Rural women's participation in solar-powered irrigation in Niger: lessons from Dimitra Clubs

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The relative lack of women's participation in energy-related development projects around the world to transform agricultural productivity has been a source of significant concern globally. Out of 181 countries, Niger holds the current position for being the second most vulnerable to climate change. Despite the emphasis on women's participation in solar-powered irrigation initiatives in Niger in energy project documents, their actual participation in renewable energy remains low. This article reviews the literature on renewable energy access and rural women in Niger and argues that proactive actions could be taken sooner and more effectively to strengthen women's participation in solar-powered irrigation technology if driven by a dialogical feminist approach. A key example is Dimitra Clubs, a well-established gender transformative initiative piloted in Niger.

Key words: gender equality, solar-powered irrigation, climate change, agriculture, dialogical feminism, egalitarian dialogue

Introduction

Climate change is a global phenomenon with devastating consequences for the planet and livelihoods. The climate-related vulnerabilities in West Africa have been well-documented, with Niger holding the position for being the second most vulnerable to climate change amongst all countries in the world (ND-GAIN, 2017). Conflict and insecurity also plague many West African countries, which worsen human welfare conditions. Niger is one of the states (the other being Chad) classified by the United Nations Development Programme as a spill-over country for conflict in Mali and Nigeria (Cooper & Price, 2019).

In both countries, inter-communal tensions are on the rise between traditional pastoralists and sedentary farmers regarding the use of grazing land. In Niger, conflict disrupts normal livelihood and trade activities, restricts access to food and limits humanitarian access, particularly in parts of the Diffa region in the extreme southeast of Niger (*ibid*). Climate variability has led to the low productivity of key food crops and livestock, which is constraining the livelihood of farmers in Niger and exacerbating vulnerability to food insecurity. Over the last few years, solar-powered sustainable irrigation has been put forward by various international development actors as a solution for Niger, aiming to reduce dependence on the weather and enable secure multiple harvests for farmers during the year (IFC 2019).

At the outset it should be noted that while there is some evidence that photovoltaic solar energy is an economically and financially viable option to give rural households access to basic energy especially when undertaken in mini-grids (Raach 2014), it is not likely to be the only climate-resilient solution based on renewable energy. It is not the intention of this article to critique the emphasis by key development actors and the government of Niger to use solar-powered to boost agricultural productivity as against other climate adaptive agriculture techniques potentially being used elsewhere. However, the adoption of this solution is hardly surprising, as the potential for solar-powered irrigation technologies in Niger is noteworthy—the current installed renewable energy capacity is less than 0.1 per cent of the energy mix (ibid., 16). The electricity access rate is less than 10 per cent and under 1 per cent of people

in rural areas (ibid., 22). Niger has a high and reliable solar irradiation intensity, and there is a significant opportunity for green mini-grids to increase energy access and tackle food insecurity brought on by climate change impacts.

Some work has taken place because of the efforts by organisations such as ENERGIA **[1]** to ensure that gender is mainstreamed in renewable energy-related development programmes. However, with the weak governance of institutions in countries such as Niger (World Bank, 2020), understanding how much progress has been made is challenging. Additionally, questions about the active participation of rural Nigerien women in solar-powered irrigation technology remain unaddressed. This article has been inspired by the author's consulting assignment with ABG-CAPS Clean Energy, a key player in in the West African energy market, to identify rapidly good practice 'in-roads' to involve Nigerien women more equally in their solar-powered irrigation schemes. I was involved with this work in 2019 and more details is provided later in the article.

Nigerien women constitute about 70 per cent of agricultural labour **[2].** More than 80 per cent of the country's energy needs are derived from traditional sources of firewood and agricultural biomass, negatively affecting women who bear the brunt of fuel collection and cooking duties (IRENA 2013, 51). The extent to which rural women farmers are involved in the decision-making, planning and implementation of solar irrigation pumps, financed through foreign investment facilities, such as USAID and the World Bank is unclear.

