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A review of gender in agricultural and pastoral livelihoods based on selected countries in west and east Africa

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This scoping paper presents the results of a review of the landscape of research on gender and agricultural and pastoral livelihoods in select countries in west and east Africa (Burkina Faso, Chad, Eritrea, Ethiopia, Kenya, Mali, Mauritania, Niger, Nigeria, Sudan, South Sudan, Somalia, and Uganda) published over 5 years (January 2016–March 2021). A keyword search of the Scopus database gave rise to an ultimate dataset of 169 papers which were coded for geographical location, approaches to gender, and theme based on inductive identification of clusters of research. There has been an increase in the number of published papers but there is an uneven geographical distribution of research. Studies vary in the way they treat gender: with an almost even split between modeling-based studies, where gender is one of many variables to be correlated with, or to determine, an outcome (e.g., poverty—for example, as a dummy variable in regressions); and studies where the expressed aim is to look at gender differences, whether through the gender of an individual or the gender of a household head. Clusters of papers look at gender differences in assets, health, perceptions of environmental degradation, agricultural perceptions and outcomes, and climate change perceptions, vulnerability, and adaptation. There is also a number of papers exploring women's empowerment, including intra-household decision making. Intersectional approaches have been employed both through modeling studies and through more in-depth qualitative studies that are able to trace changes in identity over time, and the implications therein. The household and household headship have remained common entry points and units of analysis, despite known critiques. The results highlight a need to address geographical gaps in gender research, expand the evidence base of intersectional approaches, explore other aspects of social inequality, and expand more innovative methodological studies.

KEYWORDS

gender, agriculture, pastoralism, sub-Saharan Africa, livelihoods

Introduction

Gender, and socially constructed gender roles and relations, affects access to and benefits from agricultural and pastoral livelihoods. It thus contributes to situations of inequality, and the nature of these gender differences needs to be understood in order to redress such inequality. This scoping paper presents the results of a review of recent gender-related findings in research on agricultural and pastoral livelihoods published over 5 years, from January 2016–March 2021. The aim is to characterize the landscape of research, taking into account geographical variation in evidence, the ways in which gender has been approached through studies, and the thematic range of knowledge relating to gender and agricultural and pastoral livelihoods. From this, it is possible to identify gaps and knowledge needs.

There has been a significant evolution in gender studies since feminism first arose alongside other post-structuralist epistemologies within development studies (Jackson and Pearson, 1998). These post-structuralist approaches emphasize the social construction of reality and critique the structural, intellectual tradition that prioritized the notion of universal truths. There is broad acceptance of a shift from an approach of women in development (WID) to women and development (WAD) and the current gender and development (GAD) approaches (Table 1). WID arose out of critiques of modernization by liberal and social feminists who highlighted that women had not benefited from economic growth to the same extent as men. This led to efforts to increase the visibility of women, particularly within development theory and practice—but largely as a homogeneous group. Later, the WAD approach arose from Marxist and liberal feminists who stated that structural disadvantage was the cause of women's invisibility. Both WID and WAD spawned significant attempts at women's empowerment interventions within development practices (e.g., Kabeer, 1994; Cornwall, 2016).

In contrast to the women-only focus of WID and WAD, GAD approaches recognize the social relations between men and women and how they are socio-culturally produced and reproduced. This opens up the consideration of men and masculinities (Chant, 2000; Cornwall, 2000). Within GAD, feminist voices have been influenced by post-colonialism and post-development (Mohanty, 1988; McEwan, 2001). The result is that feminism no longer relates to a western set of hegemonic ideas, but instead can take a series of forms operating at a variety of scales (McIlwaine and Datta, 2003). This opens up the recognition of the intersectionality of gender and other factors, such as race, in explaining marginalization (Crenshaw, 1989, 1991). As such, GAD has evolved to embrace the ways in which multiple facets of social identity can interact to augment or diminish opportunities and create situations of power or oppression. Intersectional approaches provide insights into situations of differential vulnerability that exist in the face of stresses such as climate change (Kaijser and Kronsell, 2014; Djoudi et al., 2016).

The era of GAD has seen significant changes in some arenas, but it has stalled in others. The visibility of gendered divisions is growing (in education, labor, employment and access to resources, etc.; Momsen, 2004). Increasing global commitments have also been made to gender equality, including through the United Nations' Millennium Development Goals and then Sustainable Development Goals, and continued efforts have been made on the empowerment of women and girls to redress inequalities brought about by patriarchy. Particular success in the Millennium Development Goals has occurred in the parity of girls and boys in primary education, and the improvement of the maternal mortality ratio (UN Women, 2016).

Whilst there have been material changes in access to education and healthcare in the era of GAD, critiques have also been raised as to the extent to which GAD approaches have effectively permeated development practices (Cornwall et al., 2007). The strength of the feminist movement in redressing gender inequalities has largely led to ongoing focus on women yet more limited engagement with any relational aspects of men and masculinities (Edström et al., 2014). Similarly, there are questions around the continued dominance of neoliberal feminism at the cost of more varied feminist perspectives (Wilson, 2015). In particular, attempts to challenge patriarchy can fail to engage with culturally contingent systems of gender equity, leading to situations where the solutions to the "gender problem" are themselves patriarchal (Tavenner and Crane, 2019). Concern has been raised that the language of gender equality and women's empowerment has been diluted in use to the extent that there is a loss of opportunities to demand rights and justice (Cornwall and Rivas, 2015).

The evolution of approaches to gender has been mirrored in methods that have been used to interrogate gender. Household economics has embraced a household-level division of labor that typically sees men engage in productive tasks whilst women engage in reproductive tasks (Becker, 1985). Household economics also provides insights into the feminization of poverty, on the grounds that the social constructions of gender roles and the lack of women's entitlements result in particularly high levels of poverty and marginalization for female-headed households (Davids and Briel, 2002). Earlier simplifications of the feminization of poverty were then displaced by livelihoods approaches and the understanding of entitlements (e.g., Kabeer, 1996; Momsen, 2002). However, household headship is still widely used as a proxy for gender differences in both quantitative and qualitative studies, in spite of its inherent problems (Folbre, 1986). Qualitative studies are variously employed to interrogate the underlying reasons for and nature of gender differences, including from an intersectional perspective.

TABLE 1 Evolution in approaches to women and gender in development.

	Women in development (WID)	Women and development (WAD)	Gender and development (GAD)
Origins	In the 1970s after the publication of Esther Boserup's book *Woman's role in economic development* (Boserup, 1970).	In the late 1970s as a critique of WID.	In the 1980s as an alternative to WAD.
Theoretical basis	A critique of the modernization theory by liberal and social feminists.	Marxist and liberal feminists drawing on dependency theory.	Socialist feminist thinking.
Features of the approach	Raised awareness of the fact that women had not benefited from development strategies in the same way as men. Focused on disaggregation analysis. Treated women crudely as a homogenous group.	In contrast to WID, claimed that women have always been part of the development process but recognized structural differences as disadvantaging women.	Extends the structural explanation of differences between men and women by including the reproductive as well as productive spheres.
Key contribution	Women became visible as a group within development theory and practice.	Accepted women as key economic actors and on that basis looked at integrating them into development.	Recognizes the social relations between men and women and how they are socio-culturally produced and reproduced.

Source: based on Rathgeber (1990).

