Forest Policy and Economics 141 (2022) 102762

Contents lists available at ScienceDirect

Forest Policy and Economics

journal homepage: www.elsevier.com/locate/forpol

Gender and women in scientific literature on bioeconomy: A systematic review

Alexia Sanz-Hernández *, Paula Jiménez-Caballero, Irene Zarauz

Department of Psychology and Sociology, Faculty of Social and Human Sciences, University of Zaragoza, Atarazanas Street, 4, 44003 Teruel, Spain

ARTICLE INFO

Keywords:
Gender
Inclusive bioeconomy
Systematic review
Feminist perspectives

ABSTRACT

A social vision is slowly emerging of the bioeconomy as an avenue towards sustainability. This paper presents a systematic review of the existing literature on the connection between gender (as a social dimension) and bioeconomy. We have reviewed 244 scientific publications which explicitly mention bioeconomy and gender/women in their title, abstract, keywords or text; 127 documents were identified as having high (19) or medium (108) gender-oriented centrality. The literature is fragmented but six cross-sectional key themes have been identified: Gender and social impacts of the bioeconomy; gender equality as a goal and a just policy; gender differences in perceptions, discourses and strategies relating to the bioeconomy; women as potential stakeholders and actors in the transition towards bioeconomy; frameworks, strategies, and tools to connect gender and the bioeconomy; and gender inequalities and geography. Moreover, they show hardly any connection with the three predominant social currents in the struggle for gender equality: grassroots social movements, ecofeminism, and intersectionality. The paper concludes by identifying key pathways for future research to address current gaps. We suggest integrating a feminist metatheoretical base with an integrative ontology, an epistemology that recognises its own partiality and situationality, and a methodology sensitive to the specificities of the contexts which are committed to the goal of transforming women's everyday contexts.

1. Introduction

The growing interest in the bioeconomy as a sustainable global development solution is reflected in the elaboration and implementation of several national and international strategies and policies in more than 50 countries and international organisations (OECD, 2018; Heimann, 2019; European Commission, 2019).

By participating in innovative value chains (Raimondo et al., 2018), the bioeconomy is bringing about a change in traditional bio-based sectors, such as forestry and agriculture, through product innovation and industry transformation (Scarlat et al., 2015) or advances in biotechnology and genomics (Levidow et al., 2012). Newly opened sectors for bio-based applications are poised to generate a range of environmental, economic, and social benefits responding to both local (McCormick and Kautto, 2013) and global goals. The prevailing techno-scientific vision of the bioeconomy (Sanz-Hernández et al., 2020) emphasises technological development and resource-efficiency to increase the flow of new goods and services, current consumption levels and competitiveness (Ramcilovik-Suominen and Pülzl, 2016). The technological bioeconomy vision has been rapidly taken up in industry, both on a large scale (Pülzl et al., 2014) and on a regional or local scale, and this is the imaginary that bioeconomy research is replicating (Holmgren et al., 2020; D'Amato et al., 2020).

Yet, transitions to a bioeconomy are not only socio-technical, but also deeply socio-political. The debates about making the bioeconomy more comprehensive and inclusive (Pfau et al., 2014; SCAR, 2015; Siegner et al., 2017; Sanz-Hernández et al., 2019a; Aguilar and Patermann, 2020) are increasingly present in the literature (Bryden et al., 2017). As Resurrección and Elmhirst (2021) argue "environment and development thinking needs to become more fully political and engaged" to bring about radical change. In a similar vein, we posit that bioeconomy thinking must address the powers and the policies that help maintain unsustainable and unfair development pathways, with the aim of making them fairer, more inclusive, or more just than the conventional economic models they displace.

New economies represent an opportunity for social change and the reduction of social inequalities. In our understanding, it is up to social research to monitor the extent to which emerging economic models,

* Corresponding author.
E-mail address: alexsanz@unizar.es (A. Sanz-Hernández).

https://doi.org/10.1016/j.forpol.2022.102762
Received 27 May 2021; Received in revised form 25 April 2022; Accepted 9 May 2022
Available online 16 May 2022

such as the bio-based economy, contribute to a more equitable and just society. One way of doing this is through academic literature that connects the bioeconomy with one of the main axes of segmentation, stratification, and social inequality, namely gender.

The concepts that this review focuses on – gender, women and bioeconomy – are complex in themselves. We use these concepts to understand the current state of knowledge within research on gender in the bioeconomy. Gender refers to a socially constructed difference between women and men that produces traditionally embedded inequalities and hierarchies. Often the two terms "women" and "gender" become blurred or used synonymously. We too largely adopt this approach in the present paper, equating the two terms according to Scott's view (Scott, 2010: 10) that whether or not gender remains a useful category of analysis depends on the critical uses that are made of the terms. Against influential strands of feminist theory, feminist theorists (such as Gunnarson, 2011) have risen to defend the category of "women" in recent years. Gunnarsson observes: "The reason why it would be fatal to leave 'women' behind as a feminist category of analysis is that we need it to denote women's specific relation to a gender structure the properties of which we may only then struggle to define" (Gunnarson, 2011: 34). She concludes: "We should, indeed, continue to deconstruct deterministic and essentialist notions of what it means to be man or woman, but such negative relating to gendered categories can never be exhaustive of feminist theorising" (Gunnarson, 2011: 34). This is the reason we use both terms—women and gender—as categories of analysis in this paper.

The gender within bioeconomy approach is complex because it involves the confluence of three fields of analysis (environment and development, science and technology, and gender and women's studies in general), which in turn are traversed by a socio-political axis composed of two dimensions often deeply interconnected: material dimensions of power – its flows of money and interests – but also the politics of knowledge (Resurrección and Elmhirst, 2021). Despite this complexity, there is agreement that a gender reckoning process (Shannon et al., 2019) is taking place in different political contexts. For example, in European science policy there has been a transformation of the priorities and conceptions around the intervention of 'gender' orienting European action plans for the relationship between science and society (FP6, FP7 and H2020) (Conceição et al., 2020). The European action plans started by highlighting the under-representation of women in the scientific and technological domain and emphasised the need to promote far-ranging new studies and debates about the issue of gender inequalities, calling for equity between men and women in scientific careers. Subsequent action plans (FP7) request the implementation of concrete organisational changes at research institutions to overcome gender inequalities. Finally, H2020 called for both scientific processes and the very content of scientific knowledge in Europe to be increasingly sensitive to "gender" issues and any differences between women's and men's concerns.

This science policy may have contributed to the fact that gender issues are timidly making their way into different areas of research such as sustainability sciences and development studies (Gottschlich et al., 2017).

This paper reviews the emerging literature on gender challenges in bioeconomy to draw out the main threads of research. This is a necessary research area in which the research is disparate and interdisciplinary. Authors have found no literature reviews focused on gender and women in the bioeconomy, with the exception of a recent review about the issue of gender in relation to the Nordic digitalised bioeconomy (Roos et al., 2021).

Our literature review aims to understand the current state of knowledge within research on gender in the bioeconomy, confirming to what extent the call for inclusive bioeconomy has captured scholarly attention. The research questions of how is gender being addressed in bioeconomy research, and how do bioeconomy researchers integrate the gender perspective, place us in the midst of feminist debates in science, technology and society (Nightingale, 2011), and lead us to reflexively interrogate the silences in ontologies, epistemologies and methodologies (Nightingale, 2016) of the great plurality of knowledge perspectives that are being deployed around the bioeconomy in its connection to gender.

On a theoretical level, we pretend to make visible the problem of gender in bioeconomy, turning it into a field of research in its own right. We consider that our research questions are more appropriately addressed with a theoretical approach (ontology and epistemology) aligned with feminist approaches which, in turn, delimits the descriptive and qualitative variables considered in this review. A feminist epistemology and situated knowledge questions the dominant forms of knowledge production. The geographical and gender patterns that shape the production of knowledge can influence which perspectives are dominant. To examine this, the article takes a three-pronged approach by analysing the professionals who carry out the research (authorship), the research context (institutions and countries) and the content (key themes) (i.e., Who, where and what).

From a methodological level, the article aims to see whether the literature makes use of gender analytical tools to identify and deconstruct the frameworks of inequality in development. We have therefore analysed gender centrality, research methods and the main contributions of the papers.

Finally, there is a practical objective in the review aimed at detecting literature linked to transformative change, grassroots activism and radical praxis that feminist approaches postulate and that acquire relevance when the current crisis frameworks (ecological, economic, health) call for commitment and action for radical transformation. To this end, the article analyses in depth the main key issues in search of transformative proposals in everyday contexts. This search uncovers current gaps and forms the basis of the discussion on the necessary future research steps.

The remainder of the manuscript is organized as follows. The methodology used to carry out the systematic review is presented in Section 2. Sections 3 and 4 summarises and discusses the main results of the bibliometric and interpretative analysis of the different scientific contributions in gender within bioeconomy. Finally, in Section 5 we conclude identifying key pathways for future research to address current gaps.

2. Methods

The methodology followed in this study was based on reviewing recently published bioeconomy research articles addressing the concepts of gender and/or women.

The systematic review is adapted from the proposals of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology by Moher et al. (2009). The PRISMA methodology provides guidelines and statements to perform a systematic review by following some scientific criteria. We have distinguished several phases (Petticrew and Roberts, 2006; Sovacool et al., 2018) (Fig. 1) which are explained below.

2.1. The selection of the literature

The literature selection process (Fig. 2) began with the adoption of a series of decisions that conditioned which articles were included or excluded from the review.

Our first decision was to prioritise the bioeconomy literature, i.e. those articles whose authors explicitly refer to the term 'bioeconomy'. The use of the keyword 'bioeconomy' could be seen as a limitation due to the existence of several similar terms that can refer to the same thing (e.g., bio-based economy, circular economy, or green economy). However, we believe that with this keyword, we can assess the penetration of this notion in science. Furthermore, 'bioeconomy' is the most widespread expression in the international regulatory and strategic framework.

This was a necessary decision because we were looking for an explicit

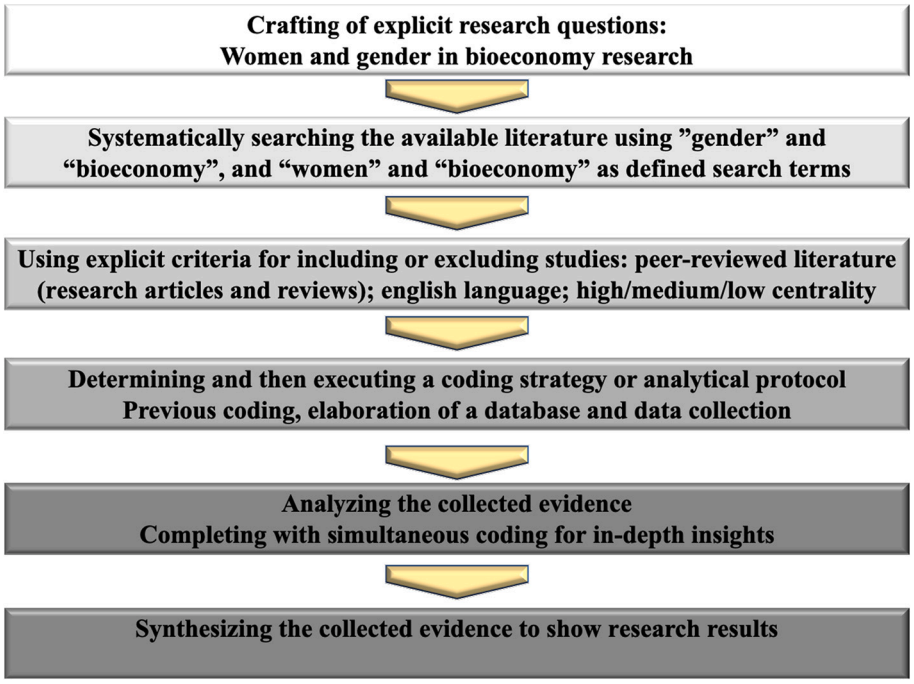

Fig. 1. Research design and phases in this systematic literature review.