The dearth in research on women's rights and policy making in Muslim-majority countries remains an important gap in the literature (Kang 2015) and on gender equality and solar-powered irrigation development in Niger has further inspired this article. Whilst the literature review in this article is not exhaustive, it provides an avenue for highlighting women's potential in contributing to similar processes and puts forward egalitarian dialogue as a route to amplifying any gender equality gains for rural women. Further, dialogical feminism could serve as an entry point to informing new or improving renewable energy initiatives to benefit women.

Conceived by Jurgen Habermas (Habermas 1984), the concept of egalitarian dialogue values an individual's contribution based on their argument (*for social change,* emphasis mine) rather than their social privileges or position. Dialogical feminism finds its roots in egalitarian dialogue, and according to **Barbara** Merrill (2005), this type of dialogue is a key aspect in any transformative process from a feminist perspective. While Merrill's focus was on marginalised women and preventing issues of 'othering' in adult education, the feminist principle of placing women in empowering positions in initiatives remains relevant for the Nigerien context.

This article draws on the case study of Dimitra Clubs (DCs) to explore how a dialogic approach can help contribute to women's transformation in solar irrigation. Based on official documentation, DCs have been described as a gender transformative project developed by the European Commission in 1994, which then became a project of the Food and Agriculture Organization of the United Nations (FAO) from 1998 to 2019 **[3]** focusing on gender, communication and rural development. The first DC or community listeners' club was launched in Niger, making it an interesting case study to help frame the discussions later on.

The article focuses on rural women's participation in transforming agricultural productivity through access to solar energy-related development projects and in particular to solar

powered irrigation technology. It makes a case for creating spaces for egalitarian dialogue to enable Nigerien women's advancement in climate-resilient farming.

Setting the context

Niger is a Muslim-majority country and is one of the poorest countries in the world. It is a large landlocked country in West Africa with a total land area of 1,267,000 km^2 and a population of ca. 18.5 million, growing at one of the world's highest rates (4.0 per cent p.a.) It has amongst the lowest population densities on the continent at 14.6 people per km^2 (World Bank 2017a, 28).

The Sahara Desert covers over 80 per cent of the country, so most of the population lives in the south of the country, predominantly in rural areas82 per cent of the population) (World Bank 2018, 2).

Since Niger joined the regional coalition against Boko Haram **[4]** a few years ago, the local population has had to bear the burden of highly restrictive security measures coupled with unresolved climate variability issues. For instance, in the Diffa region in the Southeast of Niger there have been disturbing accounts of increasing food insecurity, which has left many inhabitants deprived of their livelihood (Guéret 2017).

These co-occuring vulnerabilities in Niger are likely to affect development efforts. Addressing the local dimensions of violence between farming communities, which is crucial for peace and security, also involves combating the root cause of the tensions—land degradation and climate variability.

One key challenge facing Niger is the risk of floods and climate-related droughts. Between 1998-2015, Niger was affected by a number of floods in seven central and southern regions which affected over 1,750,000 people, with many lives and livelihoods lost (Fiorillo et al., 2018, 12). Dosso was the worst affected area. More than half of those affected received some kind of humanitarian assistance (OCHA 2015). In 2019, over 210,000 people have been affected by the floods in Niger (OCHA 2019, no page number). Similarly, drought is one of the most serious issues facing the agricultural and pastoral systems in Niger (Quenum et al., 2019).

As mentioned earlier, Niger holds the current position for being the second most vulnerable to climate change amongst all countries in the world, according to the (ND-GAIN 2017). With many women involved in farming, women's access to solar-powered irrigation pumps is likely to be paramount in tackling the impacts of climate-related vulnerabilities.

In the next section, this article examines the state of gender inequality in Niger to further set the context.

Gender inequality in Niger

Systemic gender inequalities in agricultural production continue to persist, yet the sparse literature on Niger indicates that this is still a hidden issue with respect to its impacts on rural Nigerien women's space for action.