Methods

A review of published academic literature was undertaken in order to determine the nature of findings in gender research in agricultural and pastoral livelihoods in 13 countries in east and west Africa - Burkina Faso, Chad, Eritrea, Ethiopia, Kenya, Mali, Mauritania, Niger, Nigeria, Sudan, South Sudan, Somalia, and Uganda. These countries were selected as they are the target countries in Africa for a programme that will be conducting research on agro-pastoral livelihoods in recurrent and protracted crises. The review followed the format of a scoping review, defined by Grant and Booth (2009, p. 95) as a "[p]reliminary assessment of [the] potential size and scope of available research literature [that] aims to identify [the] nature and extent of research evidence (usually including ongoing research)." A five-year period was chosen to cover the current thrusts of conceptual and empirical research in order to identify evidence and knowledge gaps and to contextualize future research in light of the current landscape.

The Scopus database was used as it is one of the world's largest abstract and citation databases of peer-reviewed literature, with more than 22,000 titles from 5,000-plus academic publishers. The search terms used were TITLE-ABS-KEY ("pastoral* OR agriculture" AND "gender" AND "country name") (where country name referred to each of the 13 target countries). This yielded a total of 430 returns, which was reduced to 240 when limiting the results to the 2016–2021 time period (covering 5 calendar years and the first 3 months of 2021, when the search was undertaken).

The returns were then reviewed to ensure relevance, and some entries were removed from the sample (Figure 1). Excluded papers either do not mention gender at all, or only mention it in a sentence that highlights the need for more research on gender dimensions, or they do not specifically refer to agricultural/pastoral livelihoods. Certain clusters of papers were also removed. For example, the presence of "pastoral" and "gender" in the search terms returned a number of papers referring to maternal and child health and nutrition, which were removed as they are not specifically relevant to agro-pastoral livelihoods. The search also returned a number of papers that relate to educational outcomes and women's involvement in tertiary (agriculture-related) education that were excluded. Other papers that were removed as "not relevant" focus on mental health, cash transfers and fisheries.

In some cases, the decision to exclude or include a study was based on the directness of relevance to agro-pastoralist contexts. Forestry-related papers were included when relevant to agricultural practices [e.g., agroforestry as an example of climate-smart agriculture (CSA)], and health-related papers were included when specifically relevant to pastoralist livelihoods (e.g., disease concerns in the human population as a result of animal transmission). For some papers, the scale and intent of analysis was a deciding factor on whether to include or exclude them from the final sample of papers in the

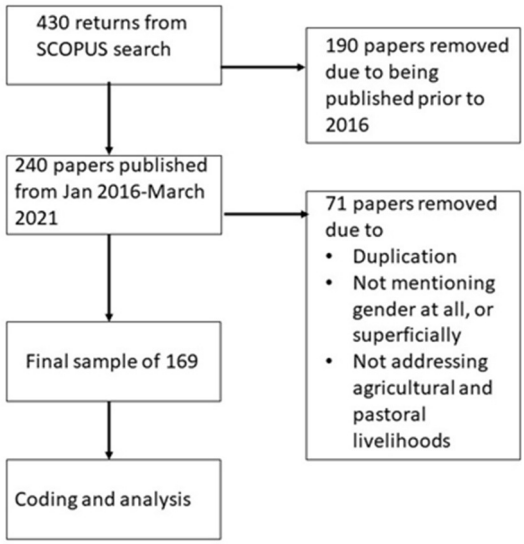

FIGURE 1
Selection process for the final sample.

review. National-level analytical papers were excluded, whilst those relating to governance as relevant to livelihoods at the local scale were included. Methodological papers were also excluded, unless the studies explicitly focus on agro-pastoral livelihoods at the local level.

The final sample comprised 169 papers. A database of bibliographic references, abstracts and keywords was created in Microsoft Excel. These were then coded for: (i) geographical location; (ii) approaches to gender; (iii) theme based on an inductive identification of clusters of research; (iv) whether studies expressly focus on women's empowerment, youth or apply an intersectional lens; and (v) methodological insights. Thematic foci were identified using inductive coding, with the initial set of codes based on a preliminary reading of the abstracts of the sample papers. Once the codes were finalized, data were captured in a spreadsheet with each paper representing its own data point.

As with all studies, there are limitations to the methods applied here. Selecting one academic database cannot be comprehensive, even amongst the field of academic literature, but it is sufficiently extensive in coverage to provide a robust indication of the state of knowledge. Furthermore, the selected database prioritizes literature published in the English language, whereas many of the target countries have French as an official language, and so it is possible that more papers have been published in French-language journals. The process of arriving at a final sample is contingent upon the quality of the search mechanism and the subjective use of key terms by authors in the titles, keywords and abstract. The review process to confirm inclusion and identify papers for exclusion was systematic but, as it was conducted by one individual, it is bound by subjectivity to a certain extent. This subjectivity was managed through several rounds of checking for consistency in the application of criteria.

Results

Number and geographical distribution of studies

Within the sample of papers, there was an increase in the number of studies published each year covering gender in agricultural and pastoral livelihoods in the target countries. The number of papers published increased by approximately one third each year, from 16 in 2016 to 43 in 2019 (Figure 2). The number of studies published in 2020 is 40, with a stagnation possibly resulting from the COVID-19 pandemic and the restrictions that this placed on activities. Thus, a small, but growing, range of research outputs are being produced on gender and agricultural and pastoral livelihoods.

Considering the target countries, there is significant geographic variation in the location of research that has been conducted (Figure 3). Kenya is covered in most papers (45), followed by Ethiopia (43), Nigeria (40), and Uganda (32). There are 12 paper reporting research in Burkina Faso, seven in Niger, five in Mali, two in Eritrea, and one each in South Sudan, Sudan, and Somalia. Two countries—Chad and Mauritania—had no papers relating to gender and agricultural and pastoral livelihoods published during the period under review.

Approach to gender

The sample comprised a diversity of approaches to gender and research designs for investigating gender. Slightly less than half the papers report a modeling or regression-based study using quantitative data where either the gender of an individual or the gender of the household head is shown to be a determinant or a source of difference in relation to the outcome. In such cases, gender is typically one of several variables tested for correlation. Many of the studies were not expressly designed with gender difference in mind, but rather happened upon gender differences as determinants in panel studies.

That is in contrast to slightly more than half the papers, where the expressed aim is to look at gender differences (whether through the gender of an individual or the gender of the household head). Some of these papers look explicitly at women's empowerment, which has been employed to rectify gender imbalances and inequalities that result from patriarchy. Others have applied a gender lens to analysis, for example through intersectional approaches (looking at the intersection between gender and age, for example—both quantitative and

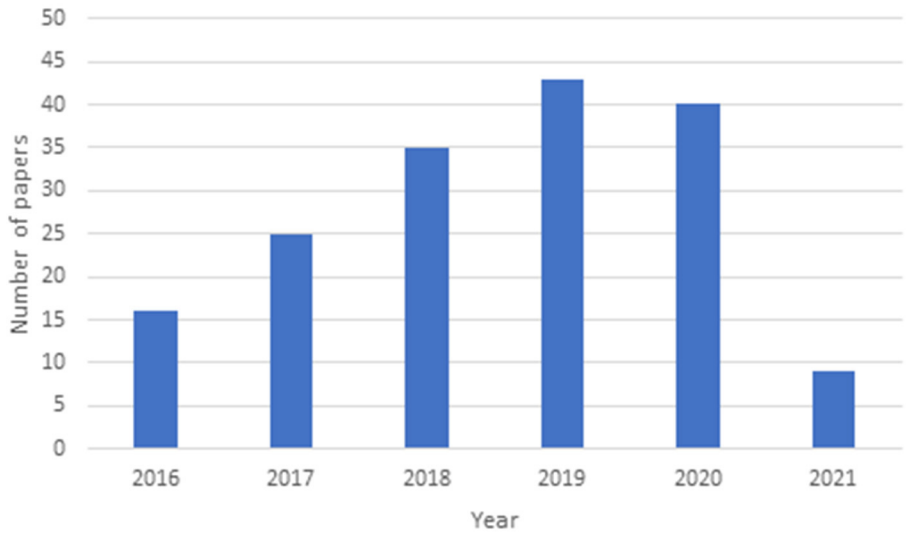

FIGURE 2
Number of publications per year covering gender in agricultural and pastoral livelihoods in selected countries (2016 to end March 2021).