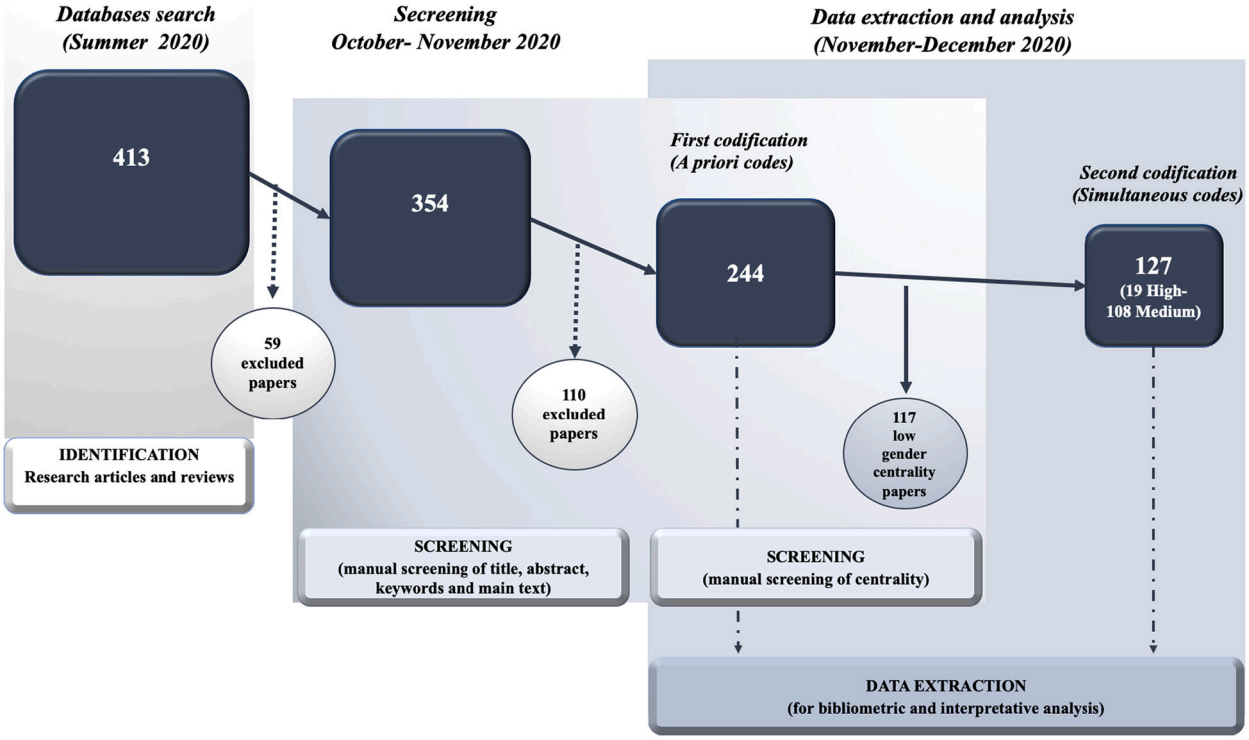

Fig. 2. Process of data collection for bibliometric and interpretative analysis.

engagement with the bioeconomy. We know that it leaves out of the analysis a broader literature on recent research linking gender, sustainability and development, for example, highlighting the centrality of a gender perspective in the green economy (Hanacek et al., 2020), or the ecosocial transition (Peralta Garcia et al., 2021), linking women to climate change action (Westholm and Arora-Jonsson, 2018; Wilson and Chu, 2020) or analysing the social benefits and impacts of the circular economy, which includes gender equality (Declich, 2018; Pla-Julian and Guevara, 2019; Perez-Pena et al., 2021; El Wali et al., 2021). This choice also distinguishes our review from other recent reviews that have focused on linking the bioeconomy and the SDGs in general (Calicioglu and Bogdanski, 2021) or addressing the circular economy as a possible framework for eliminating social inequality (Perez-Pena et al., 2021).

The second decision prior to the literature selection phase was how to address the issue of gender so as not to exclude relevant articles on women in the bioeconomy and gender in the bioeconomy. For this

purpose, we decided to use the two terms 'gender' and 'women', both as a second term that needs to appear at some point in the text. This required us to conduct a double search, using bioeconomy PLUS gender, and bioeconomy PLUS women.

We then searched several databases, including the ISI Web of Knowledge, Web of Science, Google Scholar, and Science Direct, to identify review papers and original publications appearing between 2000 and 2020 on bioeconomy and gender. In addition, the bibliographies of the most recent peer-reviewed articles were examined to find other relevant studies on gender, development and sustainability.

A first extensive search of the literature in August 2020 returned more than 5000 results, which included articles, book chapters, reports, conference papers, encyclopaedia excerpts, editorial information, news, and other uncategorized documents. We decided to include only peer-reviewed papers written in English for ease of access and considering that we had to divide the reading of the literature between the co-authors. Of the total of 413 articles downloaded, 59 were repeated among the different search engines, giving a total of 354 articles.

The co-authors performed a screening independently to accept or reject the remaining articles, and 110 articles were excluded. The decision for including papers was based on a main criterion: the mention of 'gender aspects' of the bioeconomy (in the title, abstract, keywords or main text. Some articles were excluded because they used the terms bioeconomy or gender/women in other sections such as acknowledgements, footnotes or bibliography.

This manual screening resulted in 244 articles (appendix) that were distributed among the three authors and assessed by reading the complete article.

2.2. Data extraction and analysis

To record the metadata for each of the selected studies and extract

Table 1
Descriptive variables analysed.[a]

Variable code	Typology	Description and utility	Codes	
Journal	Continuous text variable	Journal which publishes the article.	Open	
Title	Continuous text variable	Full headline.	Open	
Authors	Continuous text variable	Authors' names articles.	Open	
Publication year	Discrete variable	Publication date.	From 2000 to 2020	
Author's gender	Discrete variable	Based on the names, presentations of the authors in the articles and photographs on websites, we have determined their gender in order to find out if these variable conditions the interest in developing the relationship between bioeconomy and gender. Despite the current difficulties to know the gender identity of the authors formally, we wanted to try to get closer to this information.	Female Male	
Location	Discrete variable	Geographical setting to which the study refers. To find out in which regions most research is being done on the relationship between bioeconomy and gender.	Africa Asia Europe Latin America North America	Oceania Various (or comparative studies between regions)
Country-Corresponding author	Continuous text variable	Country to which the author's university belongs. It is relevant to know from which regions they are most concerned with understanding or linking gender and bioeconomy.	Open	
Where	Discrete variable	The first placement of the word "gender" or "women" in the article. Locating where these words appear is an objective way of measuring their prominence in the article.	Title Abstract Keywords	Main text Conclusions References
Centrality	Discrete variable	Centrality of the gender issue in the article. We assess the relevance of the gender issue throughout the article. We consider high centrality when gender is actually the central theme of the article. Low centrality when only the words gender or women are mentioned somewhere in the article.	High Medium Low	
Article contribution	Discrete variable	The type of contribution of the article. Depending on the focus of the article, it will produce more or less practical contributions that help to the development of the bioeconomy and the gender issue. The main general contributions can be: empirical (new applications or existing methods or theories, or new types of evidence), theoretical (reporting a new theory or testing an existing theory), and finally, methodological (developing or contributing to new methods) (Sovacool et al., 2018).	Theoretical Methodological Empirical	
Dominant research method	Discrete variable	Methodology used in the study. Knowing the technique used in the study helps us to better understand its purpose and how practical its contribution to the research paradigm is.	Case studies Data analysis (secondary sources and statistics) Experiments Survey	Qualitative research (interviews, speech analysis…) Review Other
Economic Sector	Discrete variable	Key economic sector associated to bioeconomy referred in the study. Depending on whether the articles take a more cross-cutting or sectoral approach, we can relate gender to specific economic sectors or aspects associated with the bioeconomy.	Agriculture Blue bioeconomy Energy Forest Health and biomedicine Industry Waste resources General (Governance, biopolitics…)	

[a] The study considered a larger number of descriptive and qualitative variables than those listed in the table; however, given the size and complexity of the database, in this review we have selected those listed, leaving the analysis of others, such as: objective, main results, perspectives and disciplines, and policy implications and recommendations, for another occasion.

data from our literature review, we used a database with several descriptive information fields (Table 1). There were a number of variables, categories and codes (database fields) that we were able to establish a priori, i.e. before the analysis, because they were clearly outlined in our research objectives and determined by our analytical frame of reference (presented in the introduction). Of all the descriptive variables considered in the literature review, those selected for this review were: year and journal of publication, geographical scope, affiliation and gender of first author, economic sector, centrality of gender, article contribution (derived from Sovacool et al., 2018), and dominant research methods.

Understanding the qualitative variable "key themes" has required moving back and forth between several phases of data analysis, data synthesis and joint discussion of our findings. The procedure used was as follows. One author took the lead in the codification process to identify codes and categories from the thematic analysis (Nowell et al., 2017), especially of regularities or patterns, similarities, differences, and interactions between categories.

We then jointly discussed the codification, selected the final codes of these variables and recoded again according to six key topics that we obtained using thematic analysis.

When comparing the data derived for all 244 articles in the main variables, we distinguished the noteworthy findings. These were written down, discussed, and prioritized among the three authors. Any disagreements between the authors were resolved through discussion.

Finally, based on our long-term engagement with the literature and the field of bioeconomy and gender in general, and our long-standing expertise, we looked at whether recent scientific production on bioeconomy is committed to a gender perspective.

3. Results: authorship, context and content

Gender has only partially captured the interest of bioeconomy researchers, although this seems to be increasing. The bibliometric overview of the articles provides evidence that the literature linking bioeconomy and gender concepts has been slowly emerging during the last two decades (Fig. 3).

In this section, we show the main results about the authors, the context of knowledge production and the content of the research. Firsly, we have considered as descriptive characteristics of the sample (Table 1) the gender, location and country affiliation of corresponding authors (instead of opting for race, which raised more methodological doubts). Then, we have considered as qualitative characteristics of the sample, the content of articles connecting gender and bioeconomy.

3.1. Authorship: female researchers in gendered bioeconomy research

In our review, out of the 244 publications, 56.6% were first authored by female researchers and 43.4% by male researchers. From a chronological perspective, women have shown greater interest in gender mainstreaming in the bioeconomy throughout the entire period analysed (except in 2014 and 2019) (Fig. 3).

It would be interesting to delve into whether this apparent feminisation of gendered bioeconomy research is impacting on science and the extent to which and how gender is being integrated into the broader bioeconomy literature. In this study we can only highlight that women sign 89.4% of the articles that focus on gender in bioeconomy (H centrality = 19) (17 out of 19) (Fig. 4).

This gender imbalance in favour of women becomes more relative if we consider the main journals in which they have ~~been~~ published. The articles reviewed were published in 134 different international journals, although a significant number were concentrated in 16 journals, as shown in Fig. 5.

These 16 journals (43.85%) have each published three or more articles linking gender and bioeconomy, so they appear to be becoming more prominent in this emerging discourse. However, looking at them separately, we can see a reduction in the women-authorship percentage: from 56.6% of the total to 50.47% in these 16 journals. A more in-depth analysis would be necessary to explain this 6 percentage point difference.

3.2. Geographical scope and authorship location

The articles' geographical focus is largely in line with the authors'

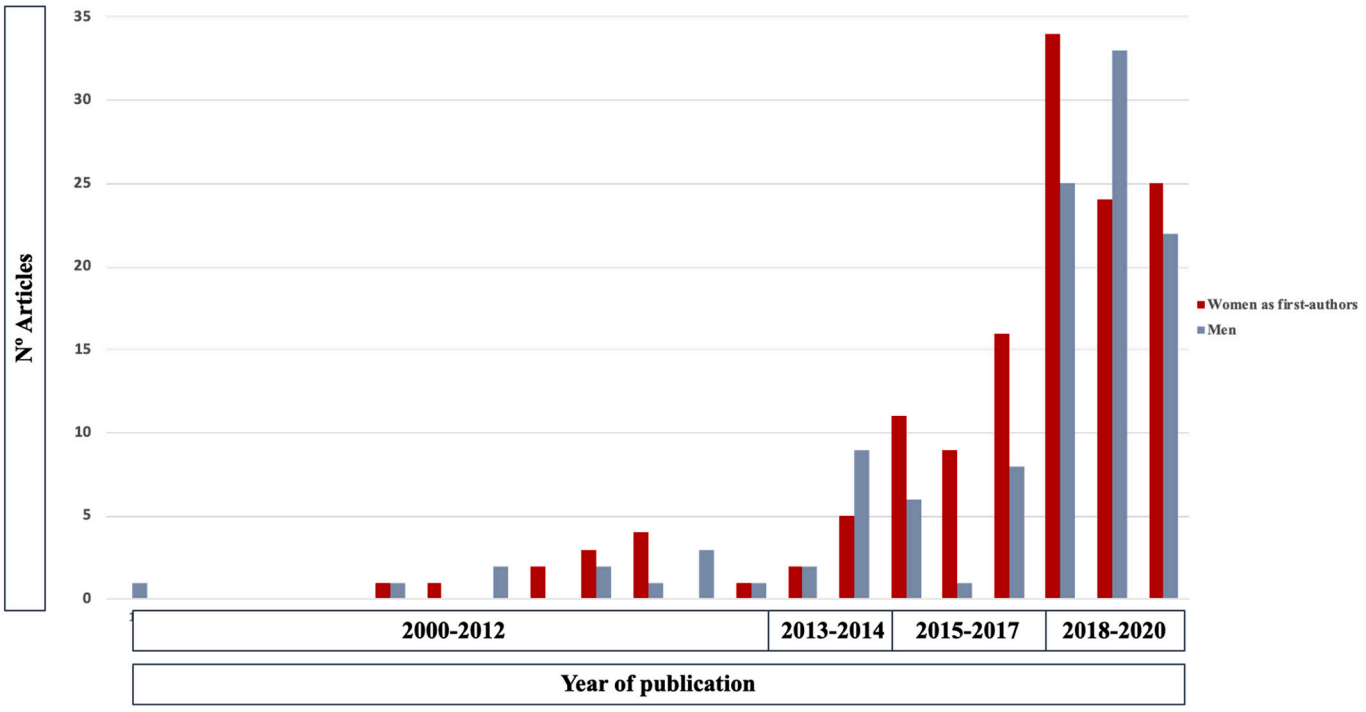

Fig. 3. Temporal evolution in the production of gender and bioeconomy literature.