Niger has been described as one of the worst five countries to be a girl or a woman. Almost 80 per cent of young women in Niger are married before they reach the age of eighteen (Save the Children 2016, 25). The Gender Inequality Index which measures gender equality in 166

countries has estimated the GII value of 0.647, ranking it 154 out of 162 countries (UN 2019, 5).

There are few published sources on gender equality and women's rights research, which are led by Nigerien women. One key reason for this dearth of feminist-led research can perhaps be explained by the persisting gender inequalities in Niger's educational system (UNESCO 2016). A dated social analysis study undertaken in 1999 by Chrystel Ferret Balmer who was working at the time with Swiss-funded international development co-operation projects in Niger, revealed the relations between men and women in Niger to be a complex combination of tradition, religion, transformation and innovation. The study found that the social status of Nigerien women is highly dependent on that of their husbands. Yet it was also recognised that women undertaking productive activities were beginning to achieve greater financial and social autonomy separate from their husbands (FAO 1999, 5). Whilst there has been no follow-up study undertaken on the social status of women in Niger since then, Alice Kang's relatively recent study on Niger and women's bargaining rights (Kang 2015) alludes to these same complex conditions revealed in Balmer's (1999) study. The implications are stark—in relation to the social status of men, that of women has not obviously improved in the twenty years between the two studies.

Nevertheless, some gender indicators have improved. The political participation of women improved following the historic march of women on May 13, 1991 to demand greater representation in the preparatory commission of the National Sovereign Conference (Kang 2015). Seventeen percent of parliamentary seats are held by women (UN 2019).

Efforts to reposition women and their needs in Niger have been influenced mainly through international pressure on policymakers to achieve progress with respect to gender and development. One dominant international influence on gender has been through the United Nation's Convention on the Elimination of Discrimination against Women (CEDAW) (OHCHR, n.d).

As noted by CEDAW, the government of Niger has demonstrated its will to comply with the universal principles of CEDAW by drafting and adopting numerous gender policies over the years, for example, the National Gender Policy in 2008 (revised in 2017) and the 2017–2021 Action Plan, the National Strategy for Economic Empowerment of Women with a 2018–2022 Action Plan, the National Strategy against Gender-Based Violence and its Action Plan 2017–2021, the revision of the 2000-08 Gender Quota Law in 2014, the Fistula Eradication Strategy, the development of a National Action Plan on United Nations Resolution 1325 on Peace and Security (OHCHR 2017), and the establishment of the National Observatory for the Promotion of Gender [5].

In particular, CEDAW noted the lack of progress in Niger on improving the socio-economic status of women as well as addressing the disproportionate impact of climate change and desertification on women (UN 2017). Whilst a degree of progress is thought to have been achieved with CEDAW, Niger maintains certain reservations about some provisions of the CEDAW, which are likely to stall any sustainable progress for women. These reservations are focused on women's quotas for political participation, issues concerning marriage and early pregnancies, female genital mutilation, women's access to education and employment, the situation of rural women and women prisoners, and customary law provisions on collective

management of resources and discriminatory land acquisition practices. All of these impact negatively on women (OHCHR 2017).

The challenges faced by rural women are particularly acute, particularly in improving their living conditions and promoting their rights (Rural Women Economic Empowerment Niger, 2019). Research has shown that women have a significantly high probability of being poor in the rural areas of Niger compared to urban areas (PEP 2014, 43).

Researching rural women's involvement in solar-powered irrigation farming

This article draws on a scoping study for ABG-CAPS Clean Energy, **[6]** a consortium operating in the West African energy market and recently in Niger to provide solar-powered agriculture in response to the Nigerien government's drive to achieve food security. The scoping study sought to understand how rural Nigerien women have been involved in solar-powered irrigation farming in Niger. It was based on desk-based research between June to Sept 2019 and aimed to rapidly review available evidence on women's space for action in accessing solar energy for climate-resilient agriculture, a challenging task due to the lack of research on rural Nigerien women. The author's experience working in international development in West Africa over the last 15 years influenced the approach adopted, and commitment to carefully illuminate the situation of rural Nigerien women. In addition, the author notes that a dialogical feminist approach **[7]** offers a helpful reminder in confronting the 'distance' which plagues most desk-based research on marginalised groups, and which may limit one's connections to the frontline issues.