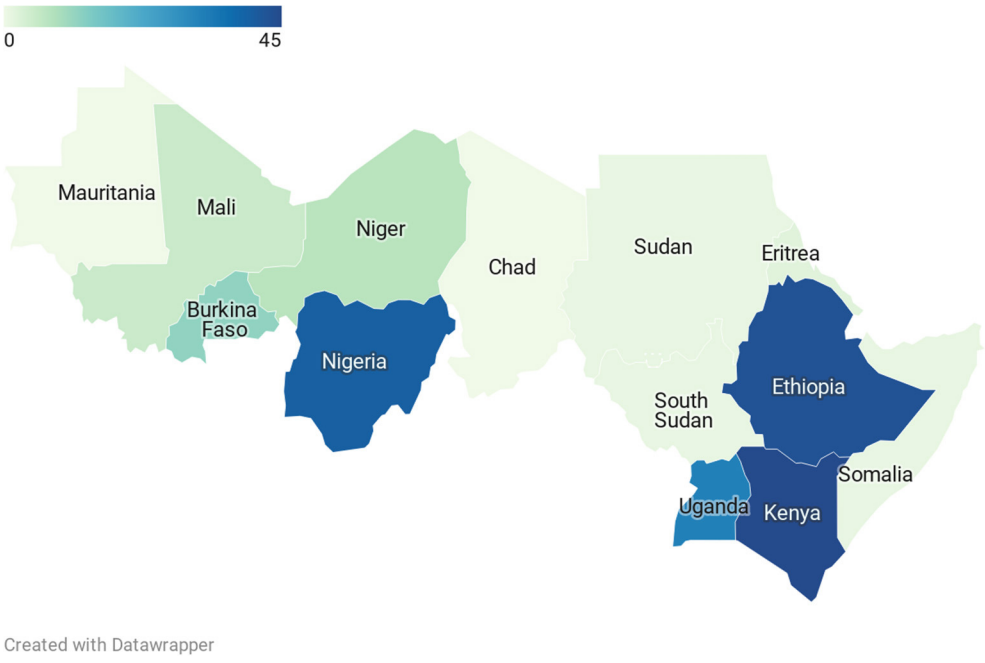

FIGURE 3
Geographic distribution of gender research in agricultural and pastoral livelihoods in target countries.

qualitative), or tracing how gender roles evolve over time through qualitative data.

Further interrogation of the ways gender is unpacked shows that household headship has been used often as a proxy for gender, for example to show differences between male-headed and female-headed households. This is despite the fact that "the household" has long been critiqued as a unit of analysis, as it is often poorly defined and exhibits variability in different cultural settings (see Folbre, 1986; Budlender, 2003). In particular, feminist critiques have highlighted that household headship disguises intra-household variation and thus can be an obstacle to truly gendered analysis (Varley, 1996). Many of

the quantitative studies with gender as a dependent variable also consider nuances, whether between different types of household headship (e.g., *de jure* female-headed vs. *de facto* female-headed), or the intersection with household headship and other social identifiers (e.g., age; see Dika et al., 2021).

What do we know about gender differences?

The vast majority of papers look at how gender influences a particular outcome, such as poverty, as opposed to how other factors affect gender (norms, roles, relations, and equality) as an outcome (Tavenner et al., 2019). Approaches are also typically based on snapshots, although there are some exceptions [e.g., Guyo (2017) looking at the evolution of gender roles and the impact of the colonial and post-colonial periods on roles and social status of Borana pastoralists in Kenya]. Clusters of papers look at various gender differences in assets (9%); health (11%); perceptions of environmental degradation (2%); agricultural perceptions and outcomes (49%); and climate change perceptions, vulnerability and adaptation, including climate-smart agriculture (CSA; 20%). Table 2 provides a summary of gender differences across various domains.

Differential assets

Gender differences in asset ownership, access and control are common themes across the target countries, and represented by 9% of the papers. Land is one example—gender is reported as a significant predictor of land ownership in Nigeria (Abubakar, 2021) and a different study from northeast and southeast Nigeria reports only 5.39% of land ownership was by women (Oladokun et al., 2018). Uneven land access between men and women has also been observed in Ethiopia (Holden and Tilahun, 2020). Even where changes have occurred to land tenure policies at the national level, they have not always benefited women. In Mutira and Chwele, Kenya, the impact of land tenure changes has proved detrimental to women's historical usufruct rights, with marital status as a key factor in determining women's access to and control of land (Davison, 2019).

As well as land, women have lower levels of access to other assets that are necessary for productive livelihoods. This includes access to microcredit and financial resources in Eritrea (Bahta et al., 2017) and Nigeria (Adegbite and Machethe, 2020; Ake et al., 2020). Other assets that have shown gender differences include livestock, inputs, education, and extension and research services in Nigeria (Ake et al., 2020). In Ethiopia, gender differences in access to extension services and training have also been observed, with women farmers having lower levels of access, and not having been considered explicitly in the design of extension services (Azanaw and Tassew, 2017; Shiferaw, 2020). However, also in Ethiopia, there has been some flexibility in gender roles when under drought conditions, with Borana women pastoralists having taken on productive and income-earning opportunities (Anbacha and Kjosavik, 2019a).

Gender differences in assets also result from migration. Whilst migration itself tends to exhibit gendered patterns, so too has the receipt and spending of remittances. Onyeneke et al. (2019) report that men were more likely to migrate, and male-headed households received more remittances than female-headed households. Female-headed households were more likely to spend remittances on agriculture than male-headed households (Onyeneke et al., 2019). In Nigeria, the level of social inclusion of migrants affected crop production levels, and gender was a determinant of the level of inclusion (Ofuoku, 2019).

Differential health status

Gender differences in assets, and gendered roles, lead to differences in outcomes relating to health, which is the topic of 11% of the papers. For pastoralists, in particular, the fact that men traditionally play a larger role with livestock means they were more likely than women to be exposed to Human African Trypanosomiasis in north-central Nigeria (Alhaji and Kabir, 2016) and *Brucella* spp. seroprevalence in Kenya (Kairu-Wanyoike et al., 2019)—both instances are also linked to whether or not people were nomadic/living in pastoral areas at that time. In Uganda, the female gender is reported as a determinant of intimate partner violence, HIV and sexually transmitted infections in fishing communities—although less so in agrarian communities (Sabri et al., 2019); whilst women were less likely to engage in drinking compared to men—and less so in agrarian communities than fishing communities (Wagman et al., 2020).

Nutrition status is often linked to gender and household headship. Gender is a determinant of consumption levels, particularly in rural areas. Evidence from Ethiopia, Nigeria, and Uganda shows that male-headed households enjoyed a consumption advantage (besides vitamins which may be due to more equal access to garden fruits, Tibesigwa et al., 2018). In Ethiopia, dietary diversity in female-headed households was higher after accounting for the effect of agricultural income and production diversity—suggesting that there were other reasons at play (Passarelli et al., 2018). One study in Nigeria shows that dietary diversity was slightly higher for female-headed households, with greater consumption of fish and seafood (Obayelu and Idowu, 2019). Yet another study, specifically in matrilineal societies in Nigeria, shows a high prevalence of household food insecurity with about one third of children having suffered stunting and about one fifth of mothers being overweight (Ene-Obong et al., 2017). Gender did not, however, influence dietary diversity in Uganda's Wakiso district (Durairaj et al., 2019).