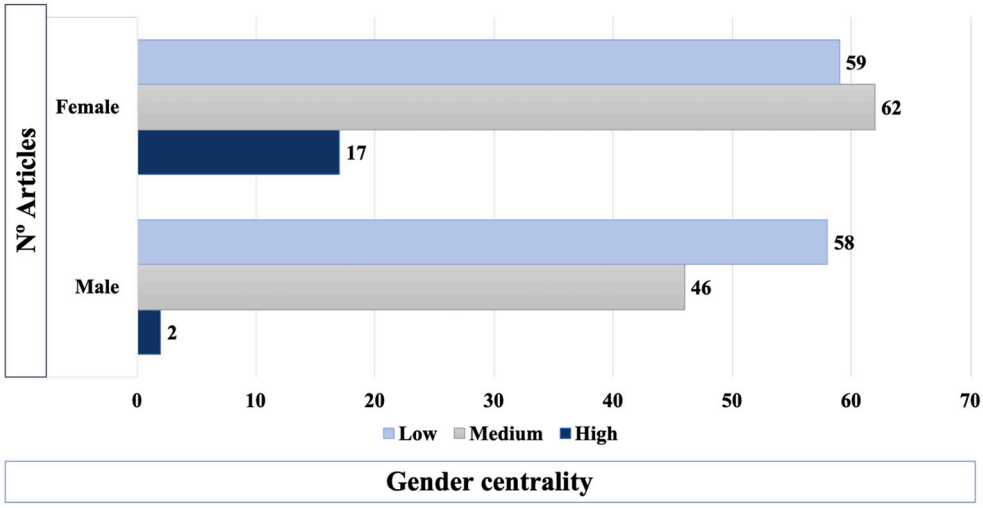

Fig. 4. Articles on bioeconomy and gender according to the sex of first-authors and gender centrality.

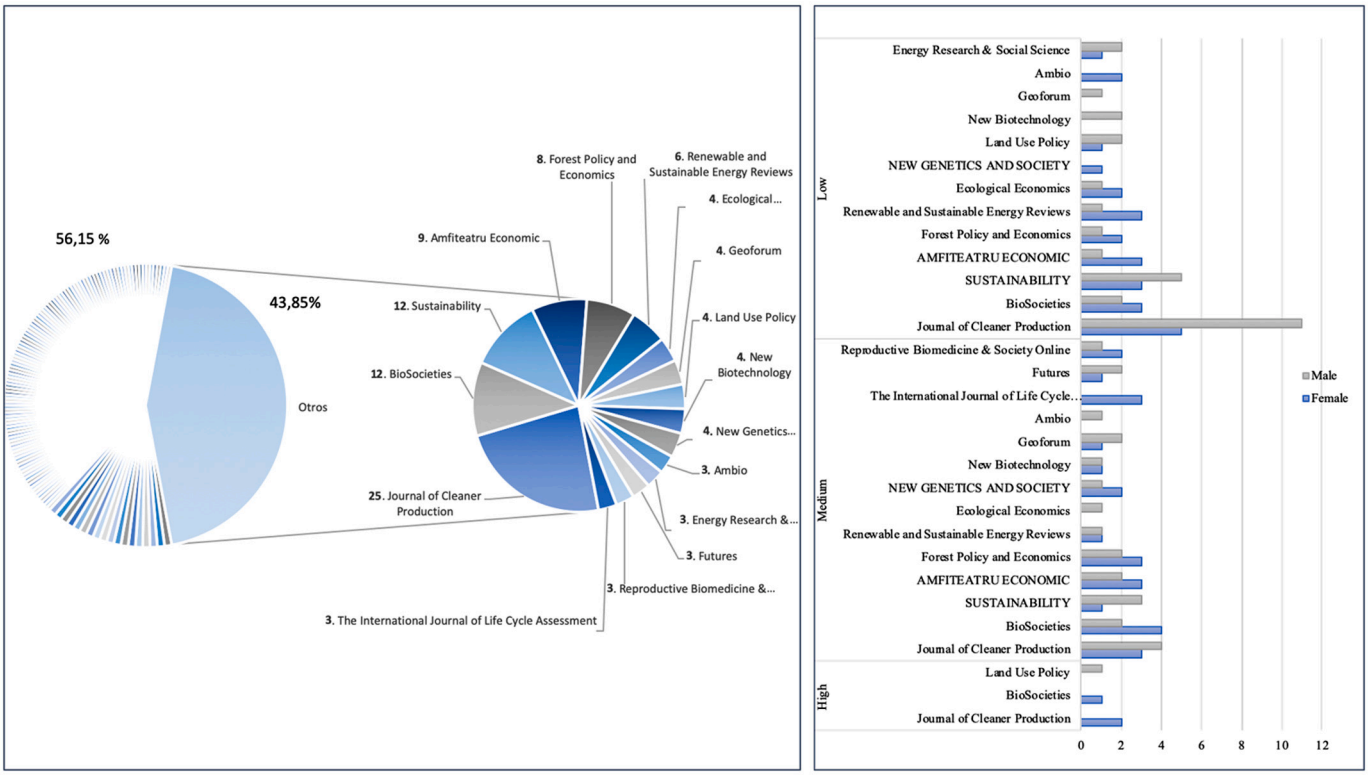

Fig. 5. Main journals in gender and bioeconomy (with three or more articles) and publications by gender centrality.

country affiliation (91%). In this respect, the dominance of studies carried out by European institutions is clear (77.5%) with Germany, Finland and the United Kingdom represented by 20 articles (Fig. 6), followed by Italy, Spain, and Sweden. Only 55 articles (22.5%) were written outside European research institutions, principally the USA (19), Australia (10) and Canada (5).

In the analysis of the geographical scope, two types of articles were considered: on the one hand, those addressing general issues or set within a global context (32%), and on the other hand, those contextualised in a specific region (see geographical scope in Fig. 6). Among the latter, studies located in a region within the European continent stand out by far (121 out of 244), representing 50% of the total.

The above shows that gender and bioeconomy is a topic mostly studied by scholars affiliated to institutions located in the Global North researching general issues of global context or only in the Global North. Another dominant feature of the gendered bioeconomy is the limited involvement of researchers from the Global South in authorship patterns, as only 4 articles are signed by authors from Latin America (1.64% of the sample) and 2 by authors from Africa (0.82% out of the total number of articles).

Furthermore, despite institutional efforts to promote a bioeconomy strategy in large regions such as Latin America, the Caribbean, Southeast Asia and South Africa (Rodriguez et al., 2018), only 14 articles have their geographical scope in the South (six in Africa, four in Latin America and four in South Asia).

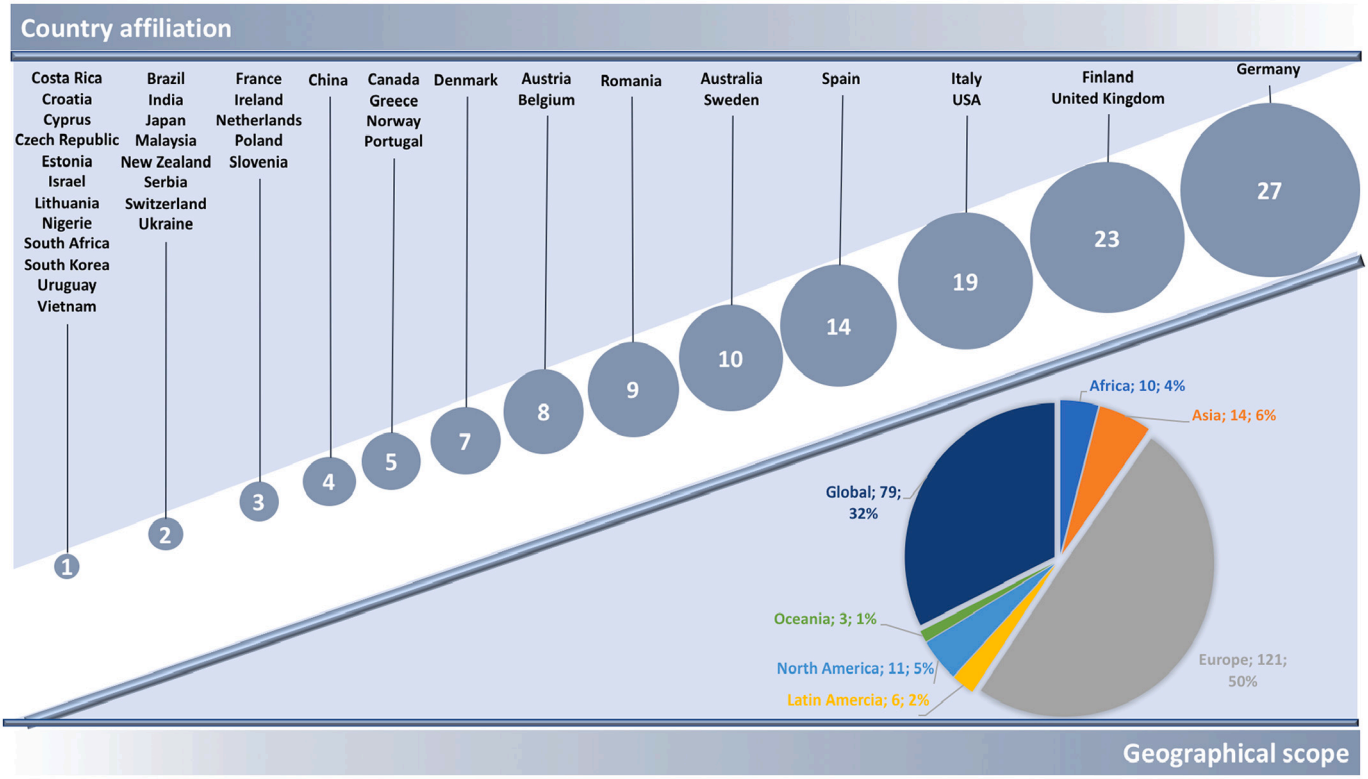

Fig. 6. Affiliation of the first authors and geographical area studied in the reviewed articles.

3.3. Key themes connecting gender and bioeconomy

Six cross-cutting themes were identified across the reviewed articles with major centrality (127, H and M); some of them appear at the same time in the same publication: Gender and social impacts of the bioeconomy; Gender equality as a goal and a just policy; Gender differences in perceptions, discourses and strategies relating to bioeconomy; Women as potential stakeholders and actors in the transition to bioeconomy; Frameworks, strategies and tools to connect gender and bioeconomy; and Gender inequalities and geography.

3.3.1. Gender and social impacts of the bioeconomy

This is the most recurrent theme dealing with women's unequal position in such areas as health, employment, labour conditions, and well-being. The sectors associated with the bioeconomy are, in general, highly male-dominated, and decision-making power, as manifested by the interests of large actors and global elites, often overlooks the needs and vulnerabilities of the world's poorest and most marginalized people. Overall, a transition to a bioeconomy model does not guarantee that pre-existing inequalities will be reduced, or even addressed.

The analysis of the different sectors associated with the bioeconomy in the sample reveals that health and biomedicine are the fields with the most prolific bioeconomy and gender debate, with one in four articles in this field (63) being rich and in-depth. Health and biomedicine also constitute an economic sector associated with the bioeconomy, insofar as they use human biological resources to pursue the generation of bio-value (Kerr et al., 2009). These studies variously address how the biological market has been structured and, specifically, the injustices arising from the use of 'biological human capital' and the non-recognition of the productive labour of women's bodies (Waldby and Cooper, 2010). Two fields of action stand out. On the one hand, regenerative medicine based on stem cell research is interested in the body's capacity for self-regeneration, and it requires a wide variety of biological tissues (e.g., oocytes, foetal tissue, embryos, and umbilical cord blood). The main generators of human biological resources and tissue donors are women, which makes them key actors in biomedicine development (Waldby and Cooper, 2010). This field has been approached primarily from a gendered economy perspective, which has called for a correct categorisation and recognition of women's productive bodily labour in biomedicine development (Waldby, 2008, 2009; Thompson, 2014). Similarly, the lack of recognition of women's reproductive work is highlighted in the second area of action: reproductive medicine (Waldby and Cooper, 2010). In this field, black feminism has made contributions to reproductive justice theory (Lewis, 2018). Criticism of the market for reproductive services goes beyond the invisibility of women's work as donors. Feminist geographers have pointed out the value hierarchies present in selection processes, influenced by notions of race, ethnicity, economic class, and gender (Schurr, 2017). And the contributions aligned with trans and queer feminism focus on the potential benefits of reproductive technology for the configuration of new family models that break with hetero-normative models (Smietana et al., 2018).

Secondly, contributions from the forest bioeconomy stand out in terms of both quantity and centrality of the gender perspective (Pätäri et al., 2017; Johansson et al., 2018; Larasatie et al., 2019, 2020). This is possibly due to the greater development of the bioeconomy linked to forests, focussing above all on the northern hemisphere, Scandinavian countries, and the USA-Canada. These studies address issues such as community forestry, community forestry enterprises, the collective management of commonly held forestlands (cooperatives) and agro-forestry models. In fact, the main critical discourse on forest issues in the Global North concentrates on gender issues (Takala et al., 2019) and it has a long tradition (Lidestav and Sjölander, 2007; Leipold, 2014; Holmgren and Arora-Jonsson, 2015; Lidestav et al., 2019).

In contrast, studies on agriculture and food (3H and 7 M), the blue bioeconomy (Bjørkan and Eilertsen, 2020), or bioenergy (Dale et al., 2016; Pulighe et al., 2019) are few, and the gender centrality in these fields is low. In this latter field, one would expect to see a greater number of studies, given that there is a recognition that both production and consumption of energy is highly gendered. Thus, in the least developed

countries in Africa and Asia, as much as 90% of total energy consumption consists of traditional biomass fuels mostly managed and collected by rural women (Johnson et al., 2020). Finally, in the field of industrial and business management, there are no studies that clearly connect gender with bioeconomy (31 articles but with medium (17) or low (14) gender centrality), and there are none in the field of waste resource management.

To conclude this section, we show some positive and negative social impacts of the bioeconomy that have been highlighted in the literature. Some of the negative aspects mentioned are the effects of land grabbing and the implementation of fierce capitalism in specific global regions that accompany the implementation of the bioeconomy (Juerges and Hansjürgens, 2018; Pye, 2019; Kumeh and Omulo, 2019). The redefinition of gender roles in traditional productive sectors increases inequality rather than reducing it and has severe consequences for women in terms of employment, deteriorating working conditions, reduced well-being, and increased poverty levels (Neimark and Healy, 2018; Kumeh and Omulo, 2019).