Most energy-related development efforts at the frontline involve multiple stakeholders and require that open spaces be created to value the views of women, both in the design and implementation of those initiatives fully and equally. Tools have been developed to help with this [8].

The reviewing process and findings

When undertaking a desk review – a common exercise for consultants working on projects of this kind – there are obvious limitations. It is quite possible that there are domestic government policies (likely to be written only in French) that have not been identified through the searches or that has not been made available in be in the public domain. This is one limitation of the review itself that plagues many desk-based research on developing countries.

Thirty newsletters produced by FAO-Dimitra from 1998 to 2019 were reviewed. Dimitra Clubs (DCs) were not immediately closely related in their concerns to the concerns of my review. However, in a context in which there was comparatively little literature to be obtained, they offered much that was interesting as discussed in the next section. Other FAO official documentation on gender mainstreaming and evaluations on DC were also included in the review. Only references to Niger were examined. While this review is by no means exhaustive, it has yielded interesting talking points which are discussed in the subsumed paragraphs.

The review indicated that some importance has been given to gender equality and solar irrigation schemes in Niger. For example, of the documents reviewed, 'Promoting Agriculture Competitiveness through Solar Energy' (ECREEE 2019), mentions women over 170 times. Niger's '*Cadre Strategique Pour L'eau Agricole Au Sahel*' (Strategic Framework for Agricultural Water in the Sahel), published in September 2017, explicitly mentions the importance of

women's participation in solar irrigation efforts once and mentions women 12 times (World Bank 2017b). It states, for example that: "*the development of irrigation must allow local productions to regain market share while maximising the value added of irrigated for job creation.* ***The question of gender must be taken into account in order to ensure the participation of women""***. (World Bank 2017b, 12)

In contrast, the 'Niger Renewables Readiness Assessment' (IRENA, 2013) developed by the International Renewable Energy Agency for the government of Niger to aid decision making in improving access to renewable energy for poverty alleviation, only mentions 'women' twice.

The assessment and briefing documents reviewed have all been commissioned by international actors that required information in guiding funding decisions and/or to understand the energy needs in Niger. It appears that these documents had some official backing or endorsement from the Nigerien government, based on the inclusion of government ministers' names as contributors to discussions upon which the development actions described in the reports were based. The Foreword of (IRENA 2013, V-VI) was authored by a government minister .

In a 2017 census conducted by the Directorate of Development and Economic Analysis of the National Office for Irrigation Schemes in Niger, there were about 85 irrigation schemes in Niger covering approximately 16,000 hectares There are more plans to develop additional irrigation schemes under the Kandadji programme for ecosystem regeneration and development in the Niger Valley, tripling the land regenerated to 45,000 hectares by 2030 (ONAHA 2017, 110). However, information on women's access to these irrigation schemes was sparse even though the schemes employ more than 40,000 farmers (ibid., 142).

It is not clear whether this lack of information on women's participation in irrigation schemes in these reports is as result of women actually not being involved in solar irrigation schemes in Niger compared to men or that the reports have been written gender blind. Both cases could act as blockages to better understanding women's involvement in these schemes.

In the next section, the article discusses the role that a dialogical approach can play in transforming women's participation in solar irrigation. Understanding Nigerien women's space for action in accessing and participating in solar-powered climate-resilient agriculture projects solely from the academic and grey literature was a challenging task, because of the lack of research in this area. However, as stated at the start of this section, the literature review revealed a rich literature on DCs. The methodology of DCs provided a critical thinking point to consider how the concept of egalitarian dialogue can be useful to build gender-transformative responses to extreme climate events including flooding, in the Nigerien context. The following section critically views DCs by examining how the clubs have opened spaces for women, increased their voice in public spaces, valued women's own knowledge, and brought together academic/expert' and non-academic voices/experts by experience.