TABLE 2 Summary of gender differences across various domains.

Domain	Significant body of evidence	Percentage of papers
Assets	Gender differences in asset ownership, access and control, with women largely disadvantaged in the assets that are required for productive livelihoods, for example in land (evidence from Nigeria, Ethiopia, Kenya), microcredit and financial resources (evidence from Eritrea, Nigeria).	9%
Health status	Health and nutrition status is often linked with gender and household headship. Male-headed households have consumption advantages in nutrition status (evidence from Ethiopia, Nigeria and Uganda). Women's dietary diversity is higher in Ethiopia; but lower in Uganda. Female-headed households are less likely to report good health (evidence from Nigeria), but the nature of vulnerability varies (men are more exposed to diseases transmitted by livestock, whilst women are more exposed to gender-based violence (evidence from Nigeria, Kenya and Uganda). Health status and outcomes are typically poorer for female-headed households and girls (evidence from Nigeria and Ethiopia); and female-headed households are more than twice as likely to borrow food or other goods overall (evidence from Kenya and Uganda).	11%
Perceptions of environmental degradation	Women are more likely to perceive invasive species negatively and believe pesticides cause water pollution (evidence from Ethiopia and Burkina Faso); but perceptions of land degradation in Mali do not show gender differences.	2%
Agricultural practices and outcomes	Gender differences exist in the agriculture sector for both livestock and crop agriculture. Women participate less in the agricultural labor force, are less likely to own land, have lesser access to inputs (including climate information, technologies and extension services) and are less likely to adopt new crops, technologies and farming practices (evidence from Nigeria, Kenya, Ethiopia, Somalia, Uganda, Mali and Niger). The consequence is lower productivity for women in agriculture across different crops, including fodder, due to both production and post-harvest losses (evidence from Niger, Nigeria, Ethiopia, Burkina Faso, Kenya and Uganda). Women tend to have fewer opportunities for diversification, other than as a coping mechanism (evidence from Kenya and Ethiopia), and are often forced to be innovative in accessing resources that are otherwise not easily available, for example through social capital and networks, although they are rarely as effective (evidence from Kenya and Uganda).	49%
Climate change, vulnerability and access to adaptations, including CSA	Women and female-headed households are more likely to perceive change in climate and climate stress (evidence from Ethiopia, Kenya, Nigeria and Mali—although the association disappears in Mali when controlling for geographic regions). Women and female-headed households are also more likely to be vulnerable to climate change as a result of differential access to assets (evidence from Eritrea, Kenya, Nigeria and Niger); gender intersects with age and marital status (evidence from Kenya); and there are other factors correlated with vulnerability. Women and female-headed households typically have less adaptive capacity and lesser access to adaptation options, including access to CSA and climate information (evidence from Nigeria, Ethiopia, Uganda and Kenya); although one study points to women making a greater contribution than men in adaptation to drought in Ethiopia.	20%

Health status is also linked to gender and household headship, and gender differences in expenditure influence the health and nutrition status of family members. In Nigeria, female heads of households were less likely to report good health (Omotayo, 2020). In selected khat and coffee-growing areas in the Sidama zone of southern Ethiopia, gender determined thinness, with girls thinner than boys—although, in the study in question, stunting is linked to a greater degree to levels of maternal education than gender alone (Juju et al., 2018). Despite this, based on research in four sites (western Kenya, eastern Kenya, Uganda, and Senegal), male- and female-headed households are reported to have spent their financial resources differently: female-headed households were most likely to use their credit for food, medical expenses and education; male-headed households were most likely to use it on food, agriculture/livestock inputs and education. In the context of food security, female-headed households were more than twice as likely to borrow food or other goods overall (Carranza and Niles, 2019).

Differential perceptions of environmental degradation

Women are often heralded as being environmental stewards, and 2% of papers in the sample address this theme. The perception of invasive species, such as *Prosopis juliflora*, shows

gender differences in Ethiopia's Amibara district, with men more likely to have perceived the species negatively compared to women (Seid et al., 2020). There were gender determinants of beliefs about water pollution in Burkina Faso, for example, where women expressed a strong belief that pesticides cause deterioration of water quality (Diendéré et al., 2018). However, based on a study of a forested area in Kenya's rangelands, it appears as though interrogations of the nature of gendered relationships with land use have not always been simple (Westervelt, 2018); and perceptions of land degradation in Mali do not show gendered differences (Touré et al., 2020).

Differential agricultural practices and outcomes

Gender differences also have implications for agricultural practices and livelihood choices, and this is covered by 49% of papers. In Nigeria, gender differences in agricultural labor force participation are reported, with men having participated the most and owning the most land, plots and buildings (Obayelu et al., 2019). These gender differences are evident in both the livestock and crop agriculture sectors. For livestock, there was differential access, preferences and roles amongst the Maasai pastoralists and elsewhere in Kenya (Mutua et al., 2017; Yurco, 2018; Nkedianye et al., 2019); amongst Somali pastoralists (Marshall et al., 2016); and in Ethiopia (Lunt et al., 2018). Although one study shows that there are no gender differences in ruminant disease priorities in Ethiopia (Alemu et al., 2019).

For crop farming, there are gender differences in women's involvement and preferences in a variety of farming systems. This has included in rice farming in Nigeria (Coker et al., 2017); wheat and coffee farming in Ethiopia (Mancini et al., 2017; Winter et al., 2020); and okra farming in Burkina Faso (Stenchly et al., 2017). These differences have often led to a situation where gender determines agricultural productivity, for example in Nigeria (Ogbeide-Osaretin et al., 2019). Specific gender differences in productivity in different farming systems have been observed in Nigeria's rice sector (Coker et al., 2017); groundnut in Burkina Faso (Sinare et al., 2021); cassava in Nigeria (Onoja et al., 2019); maize in Ethiopia (Gebre et al., 2019); bean production in Kenya (Wambua et al., 2018); and fodder production in Kenya (Omollo et al., 2018). Productivity is also affected by post-harvest losses. In Uganda, it is reported that female-headed households experienced higher post-harvest losses of bananas than male-headed households (Kikulwe et al., 2018).

Often it is differential access to assets that determines what people farm. Factors that can increase production (e.g., farm physical capital and land, as well as access to credit, yield-enhancing inputs and labor systems) are typically skewed in favor of men relative to women. However, when either men or women have access to these, it does increase the intensity of engagement of both male- and female-headed households (Palacios-Lopez et al., 2017; Wondimagegnhu et al., 2019).

Gender also influences the extent of diversification amongst pastoralists, but in different ways. In Kenya, women tended to have fewer opportunities for diversification that enables livestock addition in slaughterhouses (Gichure et al., 2020). For agriculturalists in Ethiopia, women and female-headed households were more likely to engage in diversification, but such diversification was in response to and/or contributing to land degradation, rather than being a positive adaptation (Gashu and Muchie, 2018; Sime Kidane and Wale Zegeye, 2020). There are also examples of gender differences in the adoption of different crop types, for example the adoption rates of indigenous African vegetables by women and men in Kenya (Mshenga et al., 2016). Gender differences have also been observed in many externally driven agricultural programmes targeting commercialization (Hall et al., 2017), as well as in perceptions of the positive and negative impacts of mechanization (Daum et al., 2020).