At the other extreme, the social opportunities and benefits of the bioeconomy focus on potential job opportunities and stimulation of local economies (Smith and Diggans, 2020) on the one hand, and on reducing the social impacts of climate action and energy poverty (Issa et al., 2019) on the other. However, it is striking that there is no focus on the potential benefits of the bioeconomy for gender equality, for example, in sustainable agriculture through the CAP (Matthews, 2020; Santiago-Freijanes et al., 2018) or on opportunities presented by the increasing interest in developing a socially responsible business model and the recognition of gender equality as a field to be incorporated into CSR (Zwolińska-Ligaj, 2015; Andronie et al., 2019; Androniceanu, 2019).

3.3.2. Gender equality as a goal and a just policy

Gender equality is recognized as one of the most important determinants of economic development (Beneria et al., 2003; Shannon et al., 2019) after more than 40 years in which a large body of research has been conducted into international discourses on gender in development. In the earliest studies, gender equality was seen as a challenge (Goven and Pavone, 2014; Gottschlich and Hackfort, 2016) and later became a necessary policy intervention area, not without controversy (Evans, 2016), and a global objective. Gender equality has finally been recognized as key to achieving the SDGs.

Despite this, we have not found any studies addressing in-depth the connection between gender and bioeconomy from the SDG approach. Of the 244 articles analysed, 20 papers (M and L) incorporate the SDG framework, but only to highlight the scant attention that public policy has given to achieving the SDG 5 (Biber-Freudenberger et al., 2020; Philippidis et al., 2020) and the null (Issa et al., 2019) or controversial (Zeug et al., 2019) importance that stakeholders attach to SGD 5 in the transition towards bioeconomy.

In the European context, gender in science policy is mentioned in two papers in relation to responsible research and innovation (RRI) (Stahl et al., 2019; Conceição et al., 2020). These articles contain discourses that attempt to make the equality notion compatible with economic growth and competitiveness. However, according to Vida (2020), this process leads precisely to the opposite in terms of equality: the gender perspective loses its political, feminist, and transformative potential during policy implementation due to individual and institutional resistance.

3.3.3. Gender differences in perceptions, discourses, and strategies relating to bioeconomy

20 articles provide evidence of perceptual and behavioural differences between men and women in aspects related to the bioeconomy.

Some studies establish gender differences, highlighting higher awareness of healthy and sustainable lifestyles among women (Häyrinen et al., 2016). This is generally shown in purchasing green products (Häyrinen et al., 2016; Ranacher et al., 2017; Djokic et al., 2018; Vătămănescu et al., 2018; Polimeni et al., 2018), shopping at farmers markets because they are more interested in quality than in price (Polimeni et al., 2018) or the consumption of sustainable products, such as wood in construction (Roos et al., 2021, cited in Toppinen et al., 2018). Besides, some studies reveal that women seem to have a higher demand for bio-products (Vătămănescu et al., 2018), a greater predisposition towards ecological services consumption (Ranacher et al., 2017) and environmental conservation (Weiss et al., 2019), greater involvement and motivation in programmes targeted at forest biodiversity conservation (Mäntymaa et al., 2018), and a greater openness towards non-traditional business opportunities connected with forests, such as tourism or health-oriented activities (Mäntymaa et al., 2018). The forest bioeconomy field has conducted a significant part of these studies, which have also addressed the analysis of perceptions among students, confirming that women are more receptive to sustainable development and show greater ethical concern and corporate environmental and societal responsibilities than men (Pätäri et al., 2017; Mäntymaa et al., 2018).

Other studies emphasize gender differences in the acceptance of renewable energy sources (higher among women) (Hernik et al., 2019) or economic practices of blue growth (Thomas et al., 2018) (lower in women). In the field of bioenergy, Van Dael et al. (2017) describe a lower level of knowledge in women, but a higher level of support than men, and Buck (2018) detects discursive differences with a greater presence of discourses of fear in the female sample regarding the risks of geoengineering.

Finally, Hempel et al. (2019) find differences in strategy preference for implementing bioeconomy change processes: women prefer to work with nature and natural processes while men prefer the efficient and technological utilisation of nature in the form of biomass (technological progress).

This empirical evidence on perceptual, discursive, strategic, and behavioural differences with gender requires in-depth analysis to understand to what extent the observed differences are not based on institutionalised conceptions of gender differences. This is because most of them incorporate an essentialist approach based on naturalised assumptions of gender, i.e., they adopt epistemological positions that treat women as a homogenous group.

3.3.4. Women as potential stakeholders and actors in the transition to bioeconomy

Women are agents in different types of actions such as innovation, institutional change, and place-based actions (Jolly et al., 2020), but roles that women play or may come to play in the bioeconomy (Lehtonen and Okkonen, 2013; Varela-Candamio et al., 2018; Ramírez Cendrero et al., 2017) often go unnoticed by researchers. The contributions of women in all productive sectors associated with the bioeconomy are unquestionable (Lukash, 2018), as are the inequalities in representation and decision-making in traditionally highly masculinised sectors such as agriculture (Balezentis et al., 2020), livestock (Mottet et al., 2018) or forestry (Stanturf et al., 2019; Mallick, 2020).

The female roles shown in the articles are situated in the midst of relational dynamics of different natures and great situational complexity (Gottschlich et al., 2017). From a proactive focus, the few existing studies mention empowerment, participation, and leadership (agency) and present women as agents for change in the territory (Varela-Candamio et al., 2018; Jolly et al., 2020) or in economic policies (Holmgren and Arora-Jonsson, 2015; Larasatie et al., 2020). A negative focus incorporates literature in which gender is mentioned in articles introducing the unequal living and working conditions in the framework of the bioeconomy, primarily in non-European contexts (Azevedo-Ramos et al., 2020; Neimark and Healy, 2018; Dahunsi et al., 2020), highlighting the institutionalisation of gender differences (Juerges and Hansjürgens, 2018; Grundel and Dahlström, 2016) or relating the lower presence and power of women to the structural situation in the different economic sectors associated with the bioeconomy, such as livestock

(Mottet et al., 2018), forestry (Jolly et al., 2020) or the agro-food sector (El Bilali, 2019).

Equal participation between men and women (and emerging vulnerable groups) is considered one of the principles of good governance in bioeconomy (Devaney et al., 2017). Some of the few articles on the subject call for more power for women in decision-making regarding bioeconomy implementation (Arancibia, 2013) and warn of the risks of excluding citizens in favour of experts (Andreasen, 2009) or of losing the potential for citizen cooperation in addressing sustainability challenges by disregarding "disadvantaged citizens" (Soma et al., 2016).

The scarcity of articles in our sample interested in experiences of the manifest struggles of women's movements around the world indicates the need for bioeconomy research to open up to first-hand experiences of the women in the struggle against climate change and against inequalities at both local and global levels (Escobar, 2015).

3.3.5. Gender and geography: inequalities in bioeconomy

Gender differences in connection with geographical differences (between North and South) require comparative analysis and more effort from bioeconomy research. This issue has been mentioned in several studies on the working conditions and poverty of workers in the palm oil industry (Sadhukhan et al., 2018), and gender inequalities in biomass collection (Lehtonen and Okkonen, 2013; Mengistu et al., 2018), agro-food sustainability transitions (El Bilali, 2020) and biomedicine. The inequalities present in the bioeconomy based on human biological resources are increased by introducing the geographical vector and the North-South relationship. Due to the development of bio-innovation being based on gender, race, class, and age inequalities, it risks perpetuating gender identities and inequalities (Thompson, 2014) to the detriment of southern, racialised, ethnic minority or working-class women. All this in a market with transnational decision-making practices and enriched populations that end up reproducing elitist and discriminatory attitudes (Schurr, 2017; Dowdall, 2017).

3.3.6. Frameworks, strategies, and tools to connect gender and bioeconomy

Gender research is methodologically limited by the absence of gender mainstreaming in the design of data collection tools (Rosa et al., 2018; Gudowsky and Rosa, 2019) and by the low weight given to gender as an object of research. Gender appears as just another indicator in the measurement of social sustainability (Karvonen et al., 2017; Falcone et al., 2019) and not as a relevant main category of analysis (Rafiaani et al., 2018) to enrich the international debate and improve the praxis in the transitions from the fossil-based economy to a biobased economy.

The invisibility of the gender issue in international or national bioeconomy plans results in the exclusion of gender issues from both scientific and political agendas by orienting future strategies away from the gender perspective (Ronzon and Sanjuán, 2020). Except for one reference to prioritising funding for parties that commit to diversity (Smith and Diggans, 2020) or actions linked to education and training to give greater prominence to women in bioeconomy (Bejinaru et al., 2018; Lopez, 2018; Zabaniotou et al., 2019; Wilde, 2020), we have not found any case studies that contribute to strategies and tools focused on gender and bioeconomy.

The lack of a gender perspective in public policy-making (Vida, 2020) and bioeconomy research has consequences such as the westernisation of proposals (highly technology-orientated), an increase in the centrality of a male vision, a less critical approach, and the persistent view of women as passive subjects in the processes of change (Gunnarson, 2011, cited in Ahlqvist and Rhisiart, 2015).

4. Discussion

We discuss our results connecting with the two main research questions in this study.

4.1. How is gender being addressed in bioeconomy research?

Bioeconomy and gender need to be discussed together, especially in terms of the impacts of implementing bioeconomy strategies on gender issues, because they represent two key concepts in sustainability science and policy-making. There is an increasing trend in terms of publications per year which is in line with both the momentum recently gained by bioeconomy literature written from a social sciences perspective (Sanz-Hernández et al., 2019b) and the growing interest in gender and social equality in the context of just transitions (Johnson et al., 2020). Nonetheless, our centrality analysis shows gender is actually the central theme of the article (H) in less than 8% of cases (19 papers) and only 40 articles include the notion of gender or women in the title, abstract or keywords, so the intersection of the two notions has proved to be greatly fragmented and disconnected, with very few documents discussing both concepts jointly. Gender is frequently mentioned in empirical bioeconomy studies but has a very low centrality (L) and relevance as a main research question (15 articles) or as a feminist conceptual lens (2 papers).

The low centrality of gender in the sample clearly connects with the way in which two other descriptive characteristics (main contributions and methods) are manifested, thus showing the dominant use of gender as a mere descriptive category.

The main general contributions (Sovacool et al., 2018) of the 244 inputs considered (empirical, 140 articles, theoretical, 89, and methodological, 15) are barely applicable to the field of gender, instead, they apply mostly to a bioeconomy in which women are simply named. Numerous articles echoing the few previous studies (Varela-Candamio et al., 2018; Takala et al., 2019) stress the need to incorporate gender as a research object (Ingrao et al., 2018; Von Cossel et al., 2019). But few papers integrate gender as an epistemological category (7%, 17 out of 244), address epistemologies (Gudowsky and Rosa, 2019) or delve into conceptualising dimensions of gender (Gottschlich et al., 2017; Larasatie et al., 2019). Thus, the scarcity of gender analysis that uses or extends the theoretical-analytical apparatus that feminist research has accumulated is the essential feature of the sample.

By contrast, gender appears as a descriptive category in 43% of the articles. Gender is firstly used as a socio-demographic variable or criterion to select a sample in each of the 85 empirical studies without further discussion. Only 20 studies timidly mention significant gender differences in bioeconomy-related topics (these have been discussed in Section 3.3.3). Second, gender equality appears as a social sustainability indicator in articles that mention the necessary consideration of gender issues in the measurement of the social impacts of sustainability transitions, stating that "social impacts of bioeconomy are often foreseen, but not measured" (Bracco et al., 2018). However, there is a clear lack of research with methodological contributions in gender within bioeconomy. Counting people, not objects (Seebacher, 2016) is necessary to integrate a gender perspective.

In the whole sample, there are a considerable number of reviews published (69 papers) (29%), also with low gender centrality; most of them are in the field of health and biomedicine or addressing general considerations of the bioeconomy. None of these 69 reviews in the corpus of articles reviewed includes gender of researchers as category of analysis, except for a brief mention in Holmgren et al. (2020). We highlight that the attention to the gender of researchers is necessary to show what is happening in terms of gender inequality in science. In the delimitation of our object of analysis, we have highlighted the need to consider the socio-political axis embodied not only in the materiality of power but also in the politics of knowledge. The power relationships inherent in the global academic and research landscape (Mbembe, 2016) have been reinforcing the sexist and colonial legacy of science. Gender and race are beginning to appear hand in hand in recent reviews (Apostolopoulou et al., 2021) to highlight how both structuring axes of social inequality intersect. The inclusion of gender and race in this kind of study is not without methodological limitations, but its visibility is an

important step in the debate on the "dominant science", in our case the "dominant bioeconomy".

In the rest of the research articles in the sample, both phenomenological and positivist methodologies are present (Hammersley, 2000), using qualitative research (45), surveys (43) and data analysis of secondary sources and statistics (41). However, in the whole sample there is a great paucity of case studies (28 articles, 11.48%). From our point of view, it is necessary to promote more local/regional bioeconomy research because the empirical research conducted in specific places/geographical locations connects better with research that produces situated knowledge. This kind of research makes it possible to operationalise the concern for improving people's material conditions inherent in feminist approaches with a transformative intention.

