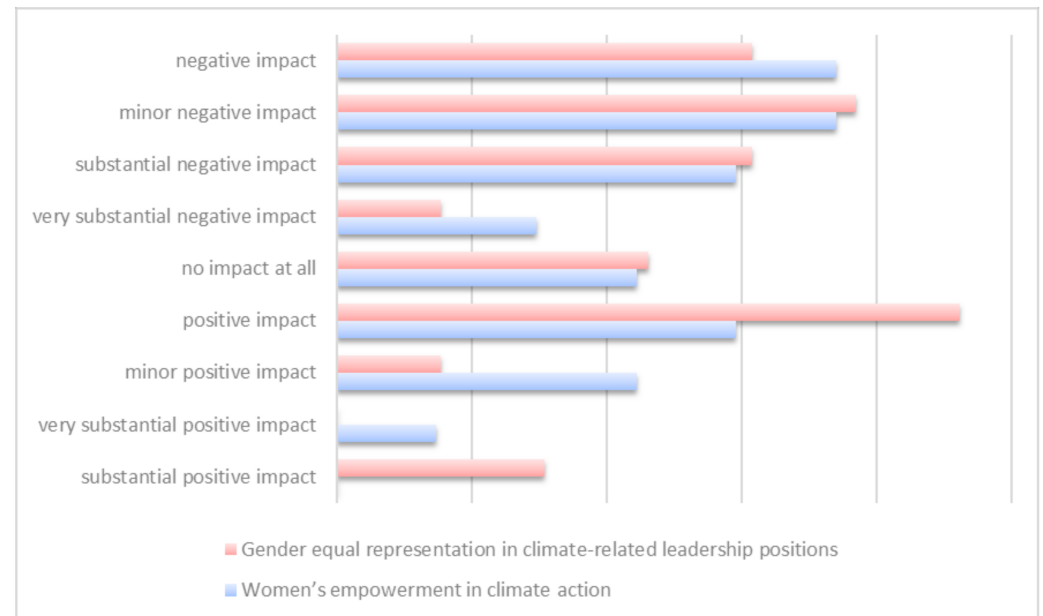
Assessing the potential timeframe to achieve gender-equal participation and representation in climate leadership in their countries, the respondents' opinions varied between less than 5 years and more than 10 years, with the latter slightly prevailing. Several respondents were even more pessimistic, indicating that gender-equal representation will never be achieved (Figure 12). At international level, the UNFCCC estimated that the gender-balanced representation of delegates will be achieved in 24 years and of COP Heads of Delegation in 46 years following the current rate of change [125]. At national level, considering the recent global emergencies and the state of the global economy, it is very difficult to project the amount of time that will be required by the countries to achieve gender-balanced participation and leadership in their climate action.



**Figure 12.** Time needed to achieve gender-equal participation and representation in leadership positions in climate action at the national level.

One such global emergency is COVID-19 and its impacts. The pandemic unveiled and further amplified existing climate change vulnerabilities, including those related to gender inequalities [106,126,127]. Furthermore, there has been a concern that the pandemic might undermine actions taken towards climate change mitigation and reduction of gender imbalances [128–130]. However, some works claim that the recovery plans could be seen as a strategic opportunity to use the lessons learned and additionally stimulate the climate agenda and its objectives [131,132]. The gender-related measures taken in

response to COVID-19 could also be applied to address the gender-related impacts of climate change [105,129]. The respondents did not come to an agreement on whether the pandemic's impacts on advancing gender-equal representation in climate-related leadership positions and women's empowerment in climate action were positive or negative. Their opinion ranged from a minor negative to a very substantial positive impact (Figure 13).



**Figure 13.** Impact of the COVID-19 pandemic.

Considering the time required to develop, introduce and implement COVID-adjusted measures regarding gender-balanced leadership and women's empowerment in climate action, it is challenging to predict their actual outcome, particularly at this stage. In addition to time, the outcome will be shaped by the gender sensitivity of the planned recovery schemes, established interconnections between the pandemic and climate change, defined priority areas, and implementation strategies.

### 5.3. Final Remarks

Although the results of the bibliometric analysis and the online questionnaire are not fully comparable, the following can be inferred. In addition to the issues that received attention from researchers and respondents, some points were indicated by the latter that were not prominent on the co-occurrence maps. This might demonstrate that these topics have received limited attention from scholars or development organizations to date. Although the raised points were based on the respondents' experience and often subjective opinion, they might reflect another perspective on the climate change–gender domain in leadership/empowerment, from those facing the outcomes of these measures. In addition, there were 'not included' topics, such as, for instance, 'COVID-19 pandemic', 'role models' or 'quota systems', which have already been discussed with reference to climate change, gender, and leadership as standalone topics [128–130,133,134]. Their lack of prominence on the maps demonstrates the need for more rigorous investigation with connection to climate change–gender in leadership/empowerment in African countries.