In addition to choice of crops and livestock, there are gender differences in the adoption and nature of farming practices, with examples from a range of contexts. In Kenya, gender determined the adoption intensity of organic-based technologies for soil fertility management amongst smallholder farmers (Mwaura et al., 2021), and soil and water control technology in semi-arid Niger (Karidjo et al., 2018). Gender influenced knowledge and willingness to pay for insect-based feed in Kenya (Chia et al., 2020). In Burkina Faso, women were less likely to adopt yield-enhancing and soil-restoring strategies than men (Theriault et al., 2017). In Uganda, plant clinics were accessed differentially, with middle-aged male farmers attending more frequently than women (although overall male attendance was also low; Karubanga et al., 2017). In Kenya, although women spent more hours in the day in gardens, this did not translate into better soil nutrient quality (Jonkman et al., 2019). Organic agriculture in the Kenyan counties of Kajiado and Murang'a was more likely where there was higher gender equity (Kamau et al., 2018). In Oromia, Ethiopia, women farmers faced greater barriers to innovation than men (Farnworth et al., 2018). Looking at the success of the Nutritious Maize for Ethiopia project, gender differences have been observed in the adoption and utilization of quality protein maize—women faced barriers of less contact with agricultural extension, lower awareness of the crop, and less input into decisions on and key aspects of adoption, production and marketing (O'Brien et al., 2016).

However, even though gender differences are reported in access to inputs in Uganda, this took place within a context of low general input use and inverse returns to plot size so strong that smaller female-managed plots had an advantage (Ali et al., 2016). Whilst gender differences in access to formalized agricultural knowledge are common, they are not universal. Zossou et al. (2017) find no gender differences in access to agricultural knowledge for rice farmers in Niger and Nigeria; whilst they find gender differences in the level of knowledge and use of rice farming methods in Niger.

Agroforestry and the use of trees also exhibits gender differences. Gender was a determinant of on-farm tree adoption and management in Ethiopia, Nigeria, and Uganda (Miller et al., 2017); Burkina Faso (Sanou et al., 2019); and Kenya, Mali and Niger (Oyekale and Oyekale, 2019). In Ethiopia, gender was not so important in determining uptake of this practice, but it did play a role in maintenance once the decision was made to employ agroforestry (Beyene et al., 2019). In Uganda, gender differences have been observed in the use of *Afzelia africana* tree species—with men placing higher value on the species for agriculture than women, who reported more social use (Biara et al., 2021).

In some cases, gender differences in access to technology have impeded opportunities for women farmers compared with male farmers (Aduwo et al., 2019). Increasingly, technology is used to provide information and services, which requires the consideration of gender differences in access to mobile phone ownership (Krell et al., 2021). Gender differences in information and communication technology use has varied for different technology types, with a study in Abuja, Nigeria showing little difference between men and women for phones, television, video, cameras, and computers; but men preferred radio and women preferred agricultural books (Atah and Atewamba, 2018). Technology use in Ethiopia shows no change in existing gender relations, such that patriarchy continued to influence production (Tsige, 2019). Access to agricultural services was better for men than women in southwest Nigeria, and better for women than men in western Kenya, reflecting geographically specific constructions whereby men in Nigeria are seen as providers whilst women in Kenya are seen as developers of the household (Bergman Lodin et al., 2019).

One asset where women have typically had preferential access relative to men is in the realm of social capital, and networks between people. This can be important for sharing information and sometimes can substitute for absences of other assets stocks. For example, amongst the Maasai women in southern Kenya, changes in land tenure and more privatization led to an increase in reliance on social networks to re-create the commons and negotiate access to resources through kin, friends and associates (Archambault, 2016). Likewise, in Uganda, gendered norms impeded women's access to commercial agriculture, but grouping in cooperatives provided an opportunity to overcome barriers (Theeuwen et al., 2021).

There is varied evidence on the ways in which social capital is used to the benefit of women. A study shows how social capital dynamics, which vary with age and gender, played a role in the nature of conflict and cooperation in a market area in Abyei between Sudan and South Sudan which has been a "theater of war" since 1965 (Furukawa and Deng, 2019). In Ethiopia, shared kinship or membership in certain groups, informal forms of mutual insurance, and having frequent meetings with network members are all associated with a higher probability of forming an information link with a network member; and a positive relationship is found also between networks and the adoption of row-planting as well as yields, with the strongest relationship amongst female networks (Mekonnen et al., 2018). Similar gender differences in access to informal institutions have been observed in Uganda, with associated improved access to inputs, regulation of quality of inputs and knowledge sharing (Yami and van Asten, 2018). However, in Mali, a social network census highlights that, when there was a reliance on the "in betweenness" of networks (i.e., a connection between nodes), gender differences in access to formalized information and information diffusion favored men, meaning that women were less likely to receive messages about composting, for example, if they relied on that route of transmission (Beaman and Dillon, 2018).

The gender differences in access to assets and involvement in agricultural and pastoral livelihoods are reflected too in the gender differences in poverty levels (Okunola and Ojo, 2019). Gender was a determinant of poverty in Ethiopia (Teka et al., 2019; Dika et al., 2021); and Nigeria (Ogundipe et al., 2019). In Uganda, women's plots were less productive than men's—childcare duties were responsible for half of this (the rest is due to the differential uptake of cash crops and return to improved seeds and inputs; Ali et al., 2016).

Perceptions of climate change, vulnerability and access to adaptations, including climate-smart agriculture (CSA)

Climate change is a reasonably common theme, with 20% of sampled papers addressing climate change, including perceptions, vulnerability and adaptive capacity/adaptation and climate-smart agriculture (CSA). Climate stresses are considered significant relative to other non-climatic stressors affecting pastoralists in Ethiopia and Kenya; and more so to women than to men (Opiyo et al., 2016; Anbacha and Kjosavik, 2019b). Gender is amongst various factors that have statistically significant associations with perceptions of change, with women or female-headed households most likely to have anticipated a change in weather variables in Ethiopia (Habtemariam et al., 2016); and in Kenya and Mali—although the association disappeared in Mali when controlling for geographic regions (Cullen et al., 2018). Men's and women's responses revealed that there were statistically significant ($p < 0.005$) changes in the onset of rainy season; early cessation of annual rainfall; alteration of growing seasons; frequent flooding; and frequent drought. Women felt greater impact of food insecurity, water shortage and had more burden of migration due to changes in rainfall in Nigeria (Nnadi et al., 2019). After floods in Nigeria, female-headed households also experienced more food insecurity than their male counterparts, despite having higher food security prior to hazard exposure (Ajaero, 2017).

The differential vulnerability to climate change is also addressed in a number of studies, including in Eritrea (Tesfamariam and Zinyengere, 2017; Montt and Luu, 2020);

Kenya (Amwata et al., 2016; Omolo and Mafongoya, 2019); Nigeria (Enete et al., 2016; Oluwatayo, 2019); and Niger (Ado et al., 2019). For agro-pastoral households, vulnerability resulted from gender differences in control over resources—which still typically disadvantage women—such as land, herds and off-farm employment (Amwata et al., 2016), as well as access to information, extension services and markets (Oluwatayo, 2019).

Beyond gender, other factors that correlate with vulnerability include poverty level, education, profession and access to water. More intersectional studies also highlight that gender, age and disability intersect to create situations in vulnerability; in Kenya, elderly women were most vulnerable, followed by elderly men, disabled people, female-headed households, married women, men and finally the youth (Omolo and Mafongoya, 2019).