4.2. How do bioeconomy researchers integrate the gender perspective?

In the six key themes identified, two main ways of perceiving and addressing the gender perspective within the bioeconomy appear in one way or another. The first and dominant approach has understood inequality as an equal opportunity problem that is solved as more women assume positions of power similar to those held by men, without challenging power structures. This approach is based on a historical explanation of the current situation of women and ends up reducing the problem of gender equality to a women-only issue, as highlighted by Roos et al. (2021), who emphasize that men's roles can not be left out of the discussion.

The second approach has drawn on the contributions of social movements and feminist theories (especially ecofeminism and intersectionality) and has been oriented to fighting for the transformation of the structural relations of domination and inequality that have accompanied capitalism and neoliberalism. The intersectional nature of gender refers to how gender inequality interacts with other inequalities of ethnicity, race, class, and age (Kaijser and Kronsell, 2014; Azocar and Ferree, 2016). The intersectionality has contributed to fuelling a reflective process on the idea of the systemic crisis of industrial capitalism, advocating a revision of the basic principles of development, growth, and the very nature of social modernisation (Carstensen-Egwuom, 2014; Mandeau, 2018).

This transformative approach aims for a radical change in both the economic model and the scientific model that legitimises it and incorporates the intention to depatriarchalize and decolonise the development and production of knowledge. Numerous disciplines have drawn attention to the need to decolonise science and development (Apostolopoulou et al., 2021; Dengler and Seebache, 2019), criticising two specific aspects. On the one hand, the way in which the North looks at the South as an object or simply ignores it and, on the other hand, the difficulty of the South to express itself in the channels of global science (which are usually those of the North).

The current research on gender in the bioeconomy is fundamentally eurocentric in terms of focus and authors. Bioeconomy research has barely attends to the knowledge and everydayness of invisibilised groups and territories. So rather than calling for the decolonisation of bioeconomy research we should suggest, as Walsh (2012) proposes, an 'epistemic interculturality'. From our point of view, what has been analysed so far highlights the need for recognition of the Global South in science in several ways: the importance of attending to the impacts of the bioeconomy in these territories (in terms of social justice) and the need to incorporate local authors into the dominant institutional circles of science, building bridges between North and South for a feminist and decolonial science (Dengler and Seebache, 2019).

5. Future pathways: much more than just a research agenda

The literature on women in bioeconomy-based development models and strategies is emerging in an attempt to address women's approach to development, and, in a minority of cases, integrating a gender analysis leading towards non-sexist and decolonial development. The literature on gender and bioeconomy shows a rich collection of disciplines, methods, related concepts or theories, and interrelated topics. It also reflects a diverse social or epistemic community of scholars. Clearly, with such diversity and complexity and within the limits of a journal paper, we do not pretend here to cover all possible insights that emerge from the sample and the database developed. We rather attempt to offer some timid key insights into the contributions of the papers that have given greater centrality to the gender issue.

This study shows that bioeconomy literature is making hardly any contribution to the debates and social currents that link gender, development, and sustainability. Even so, emerging trends in the gender-bioeconomy literature could influence the economy and sustainability in different ways and force society to grapple with and confront issues of agency, vulnerability, and gendered power relations.

Our analysis of the papers connecting gender and bioeconomy shows a literature poorly aligned with feminist approaches. Instead, it is focused on the Global North, with few methodological contributions, and especially lacking in any radical critique of the commodification of women's bodies and with little scope for exploring the implications of the bioeconomy model for gender equity and engaging in the transformation of women's everyday contexts. To conclude this review, we organize and present these ideas around five key propositions and invite scholars on bioeconomy to see them as more than just a research agenda.

5.1. Engaging with feminist theory and conceptual frameworks

The characteristics of studies on gender and bioeconomy suggests that the scientific debate also contributes to gendered ideas about the transition to bioeconomy and sustainability. We argue that bioeconomy research needs to broaden and enrich its assumptions about the nature of reality (ontology), and about how to know that reality (epistemology). There are various contemporary social currents that are contributing to shaping the global gender landscape such as social movements (local or global), ecofeminism and intersectional feminism.

Only two reviewed articles (Arancibia, 2013; Kumeh and Omulo, 2019) are focused on local grassroots social movements, which also incorporate in passing (but never as the main argument) features highlighted by ecofeminism, such as questioning the intensive use of resources, land grabbing, and the dispossession of women as the most vulnerable group.

The view from the ecofeminist perspective has highlighted two issues: a) the need to recover the essential principles of living in harmony with nature, the Sumak Kawsay (Chancoso, 2010), after the environmental degradation led by capitalism; and b) the repositioning of women as agents of change in their relationship with the environment (Puleo, 2010) and as a vehicle for applying the principle of responsibility for justice to transform structural processes leading to just outcomes (Young, 2011). Thus, an ecofeminist perspective on bioeconomy highlights issues of resource-intensive use and the negative impacts these have caused such as land grabbing and land dispossession (Adams et al., 2019; Azevedo-Ramos et al., 2020), displacement of peasants, expropriation of forests and extensive exploitation of natural resources (Bose et al., 2017), and loss of biodiversity and natural spaces (Tritsch and Arvor, 2016). The ecofeminist literature highlights that the economies of many communities in the world (especially in the Global South) depend on the sustainability of biological resources in all their diversity but also on the survival and sustainability of livelihoods based on it (Mies and Shiva, 1998: 16). Knowledge of this diversity has in many cases resided with women who have been the mainstay of local economies (especially in rural areas). In the most critical and radical position emerges the very questioning of the possibility of gender inclusion in the bio-economic transition because the bioeconomy model is based on market rationality and "is dependent on the spheres of women and nature being outside" (Spash, 2020:10).

Secondly, some arguments that align with the intersectional

perspective (e.g., Neimark and Healy, 2018; Grundel and Dahlström, 2016) incorporate a call for attention to current patterns of productivity and consumption (Latouche, 2008) and the position of inequality or discrimination resulting from socio-ecological crises and economic models (Gottschlich et al., 2017; Padmanabhan, 2011). Thus, a gender and social equity intersectional perspective on bioeconomy may bring issues of overlapping inequities to the fore in order to analyse efforts to mitigate climate change by introducing a biobased economy.

5.2. Making conscious the partiality and situationality of the production of knowledge

Two critical aspects emerge from our findings. Firstly, the reviewed literature is concentrated in the Global North; this further suggests that the Global South is playing a limited direct role in shaping the research area. A feminist epistemology of situated knowledge proposes a radically different scientific model of knowledge production that a) is aware that science and the space where it is produced is a process marked by inequality and domination, b) is committed to the heterogeneity of knowledge, c) makes visible the so-called epistemologies of ignorance, i.e. the knowledge of invisible groups that have been marginalized and systematically denied, and d) integrates the 'South epistemologies'. Bioeconomy scholars need to include this global dimension in their perspectives to a greater extent and overcome their Eurocentrism.

The second criticism problematizes bioeconomy as a concept proposed by the Global North being imposed on the Global South. We believe that a bioeconomy that not only attends to Northern visions but also to existing concepts from the South (e.g., buen vivir, ubuntu, radical ecological democracy) is possible. That is to say, a bioeconomy that fosters epistemic interculturality (Walsh, 2012) and joint lines of thought (e.g. post-development, ecofeminism, intersectionality, in short, postcolonial feminisms).

5.3. Developing new methodological proposals and making the appropriate choice of research methods

Today bioeconomy research is far from achieving a real integration of the gender perspective. This idea is reinforced by the fact that gender appears as a mere descriptive category: a socio-demographic variable or just another indicator.

There is certainly a need for further development of social sustainability indicators, which may also be integrated with assessment methods already in use (e.g., LCA) to carry out a more detailed and in-depth life cycle monitoring across sectors and industries and to set the right criteria in regulations, ensuring alignment with policy-makers' commitments to sustainable development (Ekener-Petersen et al., 2014).

But in our desire to go further, we want to highlight the need to design more participatory and innovative research methodologies that connect with contemporary social currents. Methods that give input to the *experiences of activists* and non-academic platforms of collective knowledge. In this way, as Escobar (2015) suggests, "the gap between academia and activism can be partially bridged".

5.4. Enhancing embodied and territorialized knowledge

As mentioned above, the biggest gendered debate in bioeconomy is taking place in the field of health and biomedicine due to the relevance of women's role in the health bioeconomy industries (Vertommen, 2017).

An important part of this literature is linked to a global feminist movement that claims women's rights over their bodies and makes visible dynamics such as domination, instrumentalization and oppression. The biomedical sector has highlighted the detrimental impact that bioeconomy development has on women due to the lack of regulation to adequately protect them as the main tissue donors in regenerative medicine and the reproductive labour industry. Among the challenges that the bioeconomy must face in the field of biomedicine are the following: the recognition of reproductive and regenerative labour as work (Waldby, 2008, 2009; Waldby and Cooper, 2010; Thompson, 2014), achieving reproductive justice that enables new family models (Wong, 2017; Lewis, 2018; Stuvøy, 2018; Molas and Perler, 2020), ending market pressure and control over women's bodies (Thompson, 2014; Waldby, 2015; Ikemoto, 2015; Mayes et al., 2018), balancing risk-sharing in bio-innovation (Kent, 2008; Kent and Farrell, 2015; Haddad, 2015) and ending scientific racism and subtle eugenic practices (Schurr, 2017; Dowdall, 2017) that are taking place in the field.

Studies such as Merz and Williams (2018) warn about the establishment of the "bio-value" of people and their bodily processes and its consequences for inequality and social stratification (Thompson, 2014). Transferring this idea to the realm of resources, Rudrappa (2018) argues that women and land occupy similar places in the collective imaginary, and both have been treated similarly, i.e., as natural resources. Bioavailability for bio-capital development and accessibility to human biological resources must be addressed while considering how they will be valued and sourced. Also, in this field the dominant resources-oriented vision (D'Amato et al., 2020) must be complemented by a social and critical analysis of the impacts of the processes involved.

5.5. Accepting the responsibility of bioeconomy research linked to a transformative praxis of women's everyday contexts

The greatest scientific interest in the 244 articles analysed is focused on general issues associated with the bioeconomy (sustainability, environmental concerns, involvement in biodiversity conservation programmes) and general aspects of implementing a bioeconomy model; this applies to 71 articles accounting for almost 30% of the total.

A large proportion of the studies examined shows a very low centrality and relevance of gender issues as main research. They focus on gender diversity in the face of general issues associated with the regional implementation of a bioeconomy model but do not delve into the potential benefits/risks of the bioeconomy for gender equality or into women's potential role in the transition to the bioeconomy. The majority of studies lacks critical or multilevel perspectives and there is a lack of studies with an analytical framework to reflect upon the impact of bioeconomy policies on gender roles and relational dynamics.

Furthermore, the literature on the gender bioeconomy has not sufficiently explored the implications of the bioeconomy model for women and gender equity, nor has it paid attention to the social movements in which women are playing a relevant role. The literature that has focused on analysing social movements relating to gender and bioeconomy is scarce (2 papers) (Arancibia, 2013; Kumeh and Omulo, 2019), with the exception of the contributions in health already discussed. Regarding the latter, it should be remembered that the global movement for transgender rights or feminist demands for control over one's own body is transforming health sciences and biomedicine.

We think that bioeconomy research should pay more attention to transformative movements (e.g. environmental justice movements, transition movements). Grassroots social movements are closely linked to territory. They tend to develop at a regional or local level compared to those addressing other areas such as health or gender-based violence, which are able to bring together global and online movements (e.g., #MeToo and #NiUnaMenos). Thus, a social movement approach to bioeconomy in a local context brings issues such as the relevance of women and their resistance in areas such as agroecology, food security, the defence of forests (and forest communities), the management of water resources, or cultural change to reduce poverty and energy vulnerability (Lara, 2014; Mello, 2017; Pérez Orozco, 2011). Most of the examples have in common the demand for justice, e.g., energy democracy demands the restructuring of the energy sector to prioritise community energy ownership (Allen et al., 2019), as well as the restructuring of power relations and structures that reproduce

inequitable practices which continue to be sustained in role attributions and work organisation (Lara, 2014; Pérez Orozco, 2011).

All of the above indicates that there is ample room for action to generate bioeconomy research that is more committed to the fight against gender inequalities. Researchers must accept the responsibility to contribute through their research to the transformative praxis of women's everyday contexts. We invite critical scholars to influence academic research on the bioeconomy by integrating a feminist ontology, epistemology and methodology into bioeconomy research, while building bridges between North-South, academia and activism, and research and grassroots social movements.

CRediT authorship contribution statement

Alexia Sanz-Hernández: Conceptualization, Methodology, Resources, Formal analysis, Writing – original draft. **Paula Jiménez-Caballero:** Formal analysis. **Irene Zarauz:** Formal analysis.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This study was developed in the framework of the Cátedra Tervalis of Bioeconomy and Society (University of Zaragoza).

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.forpol.2022.102762.

References

Adams, E.A., Kuusaana, E.D., Ahmed, A., Betey-Campion, B., 2019. Land dispossessions and water appropriations: political ecology of land and water grabs in Ghana. Land Use Policy 87, 104068. https://doi.org/10.1016/j.landusepol.2019.104068.

Aguilar, A., Patermann, C., 2020. Biodiplomacy, the new frontier for bioeconomy. New Biotechnol. 59, 20–25. https://doi.org/10.1016/j.nbt.2020.07.001.

Ahlqvist, T., Rhisiart, M., 2015. Emerging pathways for critical futures research: changing contexts and impacts of social theory. Futures 71, 91–104. https://doi.org/10.1016/j.futures.2015.07.012.

Allen, E., Lyons, H., Stephens, J.C., 2019. Women's leadership in renewable transformation, energy justice and energy democracy: redistributing power. Energy Res. Soc. Sci. 57, 101233 https://doi.org/10.1016/j.erss.2019.101233.