Following that, the article examined rural women's experience of the multiple floods in Niger and goes on to draw insights on how the DC experience can help address the issues of gender equality, environmental issues and food insecurity in Niger.

Case study: Dimitra Clubs in Niger

The article assesses DCs, or Dimitra community listeners' clubs, as their focus on communication and amplifying women's voices aligns with a feminist dialogic approach . The purpose of DCs is to bring people together to discuss shared challenges and collective solutions to help improve their livelihoods. They are viewed by the FAO and other international development actors as a relatively successful gender transformative approach (FAO n.d; Rural Women Economic Empowerment Niger 2019). The Dimitra project initially started in 1994 in Brussels and was aimed at improving the living conditions of rural women through information sharing and at highlighting the contributions of rural women in agriculture (FAO-Dimitra 1998). Since the first Dimitra project in Niger was established in Gasseda in 1996, the '*Dimitra* spirit' (ibid) has been replicated in other Sub-Saharan African countries dealing with a variety of issues, such as food security, climate change, education, health and women's economic empowerment (see Appendix 1).

There are 4,000 DCs [9] in Sub-Saharan Africa. They are typically set up and run by local volunteers (with technical support and help from FAO representatives). The transformative approach of DCs works by improving access to information and using solar radios to enhance various aspects of the lives of men and women in rural Niger.

The stories of women collected by the FAO used through communication and dialogue locally show that DCs have had varying degrees of success [10].

. Based on the key official publications reviewed, DCs have had a tremendous impact on the lives of Nigeriens. Compelling evidence shows that DCs have been able to create many opportunities for women in the areas of leadership, food security, health and education over the last two decades (see Appendix 1). .

At the same time, there are areas of learning that can be identified from the available literature on DCs in relation to women's participation in the climate–security debate.

In summary, the review found that DCs achieved the following:

- Brought together academic and non-academic voices in addressing issues on gender equality, environmental issues and food insecurity in Niger
- Emphasised gender equality
- Expanded women's autonomy
- Facilitated the egalitarian dialogue of women on tackling climate change issues locally

Except for a few cases, DCs have a great deal of autonomy in selecting the themes for discussion, and they have developed actions to resolve the identified issues. For example, in 2015, the consequences of climate change were an agenda of the FAO as a part of its regional humanitarian programme for disaster preparedness (FAO-Dimitra 2015).

The next section briefly discusses examples (one in Nigerian and the other in Niger) of how improving women's involvement in development processes itself as 'experts by experience' can lead to empowerment in different ways.

Practical responses to involving and empowering women farmers

When women are placed in empowering positions and their knowledge valued, they feel more able to participate and be involved in crafting solutions that work for them. Good practice from a northern Nigeria-based solar energy irrigation project that the author has connections to through ABG-CAPS, who originated the solar irrigation pump concept. This example showcases why it is important to involve women in development **[6]**. This case demonstrates that the implementation of solar-powered sustainable irrigation can mitigate the impacts of climate variability and empower women who are involved in rice farming through their participation. Water is the main input for rice farming. It requires a lot of water and the farmers tend to rely on rainfall during July to September window to cultivate their rice farms. However, because of the short period of rainfall in the north western part of Nigeria which actually borders Niger Republic, they are constrained by climate-variability issues.

The solar irrigation pumps in one run on the power of the sun. It makes efficient use of solar energy and converts it into electrical energy for pumping water. This was found to be a better alternative to petrol pumps as so much time is spent looking for petrol, especially during the frequent periods of fuel scarcity in Nigeria. ABG-CAPS' system operates on power generated using solar PV (photovoltaic) system. The photovoltaic array converts the solar energy into electricity, which is used for running the motor pump set. The pumping system draws water from an open water source and then used to irrigate the land. The current government of the Federal Republic of Nigeria has identified the diversification of the Nigerian economy, away from its reliance on oil, as one of its main policy objectives. The government has invested in boosting rice productivity to diversify the economy and has been encouraging the farmers to produce more rice.