Gender differences are also evident in studies of adaptive capacity. Mekuyie et al. (2018) find that, in southern Afar, Ethiopia, female-headed households were less resilient than male-headed households. Gender influenced access to adaptation options in Nigeria (Obasi and Chikezie, 2020), Ethiopia (Tesfaye and Seifu, 2016; Asrat and Simane, 2018; Mihiretu et al., 2019), Kenya (Mugi-Ngenga et al., 2016; Mungai et al., 2017), and Uganda (Nkuba et al., 2019).

Gender differences in adaptation are reported as partly a consequence of women having had less access to productive assets and innovations, such as the adoption of technology (Jost et al., 2016; Nyongesa et al., 2017; Balehey et al., 2018; Atube et al., 2021). There are also gender differences in access to indigenous knowledge used for adaptation, with men having typically adopted such practices faster than women (David et al., 2020). Amongst rice farmers in Nigeria, gender determined the success of adaptation strategies as reflected in levels of productivity (Ojo and Baiyegunhi, 2020). Also, when considering CSA in Nigeria, there are gender differences in uptake (Onyeneke et al., 2018). Men were more likely to adopt crop rotation, whilst women were more likely to adopt green manure and agroforestry (Oyawole et al., 2020). In Kenya, gender also affected the adoption of CSA, and the intensity of it, in dairy farming (Maindi et al., 2020).

Despite barriers and disadvantages in accessing adaptation options, other studies show that women can make higher contributions to adaptation. This has been observed amongst Afar pastoralists in Ethiopia, where women made more contributions to household adaptations to drought (Balehey et al., 2018). In another more intersectional study, nuances are found in the relationship between marital status and gender as displayed through the status of household headship; in Uganda, Gorettie et al. (2019) find that marital status, as linked to household headship, determined the extent to which women were likely to be able to adapt to climate change. In their case, women in coupled households were better able to adapt to crop failure than women in female-headed households due to better access to resources; whilst male divorced/separated/widowed households were more impacted by crop failure than female divorced/separated/widowed households (Gorettie et al., 2019). In Uganda, CSA adaptations created additional labor burdens for women (Jost et al., 2016).

There have been a number of papers published recently, particularly within the field of adaptation, that look at gender differences in access to specific climate information services that are necessary to inform adaptation decisions. This includes weather forecasts (Nkuba et al., 2019). In Burkina Faso, the willingness to pay for such services differed, with men and younger people willing to pay more than women and older people (Ouédraogo et al., 2018). However, when men and women accessed climate information services, they both used them to make changes in farming practices without any major differences (McKune et al., 2018).

Whilst the majority of papers consider gender as a determinant of perception, vulnerability, adaptive capacity or adaptation success, one study recognizes that adaptation pathways reflect social differentiation based on wealth, age and gender (Ng'ang'a and Crane, 2020). In this case, the authors caution that, whilst gendered experiences reflect cultural constructions of gender norms, recognizing and understanding these differences is an essential prerequisite to then meet the social equity and transformative norms of adaptation pathways approaches (Ng'ang'a and Crane, 2020). Similarly, another paper cautions about CSA and the extent to which it either reinforces existing social differentiation or offers opportunities for more emancipatory activities (Eriksen et al., 2019).

Successes of, and barriers to, women's empowerment

A significant number of papers specifically address aspects of women's empowerment, looking at the circumstances in which it is brought about, the success it brings and outstanding barriers. Particular interventions can be very successful when they are targeted at women, or are at least gender-sensitive in design. In Niger, participation in solar-powered irrigation initiatives was low, except in the case of gender-sensitive initiatives (Dimitra Clubs; Adisa, 2020). Likewise, in Ethiopia, several empowerment indicator variables (including input in production decisions, autonomy in plot management, membership in farmers' groups and the ability to speak in public) positively influenced women's participation in different stages of agricultural research (Mulema et al., 2019). In Kenya, and Uganda, investments in agricultural technology and capacity-building contributed to gender equality and closing the gender gap in agriculture (Warinda et al., 2020).

In contrast, initiatives designed in a gender-blind manner typically have very low rates of women's participation. In Nigeria, young rural women rarely participated in the federal government's e-wallet programme, which made no particular effort to secure their participation (Uduji and Okolo-Obasi,

2018). Moreover, gender-blind interventions can end up benefiting men and leaving women worse off. The effects of new and improved technology for integrated pest management to suppress fruit flies and maintain mango production in Kenya's Machakos County led to a decrease in women's decision-making capacity within the household on mango production and marketing (Gichungi et al., 2020).

The effects of women's empowerment are typically measured in terms of productivity. Using evidence from western Kenya, Diiro et al. (2018) find a positive relationship between maize productivity and women's empowerment in agriculture, measured using indicators derived from the Abbreviated Women's Empowerment in Agriculture Index. More specifically, the results suggest that female- and male-managed plots experienced significant improvements in productivity when the women who tended them were empowered (Diiro et al., 2018).

Women's empowerment has a positive and significant effect on women's dietary diversity scores, with examples from Kenya (Kassie et al., 2020), Uganda (Sekabira and Nalunga, 2020), Ethiopia (Abate and Belachew, 2017), Nigeria (Voufo et al., 2017), and Burkina Faso (Lourme-Ruiz et al., 2016). In Kenya, women's empowerment enhanced the positive effects of technology adoption on women's dietary diversity (although technology adoption had a positive impact on women's dietary diversity regardless of empowerment status, its effect was stronger for households with empowered vs. disempowered women; Kassie et al., 2020). In Nigeria, increases in measures of empowerment (e.g., access to resources and decision-making capacity) correlate positively with increasing dietary diversity in female-headed households and those households that had higher proportions of female members (Voufo et al., 2017). In Burkina Faso, increased dietary diversity is linked to women's control over resources rather than household-level production (Lourme-Ruiz et al., 2016).

There is some evidence surrounding the circumstances that are most likely to be successful in bringing about empowerment for women. In Uganda, age and education are associated with higher empowerment (although equality in education between spouses is reported to be more important than the average level of education); whilst in crop production, remoteness and greater commercial orientation are associated with lower women's empowerment (Sell and Minot, 2018). Women can be successfully empowered when men are not present, for example, as a result of migration (Crossland et al., 2021). As well as economic benefits and improved decision-making capacity, successful empowerment leads to the disruption of typical gender norms—as illustrated in a case in Uganda where women were provided with dairy cows (Bain et al., 2020).

Whilst there are some success stories of women's empowerment, there are also examples of fundamentally structural causes of inequality impeding success. In Nigeria, women's year-round participation in agricultural production in the Warri South Local Government Area was only around 30%, with cultural norms of patriarchy forming the major barrier (Asamu et al., 2020). In Niger, women's lack of security of land tenure remained a significant barrier to agricultural production (Issoufou et al., 2020). In the Niger delta, women's empowerment initiatives funded through corporate social responsibility were effective at increasing agricultural productivity, but not in contributing to equality (Uduji et al., 2019). In nutrition-sensitive poultry production in Burkina Faso, women's involvement in rearing was significant, and the children of mothers who had been exposed to nutrition messaging were more likely to eat eggs; but the control of revenues remained small (Nordhagen and Klemm, 2018). However, gender-blind seed governance regimes existed at the national and international levels at the time of this particular study, where gender norms impeded women from procuring seed through markets and where there was no consideration of women's different seed preferences, respectively. The result was that the empowerment of women was impeded, ultimately affecting the pillars of food security (Nordhagen and Klemm, 2018).