Andreasen, M., 2009. Who's credible? Expressions of consensus and conflict in focus groups about DNA patenting. BioSocieties 4 (1), 25–43. https://doi.org/10.1017/S1745855209006413.

Androniceanu, A., 2019. Social responsibility, an essential strategic option for a sustainable development in the field of bio-economy. Amfiteatru Econ. 21 (52), 503–519. https://doi.org/10.24818/EA/2019/52/503.

Andronie, M., Simion, V., Gurgu, E., Dijmǵrescu, A., Dijmǵrescu, I., 2019. Social responsibility of firms and the impact of bio-economy in intelligent use of renewable energy source. Amfiteatru Econ. 21 (52), 520–535. https://doi.org/10.24818/EA/2019/52/520.

Apostolopoulou, E., Chatzimentor, A., Maestre-Andrés, S., Requena-i-Mora, M., Pizarro, A., Bormpoudakis, D., 2021. Reviewing 15 years of research on neoliberal conservation: towards a decolonial, interdisciplinary, intersectional and community-engaged research agenda. Geoforum 124, 236–256. https://doi.org/10.1016/j.geoforum.2021.05.006.

Arancibia, F., 2013. Challenging the bioeconomy: the dynamics of collective action in Argentina. Technol. Soc. 35 (2), 79–92. https://doi.org/10.1016/j.techsoc.2013.01.008.

Azevedo-Ramos, C., Moutinho, P., da Arruda Laísa, S.V., Stabile, M.C.C., Alencar, A., Castro, I., Ribeiro, J.P., 2020. Lawless land in no man's land: the undesignated public forests in the Brazilian Amazon. Land Use Policy 99, 104863. https://doi.org/10.1016/j.landusepol.2020.104863.

Azocar, M.J., Ferree, M.M., 2016. Engendering the sociology of expertise. Sociol. Compass 10 (12), 1079–1089. https://doi.org/10.1111/soc4.12438.

Balezentis, T., Ribasauskiene, E., Morkunas, M., Volkov, A., Streimikiene, D., Toma, P., 2020. Young farmers' support under the common agricultural policy and sustainability of rural regions: evidence from Lithuania. Land Use Policy 94, 104542. https://doi.org/10.1016/j.landusepol.2020.104542.

Bejinaru, R., Hapenciuc, C.V., Condratov, I., Stanciu, P., 2018. The university role in developing the human capital for a sustainable bioeconomy. Amfiteatru Econ. 20 (49), 583–598. https://doi.org/10.24818/EA/2018/49/583.

Beneria, L., Berik, G., Floro, M. (Eds.), 2003. Gender, Development and Globalization: Economics as if all People Mattered. Routledge, New York.

Biber-Freudenberger, L., Ergeneman, C., Förster, J., Dietz, T., Börner, J., 2020. Bioeconomy futures: expectation patterns of scientists and practitioners on the sustainability of bio-based transformation. Sustain. Dev. 28 (5), 1220–1235. https://doi.org/10.1002/sd.2072.

Bjørkan, M., Eilertsen, S.M., 2020. Local perceptions of aquaculture: a case study on legitimacy from northern Norway. Ocean Coast. Manag. 195, 105276 https://doi.org/10.1016/j.ocecoaman.2020.105276.

Bose, P., Larson, A.M., Lastarria-Cornhiel, S., Radel, C., Schmink, M., Schmook, B., Vázquez-García, V., 2017. Women's rights to land and communal forest tenure: a way forward for research and policy agenda in Latin America. Women's Stud. Int. Forum 65, 53–59. https://doi.org/10.1016/j.wsif.2017.10.005.

Bracco, S., Calicioglu, O., Gomez San Juan, M., Flammini, A., 2018. Assessing the contribution of bioeconomy to the total economy: a review of national frameworks. Sustainability 10 (6), 1698. https://doi.org/10.3390/su10061698.

Bryden, J., Gezelius, S.S., Refsgaard, K., Sutz, J., 2017. Inclusive innovation in the bioeconomy: concepts and directions for research. Innov. Dev. 7, 1–16. https://doi.org/10.1080/2157930X.2017.1281209.

Buck, H.J., 2018. Perspectives on solar geoengineering from Finnish Lapland: local insights on the global imaginary of Arctic geoengineering. Geoforum 91, 78–86. https://doi.org/10.1016/j.geoforum.2018.02.020.

Calicioglu, O., Bogdanski, A., 2021. Linking the bioeconomy to the 2030 sustainable development agenda: can SDG indicators be used to monitor progress towards a sustainable bioeconomy? New Biotechnol. 61, 40–49. https://doi.org/10.1016/j.nbt.2020.10.010.

Carstensen-Egwuom, I., 2014. Connecting intersectionality and reflexivity: methodological approaches to social positionalities. Erdkunde 68 (4), 265–276. https://doi.org/10.3112/erdkunde.2014.04.03.

Chancoso, B., 2010. El Sumak Kawsay desde la visión de la mujer. América Latina en Movimiento 453, 6–9. https://bit.ly/3qRlyRK.

Conceição, C.P., Ávila, P., Coelho, A.R., Costa, A.F., 2020. European action plans for science–society relations: changing buzzwords, changing the agenda. Minerva 58, 1–24. https://doi.org/10.1007/s11024-019-09380-7.

Dahunsi, S.O., Fagbiele, O.O., Yusuf, E.O., 2020. Bioenergy technologies adoption in Africa: a review of past and current status. J. Clean. Prod. 264, 121683 https://doi.org/10.1016/j.jclepro.2020.121683.

Dale, V.H., Kline, K.L., Buford, M.A., Volk, T.A., Tattersall Smith, C., Stupak, I., 2016. Incorporating bioenergy into sustainable landscape designs. Renew. Sust. Energ. Rev. 56, 1158–1171. https://doi.org/10.1016/j.rser.2015.12.038.

D'Amato, D., Bartkowski, B., Droste, N., 2020. Reviewing the interface of bioeconomy and ecosystem service research. Ambio 49, 1878–1896. https://doi.org/10.1007/s13280-020-01374-0.

Declich, A., 2018. Society and materials: an interpretation of the subject in the light of sociology and gender. Mater. Tech. 105 (5–6), 513. https://doi.org/10.1051/mattech/2017038.

Dengler, C., Seebache, L.M., 2019. What about the global south? Towards a feminist decolonial degrowth approach. Ecol. Econ. 157, 246–252. https://doi.org/10.1016/j.ecolecon.2018.11.019.

Devaney, L., Henchion, M., Regan, A., 2017. Good governance in the bioeconomy. EuroChoices 16 (2), 41–46. https://doi.org/10.1111/1746-692X.12141.

Djokic, N., Grubor, A., Milićević, N., Petrov, V., 2018. New market segmentation knowledge in the function of bioeconomy development in Serbia. Amfiteatru Econ. 20, 700–716. https://doi.org/10.24818/EA/2018/49/700.

Dowdall, L., 2017. Treasured strangers: race, biopolitics, and the human in Octavia E. Butler's xenogenesis trilogy. Sci. Fict. Stud. 44, 506. https://doi.org/10.5621/sciefictstud.44.3.0506.

Ekener-Petersen, E., Höglund, J., Finnveden, G., 2014. Screening potential social impacts of fossil fuels and biofuels for vehicles. Energy Policy 73, 416–426. https://doi.org/10.1016/j.enpol.2014.05.034.

El Bilali, H., 2019. Research on agro-food sustainability transitions: a systematic review of research themes and an analysis of research gaps. J. Clean. Prod. 221, 353–364. https://doi.org/10.1016/j.jclepro.2019.02.232.

El Bilali, H., 2020. Transition heuristic frameworks in research on agro-food sustainability transitions. Environ. Dev. Sustain. 22, 1693–1728. https://doi.org/10.1007/s10668-018-0290-0.

El Wali, M., Golroudbary, S.R., Kraslawski, A., 2021. Circular economy for phosphorus supply chain and its impact on social sustainable development goals. Sci. Total Environ. 777, 146060 https://doi.org/10.1016/j.scitotenv.2021.146060.

Escobar, A., 2015. Degrowth, Postdevelopment, and transitions: a preliminary conversation. Sustain. Sci. 10, 451–462. https://doi.org/10.1007/s11625-015-0297-5.

European Commission, 2019. A sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment. Europ. Comm. 2018. Available at: https://bit.ly/32WcP97. (Accessed 14 March 2021).

Evans, E., 2016. Intersectionality as feminist praxis in the UK. Women's Stud. Int. Forum 59, 67–75. https://doi.org/10.1016/j.wsif.2016.10.004.

Falcone, P.M., García, S., Imbert, E., Lijó, L., Moreira, M., Tani, A., Tartiu, V., Morone, P., 2019. Transitioning towards the bio-economy: assessing the social dimension