From a dialogical feminist perspective, women farmers' voices in Nigeria were given the same weight as those of men. In this case, doing so helped remove the barriers to participation in accessing the solar irrigation pumps and helped secure positive outcomes for women farmers. Nigerian women themselves—through the Women Farmers Association—identified that costs were the key impediment to accessing the solar pumps. Women farmers found it challenging to afford the initial outlay to finance the cost of the pumps; this issue made it challenging to change to a more sustainable irrigation practice.

Prior to implementation of the solar irrigation pumps, the women farmers in Nigeria acknowledged that the use of the existing petrol pumps created petrol spillages and contributed to land degradation and high carbon dioxide emissions. With the solar pumps, the costs are now being spread over a period to make access easy for the women. The irrigation is done effortlessly, and the women also have access to water for their communities through the overhead tanks for everyday use. The project bought back the existing petrol pumps from the women farmers for recycling purposes in order to encourage them to switch over. The solar irrigation pumps mean improved income and better quality of lives for the women farmers, which will ensure that they send their children to school, and as a result, they will be able to afford the solar home systems in their villages to provide solar electricity to their homes.

A second example is in Dosso Niger, where community listener clubs made up of men and women were set up to promote a bottom-up approach to development. The evidence suggests that DCs placed women in empowering positions and valued their knowledge. At the time, the workshop held in Dosso Niger enabled rural women to come together for the first

time to discuss with community radio professionals and representatives from the education sector. History was said to have been made, as the voices of the women themselves were heard directly. This workshop led to the development of pilot projects, which brought together women's groups, literacy centres and community radio stations over the years (FAO-Dimitra 2007).

However, the extent to which the autonomy of women in DCs led to more agency in other areas of their lives, for example, tackling other structural barriers or contributing to improved well-being is under-researched. The key persisting inequalities in the Nigerien context confronting many Nigerien women are likely to continue constraining women's opportunities and participation in renewable energy projects. This article calls for more research in this area of work, especially as it is not clear whether this DC-driven initiatives then led to a significant difference on the Gender Inequality Index for the country.

The case studies discussed briefly here suggest that dialogue with rural women farmers and giving their voices equal weight are important in encouraging participation and involvement in development.

Implications for gender and development: Charting the way forward

The facts on gender equality and women's rights in Niger are challenging and are made more so by climate crisis. There are no easy solutions. This article suggests that dialogical feminism is a route to achieving greater participation of rural Nigerien women in renewable energy schemes that are aimed at driving agricultural productivity.

As mentioned previously, egalitarian dialogue values women's contribution based on their argument (for change) rather than their social privileges or position. Women farmers are viewed as the best sources of knowledge about their needs and the solutions required to solve their problems. A dialogical perspective promotes the involvement of women right from the start of a process, and gives women farmers' voices the same weight as that given to men. It can also help remove their barriers to participation in adaptive responses to the climate crisis and secure positive outcomes for gender equality and agricultural productivity in neighbouring Nigeria, which is discussed later on (ABG-CAPS 2019).

Using DCs to increase women's participation in the use of adaptive responses, such as the development of modern solar irrigated systems, could offer an avenue to increase production and tackle food insecurity in Niger. However, simply including gender in the renewable energy policies mentioned earlier or acknowledging the importance of women's voice in renewable energy access does not guarantee that true participation in policy planning on solar irrigation programmes will occur. As Hilary Matfess aptly said in her book on women and Boko Haram, 'Ensuring that women know their rights, have access to forums to exercise them, and feel comfortable asserting their ownership rights is the larger challenge' (Matfess 2017, 219).

Embedded traditional norms in Nigerien society continue to constrain women's participation in securing land ownership rights and their access to productive resources. These entrenched inequalities are likely to encroach on rural women's space for action in a myriad of ways, as discussed previously. The government of Niger needs to make faster progress in achieving gender equality by removing the reservations to the CEDAW provisions. As there is a greater percentage of women involved in smallholder agriculture farming and negatively affected by the lack of access to productive resources, such as available land, as well as the lack of access

to energy to irrigate the land, gender equality in renewable energy access and community management leadership in Niger must be given greater priority.