This raises a question as to what constitutes "success" in empowerment. Women's empowerment is typically defined as the ability to exercise choice over resources, agency and achievements (wellbeing outcomes; Kabeer, 1999). A study on women's access to land-related strategies in the Maradi and Zinder regions of Niger finds that the sustainability of women's involvement in agrosilvopastoral production was only sustainable when control of land by women was given legitimacy by a guarantee from customary and administrative authorities (Issoufou et al., 2020). However, these wider institutional changes are not always addressed within the context of empowerment projects. Another paper takes this a step further by asking whether women's empowerment actually leads to women having more decision-making power, or whether that is just a perception (Acosta et al., 2020).

Some papers also highlight the continued existence of persistent gaps between men and women in status. In Nigeria, men are reported as having had more empowerment than women in four of five components in the Abbreviated Women's Empowerment in Agriculture Index[1] (Oyawole et al., 2020). In Ethiopia, women are reported as having been disempowered across all five components of empowerment due to cultural patriarchal norms and despite government and financial institution policy changes (Petros et al., 2018). The nature of the disempowerment also highlights priority areas for interventions. In the same study, Petros et al. (2018) find the role of women in Ethiopia was significant post-harvest, but that poor storage led to damaged grains (which were then consumed by women)—so, promoting improved technologies to women

1 The five components in the Abbreviated Women's Empowerment in Agriculture Index are production, resources, income, leadership, and time.

could reduce women's work burden and protect against grain losses. The importance of post-harvest food management was amongst the themes considered at a gender forum on women in agribusiness in Africa (Adam et al., 2017). In Burkina Faso, the macroeconomic impacts of policy decisions to support farming women through access to land and inputs returned positive results in terms of food security and economic growth (Souratié et al., 2020).

Intra-household decision making

The household is the unit of analysis used in a significant proportion of the sampled research. A number of papers also investigate intra-household decision making and, in particular, the consequences that stem from women having more decision-making power as a result of empowerment. The gendered nature of decision making within households is still evident, with men typically controlling decision making on assets and the control and use of assets, particularly where productive assets were concerned [for examples in Kenya, see Nyongesa et al. (2017) and Osanya et al. (2020); and for Ethiopia see Kang et al. (2020)]. In Uganda's Masindi district, a study investigated the decision-making processes that led to land-use transformation through woodlots and tree planting finding that, whilst various factors were considered in decision making, ultimately final decisions were made by husbands, with less participation from wives and other family members (Ahimbisibwe et al., 2019). Lack of active involvement of women in decision making is considered to have led to reduced demand by women for labor-saving technologies [e.g., see Badstue et al. (2020) in Ethiopia]. However, in western Kenya, no difference is found between plots that were male-, female- or jointly managed in push-pull pest management technology, nor between other agricultural management techniques, such as intercropping, rotation, fertilizer use, and improved seeds (Muriithi et al., 2018).

However, there is evidence that greater women's involvement in decision making leads to positive outcomes in health. In Kenya, maternal participation in agricultural decision making shows a significant positive correlation with child growth (Po et al., 2020). Likewise, when women in Kenya had control over income, dietary diversity tended to be higher (Ogutu et al., 2020). In Nigeria, households that were female-biased (i.e., households that favor female leadership and/or households with a higher ratio of women to men) tended to have higher significant improvements in dietary intake alongside empowerment (Voufo et al., 2017).

Where women do have greater decision-making capacity (e.g., over land under joint control where women control decisions or have more bargaining power of household resources) it typically brings about better dietary diversity. In Burkina Faso, increased dietary diversity is linked to women's control over resources rather than household-level production (Lourme-Ruiz et al., 2016). A study in Uganda shows that women with decision-making power were more likely to adopt orange sweet potato (a biofortified crop promoted to increase dietary intakes of vitamin A; Gilligan et al., 2020). However, the same study shows no impact of women's bargaining power on children's dietary intakes of vitamin A.

Whilst improved capacity to make decisions is often cited as a success of women's empowerment, the nature of what it means to make decisions, and different perceptions therein, is also important. Using a combination of quantitative and qualitative data from Uganda, Acosta et al. (2020) find that women reported joint decision making more often than men and, when interrogated, "joint decision making" included a range of circumstances from no conversation amongst partners, to conversations when a female spouse's ideas were considered, but the male had the final say.

Intersectional approaches and youth

Intersectional approaches

A growing number of studies provide insight into the role of intersectionality. Both quantitative studies, which determine significant variables giving rise to different outcomes, and more qualitative studies, which add depth of understanding to how different aspects of identity intersect, are included here.

Gender intersects with various other facets of social identity, including age and ethnicity, as well as marital status and education. Assets of local ecological knowledge in Ghana and Burkina Faso are shown to link to gender and ethnicity, although not in simple or unidirectional patterns (Naah and Guuroh, 2017). Likewise, vulnerability to climate hazards, uptake of CSA technologies and practices, other adaptation options including adoption of particular crop types, and overall agricultural productivity and income levels are shown to variously depend on the intersection of ethnicity, education, age, occupation, and marital status with gender (Akoteyon and Aromolaran, 2016; de la O Campos et al., 2016; Enete et al., 2016; Mshenga et al., 2016; Mugi-Ngenga et al., 2016; Mungai et al., 2017; Luna, 2019). A study in six sub-Saharan African countries, including Uganda, Nigeria, Ethiopia and Niger, shows that female labor shares were higher where women owned a larger share of land and when they were more educated. However, female labor shares were not changed when controlling for the gender and knowledge profile of the respondents. This raises questions on the effectiveness of attempting to increase female agricultural productivity as a means of increasing crop output (Palacios-Lopez et al., 2017).

Youth

In addition to age appearing in some of the intersectional studies, a handful of papers in the sample expressly consider youth. Limitations in asset access, ownership and control

impeded youth participation in both crop and livestock production according to studies in Kenya (Mutua et al., 2017) and Nigeria (AlabiOluwakemi et al., 2019). Both studies note the implications for policy—with youth "agripreneurs" in Nigeria particularly highlighting challenges of inadequate training, infrastructure and access to land (AlabiOluwakemi et al., 2019). In Uganda, whilst agriculture was perceived positively amongst youth agripreneurs, neither young men nor young women in the center of the country aspired to farming, although most did engage with it in some way (Rietveld et al., 2020). The same study notes particular barriers to young women's engagement in commercial agriculture, highlighting that structural causes of gender inequality would need to be addressed to change this situation (Rietveld et al., 2020). However, youth disengagement from agriculture is challenged by evidence from Ethiopia, where young people were strongly engaged in agriculture—although gender differences are noted (Sakketa and Gerber, 2020). One study shows how gender norms and practices contributed to the passing of traditional ecological knowledge from adult to child, with Maasai girls in southern Kenya having learned about wood species during firewood collection duties (Tian, 2017).

Methodological reflections on gender studies

Methodological papers did not constitute a significant proportion of the sample, and purely methodological papers were excluded from the sample. However, a number of papers were retained that highlight methodological issues of relevance to how gender issues are interrogated in agricultural and pastoral livelihoods. While time-use surveys have long been used to unpack gender differences in activities, one study finds that low literacy and unfamiliarity with clock-oriented time has impeded accuracy, and stylized questions and time diaries yielded systematic differences between time-use estimates (Seymour et al., 2020). The Women's Empowerment in Agriculture Index is widely used to monitor the extent of women's empowerment, but indicators have to be modified to suit livestock farming (e.g., see Colverson et al., 2020).