through a stakeholder lens. Corp. Soc. Responsib. Environ. Manag. 26 (5), 1135–1153. https://doi.org/10.1002/csr.1791.
Gottschlich, D., Hackfort, S., 2016. Democratization of societal relations with nature. The relevance of political ecology's perspective. Politische Vierteljahresschrift 57 (2), 300–322. https://doi.org/10.5771/0032-3470-2016-2-300.
Gottschlich, D., Mölders, T., Padmanbhan, M., 2017. Introduction to the symposium on feminist perspectives on human–nature relations. Agric. Hum. Values 34, 933–940. https://doi.org/10.1007/s10460-016-9762-8.
Goven, J., Pavone, V., 2014. The bioeconomy as political project: a polanyian analysis. Sci. Technol. Hum. Values 40 (3), 302–337. https://doi.org/10.1177/0162243914552133.
Grundel, I., Dahlström, M., 2016. A quadruple and quintuple helix approach to regional innovation systems in the transformation to a forestry-based bioeconomy. J. Knowl. Econ. 7, 963–983. https://doi.org/10.1007/s13132-016-0411-7.
Gudowsky, N., Rosa, A., 2019. Bridging epistemologies—identifying uniqueness of lay and expert knowledge for agenda setting. Futures 109, 24–38. https://doi.org/10.1016/j.futures.2019.04.003.
Gunnarson, L., 2011. A defence of the category 'women'. Fem. Theory 12 (23), 23–37.
Haddad, C., 2015. Services in the self: embodied labor and the global bioeconomy. Life Sci. Soc. Pol. 11, 9. https://doi.org/10.1186/s40504-015-0027-x.
Hammersley, M., 2000. Taking Sides in Social Research. Routledge, London.
Hanacek, K., Roy, B., Avila, S., Kallis, G., 2020. Ecological economics and degrowth: proposing a future research agenda from the margins. Ecol. Econ. 169, 106495 https://doi.org/10.1016/j.ecolecon.2019.106495.
Häyrinen, L., Mattila, O., Berghäll, S., Toppinen, A., 2016. Lifestyle of health and sustainability of forest owners as an indicator of multiple use of forests. Forest Policy Econ. 67, 10–19. https://doi.org/10.1016/j.forpol.2016.03.005.
Heimann, T., 2019. Bioeconomy and sustainable development goals (SDGs): does the bioeconomy support the achievement of the SDGs? Earth's Future 7, 43–57. https://doi.org/10.1029/2018EF001014.
Hempel, C., Will, S., Zander, K., 2019. Societal perspectives on a bio-economy in Germany: an explorative study using Q methodology. Int. J. Food Syst. Dynam. 10 (1), 21–37. https://doi.org/10.18461/ijfsd.v10i1.02.
Hernik, J., Noszczyk, T., Rutkowska, A., 2019. Towards a better understanding of the variables that influence renewable energy sources in eastern Poland. J. Clean. Prod. 241, 118075 https://doi.org/10.1016/j.jclepro.2019.118075.
Holmgren, S., Arora-Jonsson, S., 2015. The Forest kingdom—with what values for the world? Climate change and gender equality in a contested forest policy context. Scand. J. For. Res. 30 (3), 235–245. https://doi.org/10.1080/02827581.2014.1002216.
Holmgren, S., D'Amato, D., Giurca, A., 2020. Bioeconomy imaginaries: a review of forest-related social science literature. Ambio 49, 1860–1877. https://doi.org/10.1007/s13280-020-01398-6.
Ikemoto, L.C., 2015. Egg freezing, stratified reproduction and the logic of not. J. Law Biosci. 2, 112–117. https://doi.org/10.1093/jlb/lsu037.
Ingrao, C., Bacenetti, J., Bezama, A., Blok, V., Goglio, P., Koukios, E.G., Lindner, M., Nemecek, T., Siracusa, V., Zabaniotou, A., Huisingh, D., 2018. The potential roles of bio-economy in the transition to equitable, sustainable, post fossil-carbon societies: findings from this virtual special issue. J. Clean. Prod. 204, 471–488. https://doi.org/10.1016/j.jclepro.2018.09.068.
Issa, I., Delbrück, S., Hamm, U., 2019. Bioeconomy from experts' perspectives – results of a global expert survey. PLoS One 14 (5), e0215917. https://doi.org/10.1371/journal.pone.0215917.
Johansson, M., Johansson, K., Andersson, E., 2018. #Metoo in the Swedish Forest sector: testimonies from harassed women on sexualised forms of male control. Scand. J. For. Res. 33 (5), 419–425. https://doi.org/10.1080/02827581.2018.1474248.
Johnson, O.W., Han, J.Y.-C., Knight, A.-L., Mortensen, S., Aung, M.T., Boyland, M., Resurrección, B.P., 2020. Intersectionality and energy transitions: a review of gender, social equity and low-carbon energy. Energy Res. Soc. Sci. 70, 101774 https://doi.org/10.1016/j.erss.2020.101774.
Jolly, S., Grillitsch, M., Hansen, T., 2020. Agency and actors in regional industrial path development. A framework and longitudinal analysis. Geoforum 111, 176–188. https://doi.org/10.1016/j.geoforum.2020.02.013.
Juerges, N., Hansjürgens, B., 2018. Soil governance in the transition towards a sustainable bioeconomy – a review. J. Clean. Prod. 170, 1628–1639. https://doi.org/10.1016/j.jclepro.2016.10.143.
Kaijser, A., Kronsell, A., 2014. Climate change through the lens of intersectionality. Environ. Pol. 23 (3), 417–433. https://doi.org/10.1080/09644016.2013.835203.
Karvonen, J., Halder, P., Kangas, J., Leskinen, P., 2017. Indicators and tools for assessing sustainability impacts of the forest bioeconomy. For. Ecosyst. 4, 2. https://doi.org/10.1186/s40663-017-0089-8.
Kent, J., 2008. The fetal tissue economy: from the abortion clinic to the stem cell laboratory. Soc. Sci. Med. 67, 1747–1756. https://doi.org/10.1016/j.socscimed.2008.09.027.
Kent, J., Farrell, A., 2015. Risky bodies in the plasma bioeconomy: a feminist analysis. Body Soc. 21 (1), 29–57. https://doi.org/10.1177/1357034X13520331.
Kerr, A., Woods, B., Nettleton, S., Burrows, R., 2009. Testing for food intolerance: new markets in the age of biocapital. BioSocieties 4, 3–24. https://doi.org/10.1017/S1745855209006401.
Kumeh, E.M., Omulo, G., 2019. Youth's access to agricultural land in sub-Saharan Africa: a missing link in the global land grabbing discourse. Land Use Policy 89, 104210. https://doi.org/10.1016/j.landusepol.2019.104210.
Lara, M.P., 2014. ¿Es posible construir un puente teórico entre la teoría feminista y las teorías sobre la ecología? Debate Feminista 49, 125–147. https://doi.org/10.1016/S0188-9478(16)30007-X.
Larasatie, P., Baublyte, G., Conroy, K., Hansen, E., Toppinen, A., 2019. "From nude calendars to tractor calendars": the perspectives of female executives on gender aspects in the North American and Nordic forest industries. Can. J. For. Res. 49 (8), 915–924. https://doi.org/10.1139/cjfr-2018-0402.
Larasatie, P., Barnett, T., Hansen, E., 2020. The "Catch-22" of representation of women in the forest sector: the perspective of student leaders in top global forestry universities. Forests 11 (4), 419. https://doi.org/10.3390/f11040419.
Latouche, S. (Ed.), 2008. La apuesta por el decrecimiento ¿Cómo salir del imaginario dominante? Icaria, Barcelona.
Lehtonen, O., Okkonen, L., 2013. Regional socio-economic impacts of decentralised bioeconomy: a case of Suutela wooden village, Finland. Environ. Dev. Sustain. 15, 245–256. https://doi.org/10.1007/s10668-012-9372-6.
Leipold, S., 2014. Creating forests with words—A review of forest-related discourse studies. Forest Policy Econ. 40, 12–20. https://doi.org/10.1016/j.forpol.2013.12.005.
Levidow, L., Birch, K., Papaioannou, T., 2012. EU Agri-innovation policy: two contending visions of the bio-economy. Critic. Pol. Stud. 6, 40–65. https://doi.org/10.1080/19460171.2012.659881.
Lewis, S., 2018. International solidarity in reproductive justice: surrogacy and gender-inclusive polymaternalism. Gend. Place Cult. 25 (2), 207–227. https://doi.org/10.1080/0966369X.2018.1425286.
Lidestav, G., Sjölander, A.E., 2007. Gender and forestry: a critical discourse analysis of forestry professions in Sweden. Scand. J. For. Res. 22 (4), 351–362. https://doi.org/10.1080/02827580701504928.
Lidestav, G., Johansson, M., Huff, E.S., 2019. Gender perspectives on Forest Services in the Rise of a bioeconomy discourse. In: Hujala, T., Toppinen, A.J., Butler, B. (Eds.), Services in Family Forestry. Springer, Cham, p. 24. https://doi.org/10.1007/978-3-030-28999-7_15. World Forests.
Lopez, A.G., 2018. Perspectives for a "radical" brand of pedagogy. Gender, techno-sciences and the economy of bodies. Philos. Stud. 8 (7), 322–328. https://doi.org/10.17265/2159-5313/2018.07.004.
Lukash, S., 2018. Bioeconomy: opportunities for a bio-based and sustainable future. Visnyk Sumy Nat. Agrar. Univ. Sci. J. 6 (72), 23–31. https://bit.ly/3GdJxRW.
Mallick, P., 2020. Scientific Forest Resource Management: A Trajectory Towards Bioeconomy – A Case Study of Jalpaiguri District. Business Spectrum, Special Volume March 2020, 01/03/2020. Available at: https://bit.ly/3qZsNY8.
Mandeau, N., 2018. Postdesarrollo, decrecimiento y el buen vivir. Documentos de trabajo, 41. Instituto Universitario de Desarrollo y Cooperación. Univ. Complut. Madrid 41, 2–81. Available at. https://bit.ly/3HJCJeX (accessed 12 March 2021).
Mäntymaa, E., Juutinen, A., Tyrväinen, L., Karhu, J., Kurttila, M., 2018. Participation and compensation claims in voluntary forest landscape conservation: the case of the Ruka-Kuusamo tourism area, Finland. J. For. Econ. 33, 14–24. https://doi.org/10.1016/j.jfe.2018.09.003.
Matthews, A., 2020. The new CAP must be linked more closely to the UN sustainable development goals. Agric. Food Econ. 8, 19. https://doi.org/10.1186/s40100-020-00163-3.
Mayes, C., Williams, J., Lipworth, W., 2018. Conflicted hope: social egg freezing and clinical conflicts of interest. Health Sociol. Rev. 27 (1), 45–59. https://doi.org/10.1080/14461242.2017.1349545.
Mbembe, J.A., 2016. Decolonizing the university: new directions. Arts Human. Higher Educ 15 (1), 29–45. https://doi.org/10.1177/1474022215618513.
McCormick, K., Kautto, N., 2013. The bioeconomy in Europe: an overview. Sustainability 5 (6), 2589–2608. https://doi.org/10.3390/su5062589.
Mello, D., Schmink, M., 2017. Amazon entrepreneurs: women's economic empowerment and the potential for more sustainable land use practices. Women's Stud. Int. Forum 65, 28–36. https://doi.org/10.1016/j.wsif.2016.11.008.
Mengistu, T.W., Gupta, S., Birner, R., 2018. Analysis of maize biomass use in Ethiopia and its implications for food security and the bioeconomy. Food Sec. 10, 1631–1648. https://doi.org/10.1007/s12571-018-0865-5.
Merz, S., Williams, R.G., 2018. 'We all have a responsibility to each other': valuing racialised bodies in the neoliberal bioeconomy. New Pol. Econ. 23 (5), 560–573. https://doi.org/10.1080/13563467.2017.1417368.
Mies, M., Shiva, V., 1998. La práxis del ecofeminismo. Biotecnología, Consumo, Reproducción, Icaria, Barcelona.
Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., The PRISMA Group, 2009. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 6 (7), e1000097 https://doi.org/10.1371/journal.pmed.1000097.
Molas, A., Perler, L., 2020. Selecting women, taming bodies? Body ontologies in egg donation practices in Spain. Tapuya: Latin American. Sci. Technol. Soc. 3 (1), 396–414. https://doi.org/10.1080/25729861.2020.1781371.
Mottet, A., Teillard, F., Boettcher, P., De', Besi G., Besbes, B., 2018. Review: domestic herbivores and food security: current contribution, trends and challenges for a sustainable development. Animal 12 (2), 188–198. https://doi.org/10.1017/S1751731118002215.
Neimark, B.D., Healy, T.M., 2018. Small-scale commodity frontiers: the bioeconomy value chain of castor oil in Madagascar. J. Agrar. Chang. 18, 632–657. https://doi.org/10.1111/joac.12231.
Nightingale, A.J., 2011. Bounding difference: intersectionality and the material production of gender, caste, class and environment in Nepal. Geoforum 42 (2), 153–162. https://doi.org/10.1016/j.geoforum.2010.03.004.
Nightingale, A.J., 2016. Adaptive scholarship and situated knowledges? Hybrid methodologies and plural epistemologies in climate change adaptation research. Area 48 (1), 41–47. https://doi.org/10.1111/area.12195.
Nowell, L.S., Norris, J.M., White, D.E., Moules, N.J., 2017. Thematic analysis: striving to meet the trustworthiness criteria. Int J Qual Methods. https://doi.org/10.1177/1609406917733847.