Even though the obtained findings are not directly connected to enterprises, several assumptions can be made. It could be implied that companies of any background will have to comply with stronger climate-change-related binding policies and regulations due to a positive trend in advances in women's leadership and empowerment regarding climate change. In addition, the gender gap will decrease on more executive boards and the number of women executives will reach the minimum number indicated by some studies as being

necessary to integrate more climate-friendly activities and improve climate/environmental performance [77,78].

Overall, the results of this study outline the thematic structure of the climate change–gender research domain, provide insights into the outcomes of the advances made towards reduction of gender imbalances in climate change leadership in African countries, and elucidate the areas and directions that might need to be addressed in more depth.

## 6. Conclusions

Gender-balanced representation is perceived as one of the integral characteristics of effective leadership and empowerment, which are required to overcome and tackle complex challenges such as climate change and its impacts. Being recognized as one of the most vulnerable global areas [135], the African continent will continue to face climate change impacts that affect its socio-economic development, increase inequalities, and exacerbate threats to human health, food and water security. On the other hand, African countries are increasingly contributing to the global climate change agenda, for example by taking on commitments in the frame of the Paris Agreement. In this context, it is essential to ensure that the countries will also continue to amplify their efforts to reduce gender imbalances in leadership and empowerment. Therefore, the visibility of the already-attained outcomes, in terms of both gender and climate change experts, demonstrates their effectiveness, the potential benefits and risk reductions, which are key factors supporting the importance of, and need for, further measures.

The paper investigates the need and potential for gender-balanced leadership/empowerment in climate change adaptation and mitigation based on the views and perspectives of climate change experts regarding the advances made in African countries over the last five years. The study is complemented by a bibliometric analysis (i.e., co-occurrence analysis) of the literature published on the topic between the years 2015 and 2022, which demonstrates the considerable prevalence of grey literature compared to peer-reviewed works.

Although the results from the online questionnaire and the bibliometric analysis are not fully comparable, some of the points raised by the respondents are reflected on the maps. For instance, the questionnaire findings revealed agriculture, the topic with the high number of co-occurrences on the maps, as one of the sectors where women are better supported. This type of support is also accompanied by a high number of studies (publications), development projects and initiatives on vulnerability, adaptation, climate-smart agriculture, etc. However the co-occurrence maps do not demonstrate the prominence of such topics as ‘COVID-19 pandemic’, ‘role models’ or ‘quota systems’, although the respondents saw the latter as being among the potential solutions, and perceived that the pandemic has both positive and negative impacts on reducing gender imbalances in leadership/empowerment.

Additionally, the questionnaire findings indicated renewable energy, transportation, oil and gas, and mining as sectors where men are better supported. The study suggests that women’s influence on climate change related decisions, as well as their ability to overcome its impacts, *have* changed, but mainly to a small or certain degree. The lack of knowledge, expertise, skills and qualities, political will and female leader role models were indicated as being among the hindrances to women’s representation in climate-related leadership positions. Overcoming these barriers was linked to better climate change knowledge-sharing, additional training and capacity building, skills development, the introduction of a gender quota system and a reduction in corruption in recruitment processes. The importance of providing merit-based and not only gender-based opportunities was highlighted, as the latter might amplify some stereotypes regarding women if they failed to succeed. Assessing the potential timeframe needed to achieve gender-equal representation in climate change leadership in their home countries, the respondents’ opinions ranged from very optimistic (less than five years) to very pessimistic (never).

The current study has several limitations. The Google Scholar (GS) dataset used for the bibliometric analysis was limited to a maximum of one thousand records due to software

features. Only English-language publications were retrieved and analysed, which might alter some of the obtained results. The structure of the questionnaire and the types of questions affected the number of respondents and countries' representation.

Nevertheless, despite the aforementioned limitations, the findings demonstrate the visibility of the measures that have already been taken to those who are not directly engaged in the gender/women field but undoubtedly experience its outcomes. Their opinion provides a better understanding of the actual progress and its implications, particularly those that are not quantifiable. This study can be used as a premise when identifying possible directions of further actions towards gender-balanced leadership/empowerment in climate change, supporting their development, types and areas to be applied in the adaptation and mitigation context in African countries.

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## Appendix A

**Table A1.** List of Abbreviations of the UNFCCC bodies (based on Gender Climate Tracker).

Abbreviation	Name
CTCN Advisory Board	Climate Technology Centre and Network Advisory Board
CC Facilitative Branch	Compliance Committee Facilitative Branch
CC Enforcement Branch	Compliance Committee Enforcement Branch
CGE	Consultative Group of Experts
CDM Executive Board	Clean Development Mechanism Executive Board
GCF Board	Green Climate Fund Board
JISC	Joint Implementation Supervisory Committee
LEG	Least Developed Countries Expert Group
PCCB	Paris Committee on Capacity-building
SCF	Standing Committee on Finance
TEC	Technology Executive Committee
FWG	Facilitative Working Group
KCI	Katowice Committee of Experts on the Impacts of the Implementation of Response Measures
PAICC	Paris Agreement Implementation and Compliance Committee
COP	Conference of the Parties

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