Ensuring that tools have the capacity to capture gender differences is important to avoid gender-blindness. Some studies highlight the limitation of certain standard research tools. In Uganda, the use of time fixed-effects and decomposition on nationally representative surveys applying different gender dummy variables (e.g., female head of household, female plot holder and female plot manager) shows that the typically available gender variables are insufficient for identifying how gender and the decision making of different household members play a role in productivity (de la O Campos et al., 2016). In that case, regardless of the variable of choice, the gender gap in agricultural productivity decreased or disappeared when controlling for factors of production and crop choice. The conditional gender gap was about 10% and significant when using female plot manager as the gender variable, but there was no conditional gender gap when using female head of household or female plot holder (de la O Campos et al., 2016). Other tools have been modified to expressly counter gender-blindness. For example, the Climate-Smart Agriculture Rapid Appraisal tool takes into account gendered perceptions of climate change, as well as disaggregating common participatory and rapid rural appraisal tools, so as to be sure to render visible any gender differences (Mwongera et al., 2017).

Despite the variety of tools to measure gender differences, there are particular limitations in attempts to measure intra-household decision making. A mixed method paper in Uganda that compares and contrasts quantitative survey data with more in-depth qualitative data from (i) focus group discussions, (ii) a decision-making game, and (iii) participant observation also highlights the methodological limitations of attempting to interrogate the nature of intra-household decision making whilst relying on only one source of data (Acosta et al., 2020). The authors find that "joint decision making" can have different meanings, which needs to be taken into account when the term is used in collecting quantitative data; and also that in a survey women reported joint decision making more often than men, who presented themselves more as sole decision-makers.

Problematizing household headship as the entry point for gender

The common approach to look at gender differences through household headship disguises many gender differences. In some circumstances, women are impeded in opportunities regardless of whether they are in a male- or female-headed household. In Ethiopia's Fogera district, the participation of women farmers in agricultural extension programmes was lower than that of men, regardless of the headship of the household from which they came (Azanaw and Tassew, 2017). However, the vulnerability to food insecurity amongst pastoral and agropastoral households did not always correlate with the gender of the household head (Amwata et al., 2016).

Discussion and conclusion

The volume of gender-related research on agricultural and pastoral livelihoods in the target west and east African countries has increased over time, but the coverage is very uneven geographically. There are various potential reasons that explain both of these phenomena. On the volume of literature, this increase over time may, at least in part, reflect the overall growth in the number of journals of relevance that have published papers over the same time period; meaning there are more outlets for such material. That said, to fill such journals, research

must be conducted and papers must be written—so the increase over time nonetheless signals vibrant interest in pastoral and agricultural livelihoods in sub-Saharan countries.

There are several potential reasons for the uneven geographical distribution of coverage. The Scopus academic database largely covers papers published in the English language, which may explain why relatively more papers cover countries such as Kenya, Uganda, and Nigeria, where English is an official language; and fewer papers cover Francophone countries such as Mauritania and Chad. Conducting research in countries that are politically unstable and conflict-affected is typically difficult and creates issues of personal security for researchers, including those who are based in country. This may at least partially explain why Somalia and Mali are the subject of limited papers during the period under review—each country appeared in the bottom 10 of the Political Stability and Absence of Violence Terrorism Index 2020 (although Nigeria is also in the bottom 10 and yet features in a relatively large number of papers). However, regardless of the reason, the fact that no research has been published in academic literature on the target themes in some west and east African countries limits the evidence base upon which development programming and adaptation finance decisions are based.

Although the evidence base in general is growing, it does coalesce around several established approaches. The studies here are almost evenly split between two approaches. Slightly less than half have used modeling-based approaches, where gender is one of many variables that may be correlated with, or that determines, an outcome (for example, as a dummy variable in regression)—typically poverty. Slightly more than half are studies where the expressed aim is to look at gender differences, whether through the gender of an individual or the gender of the household head. The former modeling studies typically represent a snapshot in time, whilst there is some evidence of tracing change over time in the latter.

A number of thematic clusters were identified from the literature. Clusters of papers look at gender differences in assets, health, perceptions of environmental degradation, agricultural perceptions and outcomes, and climate change perceptions, vulnerability, and adaptation. There is a substantial base of evidence that exists on gender differences in agriculture in terms of access to assets and resources and how that plays out through various farming systems (e.g., crop and livestock preferences and cultivation practices) dependent on access to assets and inputs. Increasingly, there are more studies looking at the gendered aspects of climate change—whether in perceptions of the risk, or differences in vulnerability and adaptation - which typically reflect the agricultural literature because adaptation options are contingent on gender differences in access to assets.

Although explicit policy analysis studies were excluded from the sample, there are few studies that look at the interaction of policy and practice, and the role that policy and practice has had on gender roles/relations and equality. Instead, the majority of the focus is on how gender-blind policies and programmes provide differential access to opportunities and can reinforce inequalities and differential decision-making capacity. Studies on women's empowerment are relatively common, as they have been throughout the WID and WAD paradigms. These papers unpack examples of achievements and improvements in productivity and related implications. Typically, these are measured through a reduction in poverty, or through changes in dietary diversity, or through any outstanding barriers. A few of these studies highlight that women's empowerment initiatives are more likely to have sustainable success when they address the underlying causes of gender inequality, for example by tackling the structural barriers to resources such as land.

Overall, despite the evolution of paradigms for addressing gender, the extent to which GAD approaches are used in research on agricultural and pastoral livelihoods is still minimal. The household is still used as the unit of analysis in a significant proportion of the research, although a number of papers also investigate intra-household decision making and, in particular, the consequences that stem from women having more decision-making power as a result of empowerment. Although the nature of decision making within households is still strongly gendered, when women are involved, it has often led to positive outcomes for health and dietary diversity. Several papers have investigated the effects of gender on decision making by comparing outputs and outcomes from land that is under male control, female control or joint control. However, using household headship as an entry point has already been widely problematized for its limitations in showing gender differences—this includes the GAD paradigm—yet it continues to be a very common proxy for gender, particularly in modeling studies.

Application of a relational and intersectional gender lens has grown over time. However, it still only comprises a small proportion of the body of research across various thematic areas. Intersectional studies include modeling studies where the intersection of gender with age and, more rarely, ethnicity, is occasionally explored; as well as in more qualitative studies that add depth of understanding to how different aspects of identity intersect, and how they have intersected over time. Only a small proportion of the sample explicitly consider youth, with those studies looking at the nature (or otherwise) of aspirations for commercial agriculture; differences between young men and young women; and how gender norms and practices have contributed to the passing of traditional ecological knowledge from adult to child, as with Maasai girls in southern Kenya learning about wood species during firewood collection duties.

These findings give an idea of the current state of the landscape of published research on gender in agricultural and pastoral livelihoods in selected west and east African countries and, crucially, highlight important new research directions. It will be important to address geographical gaps in gender gaps, with need for a focus on Mauritania and Chad, as two countries on which no papers were produced in the last 5 years, but also

across the many further countries that have very scant evidence. As well as geographical gaps, there is a need to expand the evidence base on intersectional approaches, which have begun to appear but are still not as common as more traditional studies that consider gender irrespective of other social identifiers. Likewise there is a need for explicit research on other aspects of social exclusion and inequality. Of the current sample, only one paper had any mention of disability (Omolo and Mafongoya, 2019).

Neither methodological studies nor policy analysis were explicitly included in this analysis, however the review of empirical papers highlights some research directions that are relevant to these fields. The predominance of the household as the entry point for the gender papers, despite known critiques, underlines the scope for new methodological approaches that will make visible the nuanced nature of intersectionality. Similarly, the majority of papers focus on how gender-blind policies and programmes provide differential access to opportunities and can reinforce inequalities—but there is a need to look at the impact that policy and practice have on gender roles/relations and equality.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

KV conceived of the design, conducted the analysis, and wrote up the study.

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