OECD, 2018. Meeting Policy Challenges for a Sustainable Bioeconomy. Organization for Economic Co-Operation and Development, France. https://doi.org/10.1787/9789264292345-en.
Padmanabhan, M., 2011. Women and men as conservers, users and managers of agrobiodiversity: A feminist social–ecological approach. J. Socio-Econ. 40, 968–976. https://doi.org/10.1016/j.socec.2011.08.021.
Pätäri, S., Arminen, H., Albareda, L., Puumalainen, K., Toppinen, A., 2017. Student values and perceptions of corporate social responsibility in the forest industry on the road to a bioeconomy. Forest Policy Econ. 85 (Part 1), 201–215. https://doi.org/10.1016/j.forpol.2017.10.009.
Peralta Garcia, L., Chaparro Escudero, M., Espinar Medina, L., 2021. Ecosocial transition indicators from a feminist perspective. Castilla-La Mancha as a case study. Investig. Feminist. 12 (2), 529–538. https://doi.org/10.5209/infe.68526.
Pérez Orozco, A., 2011. Crisis multidimensional y sostenibilidad de la vida. Investig. Feminist. 1, 29–53. https://doi.org/10.5209/rev_INFE.2011.v2.38603.
Perez-Pena, M.D.C., Jiménez-García, M., Ruiz-Chico, J., 2021. Analysis of research on the SDGs: the relationship between climate change, poverty and inequality. Appl. Sci. Basel 11 (19), 8947. https://doi.org/10.3390/app11198947.
Petticrew, M., Roberts, H. (Eds.), 2006. Systematic Reviews in the Social Sciences: A Practical Guide. Wiley-Blackwell, Malden, MA.
Pfau, S.F., Hagens, J.E., Dankbaar, B., Smits, A., 2014. Visions of sustainability in bioeconomy research. Sustainability 6 (3), 1222–1249. https://doi.org/10.3390/su6031222.
Philippidis, G., Shutes, L., M'Barek, R., Ronzon, T., Tabeau, A., Van Meijl, H., 2020. Snakes and ladders: world development pathways' synergies and trade-offs through the lens of the sustainable development goals. J. Clean. Prod. 267, 122147 https://doi.org/10.1016/j.jclepro.2020.122147.
Pla-Julian, I., Guevara, S., 2019. Is circular economy the key to transitioning towards sustainable development? Challenges from the perspective of care ethics. Futures 105, 67–77. https://doi.org/10.1016/j.futures.2018.09.001.
Polimeni, J.M., Iorgulescu, R.I., Mihnea, A., 2018. Understanding consumer motivations for buying sustainable agricultural products at Romanian farmers markets. J. Clean. Prod. 184, 586–597. https://doi.org/10.1016/j.jclepro.2018.02.241.
Puleo, A.H., 2010. Ecofeminismo: la perspectiva de género en la conciencia ecologista. In: Ecologistas en Acción (Ed.), Claves del Ecologismo Social, Madrid. Available at: https://bit.ly/3t5paSW.
Pulighe, G., Bonati, G., Colangeli, M., Morese, M.M., Traverso, L., Lupia, F., Khawaja, C., Janssen, R., Fava, F., 2019. Ongoing and emerging issues for sustainable bioenergy production on marginal lands in the Mediterranean regions. Renew. Sust. Energ. Rev. 103, 58–70. https://doi.org/10.1016/j.rser.2018.12.043.
Pülzl, H., Kleinschmit, D., Arts, B., 2014. Bioeconomy - an emerging metadiscourse affecting forest discourses? Scand. J. For. Res. 29 (4), 386–393. https://doi.org/10.1080/02827581.2014.920044.
Pye, O., 2019. Commodifying sustainability: development, nature and politics in the palm oil industry. World Dev. 121, 218–228. https://doi.org/10.1016/j.worlddev.2018.02.014.
Rafiaani, P., Kuppens, T., Dael, M.V., Azadi, H., Lebailly, P., Passel, S.V., 2018. Social sustainability assessments in the biobased economy: towards a systemic approach. Renew. Sust. Energ. Rev. 82 (Part 2), 1839–1853. https://doi.org/10.1016/j.rser.2017.06.118.
Raimondo, M., Caracciolo, F., Cembalo, L., Chinnici, G., Pecorino, B., D'Amico, M., 2018. Making virtue out of necessity: managing the citrus waste supply chain for bioeconomy applications. Sustainability 10 (12), 4821. https://doi.org/10.3390/su10124821.
Ramcilovik-Suominen, S., Pülzl, H., 2016. Sustainable development—A 'selling point' of the emerging EU bioeconomy policy framework? J. Clean. Prod. 172, 4170–4180. https://doi.org/10.1016/j.jclepro.2016.12.157.
Ramírez Cendrero, J.M., García, S., Santillán, A., 2017. Sumak kawsay in Ecuador: the role of communitarian economy and the experience of the rural communities in Sarayaku (Ecuadorian Amazonia). J. Rural. Stud. 53, 111–121. https://doi.org/10.1016/j.jrurstud.2017.05.018.
Ranacher, L., Lähtinen, K., Järvinen, E., Toppinen, A., 2017. Perceptions of the general public on forest sector responsibility: A survey related to ecosystem services and forest sector business impacts in four European countries. Forest Policy Econ. 78, 180–189. https://doi.org/10.1016/j.forpol.2017.01.016.
Resurrección, B.P., Elmhirst, R., 2021. Negotiating Gender Expertise in Environment and Development: Voices from Feminist Political Ecology. Routledge.
Rodriguez, A.G., Aramendis, R.H., Mondaini, A.O., 2018. El financiamiento de la bioeconomía en países seleccionados de Europa, Asia y África. Experiencias Para América Latina y el Caribe. 222, 5–59. Available at. https://bit.ly/3r1bHcn [accessed 29 December 2021].
Ronzon, T., Sanjuán, A.I., 2020. Friends or foes? A compatibility assessment of bioeconomy-related sustainable development goals for European policy coherence. J. Clean. Prod. 254, 119832 https://doi.org/10.1016/j.jclepro.2019.119832.
Roos, A., Blomquist, M., Bhatia, R., Ekegren, K., Rönnberg, J., Torfgård, L., Tunberg, M., 2021. The digitalisation of the Nordic bioeconomy and its effect on gender equality. Scand. J. For. Res. 36 (7–8), 639–654. https://doi.org/10.1080/02827581.2021.1996629.
Rosa, A., Gudowsky, N., Warnke, P., 2018. But do they deliver? Participatory agenda setting on the test bed. Europ. J. Futures Res. 6, 14. https://doi.org/10.1186/s40309-018-0143-y.
Rudrappa, S., 2018. Land, women and techno-pastoral development in southern Karnataka, India. Reprod. Biomed. Soc. Online 7, 141–149. https://doi.org/10.1016/j.rbms.2018.12.001.
Sadhukhan, J., Martinez-Hernandez, E., Murphy, R.J., Ng, D.K.S., Hassim, M.H., Siew Ng, K., Yoke Kin, W., Jaye, I.F.M., Leung Pah Hang, M.Y., Andiappan, V., 2018. Role of bioenergy, biorefinery and bioeconomy in sustainable development: strategic pathways for Malaysia. Renew. Sust. Energ. Rev. 81 (Part 2), 1966–1987. https://doi.org/10.1016/j.rser.2017.06.007.
Santiago-Freijanes, J.J., Mosquera-Losada, M.R., Rois-Díaz, M., Ferreiro-Domínguez, N., Pantera, A., Aldrey, J.A., Rigueiro-Rodríguez, A., 2018. Global and European policies to foster agricultural sustainability: agroforestry. Agrofor. Syst. 95, 775–790. https://doi.org/10.1007/s10457-018-0215-9.
Sanz-Hernández, A., Sanagustin Fons, M.V., López Rodriguez, M.E., 2019a. A transition to an innovative and inclusive bioeconomy in Aragon, Spain. Environ. Innov. Soc. Trans. 33, 301–316. https://doi.org/10.1016/j.eist.2019.08.003.
Sanz-Hernández, A., Esteban, E., Garrido, P., 2019b. Transition to a bioeconomy: perspectives from social sciences. J. Clean. Prod. 224, 107–119. https://doi.org/10.1016/j.jclepro.2019.03.168.
Sanz-Hernández, A., Esteban, E., Marco, P., Soriano, G., 2020. Forest bioeconomy in the media discourse in Spain. Ambio 49, 1897–1911. https://doi.org/10.1007/s13280-020-01390-0.
SCAR, 2015. Sustainable Agriculture, Forestry and Fisheries in the Bioeconomy - A Challenge for Europe, 4th SCAR Foresight Exercise. Standing Committee on Agricultural Research, Brussels. Available at: https://bit.ly/3q4JbHt [accessed 12 March 2021].
Scarlat, N., Dallemand, J.F., Monforti-Ferrario, F., Nita, V., 2015. The role of biomass and bioenergy in a future bioeconomy: policies and facts. Environ. Dev. 15, 3–34. https://doi.org/10.1016/j.envdev.2015.03.006.
Schurr, C., 2017. From biopolitics to bioeconomies: the ART of (re-)producing white futures in Mexico's surrogacy market. Environ. Plan. D: Soc. Space 35 (2), 241–262. https://doi.org/10.1177/0263775816638851.
Scott, J.W., 2010. Gender: still a useful category of analysis? Diogenes 57 (7), 7–14.
Seebacher, L.M., 2016. Counting People, Not Objects. A Feminist Standpoint Theoretical Perspective on Quantitative Methods & Questionnaire Construction. Master Thesis. WU, Vienna.
Shannon, G., Jansen, M., Williams, K., Cáceres, C., Motta, A., Odhiambo, A., Eleveld, A., Mannell, J., 2019. Gender equality in science, medicine, and global health: where are we at and why does it matter? Lancet 393, 560–569. https://doi.org/10.1016/S0140-6736(18)33135-0.
Siegner, M., Panwar, R., Kozak, R., 2017. Making the bio-economy more inclusive: the role of community forestry and agro-forestry. Jahrbuch der Österreichischen Gesellschaft für Agrarökonomie, Band 26, 229–238. Available at. https://bit.ly/336M7KF.
Smietana, M., Thompson, C., Twine, F.W., 2018. Making and breaking families – reading queer reproductions, stratified reproduction and reproductive justice together. Reprod. Biomed. Soc. Online 7, 112–130. https://doi.org/10.1016/j.rbms.2018.11.001.
Smith, E., Diggans, J., 2020. Next steps to grow the bioeconomy. Health Secur. 18 (4), 297–302. https://doi.org/10.1089/hs.2020.0012.
Soma, K., Onwezen, M.C., Salverda, I.E., van Dam, I.R., 2016. Roles of citizens in environmental governance in the information age—four theoretical perspectives. Curr. Opin. Environ. Sustain. 18, 122–130. https://doi.org/10.1016/j.cosust.2015.12.009.
Sovacool, B.K., Axsen, J., Sorrell, S., 2018. Promoting novelty, rigor, and style in energy social science: towards codes of practice for appropriate methods and research design. Energy Res. Soc. Sci. 45, 12–42. https://doi.org/10.1016/j.erss.2018.07.007.
Spash, C.L., 2020. A tale of three paradigms: realising the revolutionary potential of ecological economics. Ecol. Econ. 169, 106518 https://doi.org/10.1016/j.ecolecon.2019.106518.
Stahl, B.C., Chatfield, K., Ten Holter, C., Brem, A., 2019. Ethics in corporate research and development: can responsible research and innovation approaches aid sustainability? J. Clean. Prod. 239, 118044 https://doi.org/10.1016/j.jclepro.2019.118044.
Stanturf, J.A., Kleine, M., Mansourian, S., Parrotta, J., Madsen, P., Kant, P., Burns, J., Bolte, A., 2019. Implementing forest landscape restoration under the Bonn challenge: a systematic approach. Ann. For. Sci. 76, 50. https://doi.org/10.1007/s13595-019-0833-z.
Stuvøy, I., 2018. Troublesome reproduction: surrogacy under scrutiny. Reprod. Biomed. Soc. Online 7, 33–43. https://doi.org/10.1016/j.rbms.2018.10.015.
Takala, T., Hujala, T., Tanskanen, M., Tikkanen, J., 2019. Competing discourses of the forest shape forest owners' ideas about nature and biodiversity conservation. Biodivers. Conserv. 28, 3445–3464. https://doi.org/10.1007/s10531-019-01831-7.
Thomas, J.-B.E., Nordström, J., Risén, E., Malmström, M.E., Gröndahl, F., 2018. The perception of aquaculture on the Swedish west coast. Ambio 47 (4), 398–409. https://doi.org/10.1007/s13280-017-0945-3.
Thompson, C., 2014. Three times a woman: voting, egg donation, cosmetics, and the punctuated gendering of stem cell innovation in California. Cahiers du Genre 1 (1), 105–138. https://doi.org/10.3917/cdge.056.0105.
Toppinen, A., Röhr, A., Pätäri, S., Lähtinen, K., Toivonen, R., 2018. The future of wooden multistory construction in the forest bioeconomy – A Delphi study from Finland and Sweden. J. For. Econ. 31, 3–10. https://doi.org/10.1016/j.jfe.2017.05.001.
Tritsch, I., Arvor, D., 2016. Transition in environmental governance in the Brazilian Amazon: emergence of a new pattern of socio-economic development and deforestation. Land Use Policy 59, 446–455. https://doi.org/10.1016/j.landusepol.2016.09.018.
Van Dael, M., Lizin, S., Swinnen, G., Van Passel, S., 2017. Young people's acceptance of bioenergy and the influence of attitude strength on information provision. Renew. Energy 107, 417–430. https://doi.org/10.1016/j.renene.2017.02.010.
Varela-Candamio, L., Calvo, N., Novo-Corti, I., 2018. The role of public subsidies for efficiency and environmental adaptation of farming: A multi-layered business model

based on functional foods and rural women. J. Clean. Prod. 183, 555–565. https://doi.org/10.1016/j.jclepro.2018.02.109.
Vătămănescu, E.-M., Alexandru, V.-A., Cristea, G., Radu, L., Chirica, O., 2018. A demand-side perspective of bioeconomy: the influence of online intellectual capital on consumption. Amfiteatru Econ. 20 (49), 536–552. https://doi.org/10.24818/EA/2018/49/536.
Vertommen, S., 2017. From the pergonal project to Kadimastem: a genealogy of Israel's reproductive-industrial complex. BioSocieties 12, 282–306. https://doi.org/10.1057/biosoc.2015.44.
Vida, B., 2020. Policy framing and resistance: gender mainstreaming in horizon 2020. Eur. J. Women's Stud. 28, 1–16. https://doi.org/10.1177/1350506820935495.
Von Cossel, M., Wagner, M., Lask, J., Magenau, E., Bauerle, A., Von Cossel, V., Warrach-Sagi, K., Elbersen, B., Staritsky, I., Van Eupen, M., Iqbal, Y., Jablonowski, N.D., Happe, S., Fernando, A.L., Scordia, D., Cosentino, S.L., Wulfmeyer, V., Lewandowski, I., Winkler, B., 2019. Prospects of bioenergy cropping systems for a more social-ecologically sound bioeconomy. Agronomy 9 (10), 605. https://doi.org/10.3390/agronomy9100605.
Waldby, C., 2008. Oocyte markets: women's reproductive work in embryonic stem cell research. New Genet. Soc. 27, 19–31. https://doi.org/10.1080/14636770701843576.
Waldby, C., 2009. Singapore biopolis: bare life in the city-state. East Asian Sci. Technol. Soc. Int. J. 3 (2–3), 367–383. https://doi.org/10.1215/s12280-009-9089-2.
Waldby, C., 2015. 'Banking time': egg freezing and the negotiation of future fertility. Cult. Health Sex. 17 (4), 470–482. https://doi.org/10.1080/13691058.2014.951881.
Waldby, C., Cooper, M., 2010. From reproductive work to regenerative labour: the female body and the stem cell industries. Fem. Theory 11, 3–22. https://doi.org/10.1177/1464700109355210.
Walsh, C., 2012. Other' knowledges, 'other' critiques: reflections on the politics and practices of philosophy and decoloniality in the 'other' America. Transmodernity 1 (3), 11–27. https://doi.org/10.5070/T413012880.
Weiss, G., Lawrence, A., Lidestav, G., Feliciano, D., Hujala, T., Sarvašová, Z., Dobšinská, Z., Živojinović, I., 2019. Research trends: forest ownership in multiple perspectives. Forest Policy Econ. 99, 1–8. https://doi.org/10.1016/j.forpol.2018.10.006.
Westholm, L., Arora-Jonsson, S., 2018. What room for politics and change in global climate governance? Addressing gender in co-benefits and safeguards. Environ. Pol. 27 (5), 917–938. https://doi.org/10.1080/09644016.2018.1479115.
Wilde, D., 2020. Design research education and global concerns. She Ji: J. Design Econ. Innov. 6 (2), 170–212. https://doi.org/10.1016/j.sheji.2020.05.003.
Wilson, J., Chu, E., 2020. The embodied politics of climate change: analysing the gendered division of environmental labour in the UK. Environ. Pol. 29 (6), 1085–1104. https://doi.org/10.1080/09644016.2019.1629170.
Wong, K.-A., 2017. Donor conception and "passing," or; why australian parents of donor-conceived children want donors who look like them. J. Bioethic. Inquiry 14, 77–86. https://doi.org/10.1007/s11673-016-9755-8.
Young, I.M., 2011. Responsibility for Justice. Oxford University Press, Oxford. https://doi.org/10.1093/acprof:oso/9780195392388.001.0001.
Zabaniotou, A., Fytili, D., Lakioti, E., Karayannis, V., 2019. Transition to bioenergy: engineering and technology undergraduate students' perceptions of and readiness for agricultural waste-based bioenergy in Greece. Glob. Trans. 1, 157–170. https://doi.org/10.1016/j.glt.2019.09.001.
Zeug, W., Bezama, A., Moesenfechtel, U., Jähkel, A., Thrän, D., 2019. Stakeholders' interests and perceptions of bioeconomy monitoring using a sustainable development goal framework. Sustainability 11 (6), 1511. https://doi.org/10.3390/su11061511.
Zwolińska-Ligaj, M., 2015. Corporate social responsibility of bioeconomy in the natural valuable areas of the Lubelskie voivodeship. Econ. Region. Stud. 8, 92–111. https://doi.org/10.22004/ag.econ.265103.