Development organisations working with the Nigerien government to expand solar-powered irrigation technology provision to support the country's efforts to tackle climate variability issues must also strive to listen to the experiences and needs of women farmers in Niger and what they consider to be the solutions to these issues right at the beginning of the projects. International development organisations also need to help support processes that address wider power dynamics and structural constraints that exclude women.

Rural Nigerien women must be viewed as sources of knowledge and experts in their own right. Implementers of new solar irrigated projects in Niger, like ABG-CAPS Clean Energy, should draw on the existing capacities of rural women farmers ensuring that Nigerien women have full participation and leadership of the initiatives. The relative success of the FAO's DCs has shown that when a dialogical space is provided, rural Nigerien women are quite capable of identifying shared problems and solutions and their knowledge and lived experience need to be given equal weight in designing solutions for change. Evidence also suggests that improving sustainable gender-sensitive governance of productive resources makes a tremendous difference for women of Niger (World Food Programme 2017).

Gender equality in renewable energy access in Niger must be given greater priority as there is a greater percentage of women involved in smallholder agriculture farming and women are likely to be negatively affected by the lack of access to productive resources, such as available land, as well as the lack of access to energy to irrigate the land.

The article has shown that more research is needed to examine as far as possible the extent to which solar irrigation schemes in Niger have improved or constrained women's participation and leadership and impacted positively on women's lives?. Information on women's participation in solar energy irrigation schemes on a larger scale in Niger remains elusive. With much at stake for the welfare of rural Nigerien women affected by the vulnerabilities of climate variability and precarious food insecurity, priority must be given to improve their access, participation, and leadership in ongoing and future solar-powered irrigation technologies. A good starting point would be to view rural Nigerien women as equal partners in rural development.

Acknowledgments

A version of this paper was presented at the Gender, Peace and Nature workshop convened by the Centre for Women, Peace and Security at the London School of Economics in June 2019. Useful comments and feedback were provided on the initial ideas for this paper, which further inspired the writing of this article.

Thanks to the ABG-CAPS staff, and the FAO-Dimitra Project Coordinator for the resources and information on DCs and for confirming the actual number of DCsin existence by email. Thanks also to the editor of the Journal of Gender and Development, Caroline Sweetman, for commissioning this article and the anonymous reviewers' comments which greatly improved the article.

Notes

[1] The International Network on Gender and Sustainable Energy. (https://www.energia.org/)

[2] World Bank. (https://data.worldbank.org/indicator/SL.AGR.EMPL.FE.ZS)

[3] What is Dimitra? http://www.fao.org/dimitra/about-dimitra/en/

[4] Boko Haram is an ISIS-aligned jihadist group based in north-eastern Nigeria with activities in Cameroon, Chad, and Niger. (Source: Counter Extremism Project https://www.counterextremism.com/threat/boko-haram)

[5] See Kang 2015 for a more thorough discussion.

[6] ABG-CAPS Clean Energy Ltd, initiates renewable energy projects in West Africa and aims to improve agricultural productivity and address improvement challenges through solar irrigation, particularly for women farmers in rural Nigeria, Ghana, and Niger. (http://abgcapsenergy.com/).

[7] Dialogical feminism has been influenced by Habermas' (1984) egalitarian dialogue concept. This feminist perspective is concerned with bringing together academic and non-academic voices and assigning equal weights to both, not privileging one over the other. Dialogical feminism emphasises listening and valuing the voices of other women and their experiences (Merrill 2005).

[8] For a review of gender audit tools, see Clancy and Mohlakoana (2020). For the purpose of this study, the ENERGIA Quick Scan tool (ENERGIA 2010) has been used because of its simplicity and relevance to renewable energy, and in light of time constraints to gather the existing evidence rapidly. The ENERGIA's Quick Scan tool includes an approach to examine policies and documents generally by searching how many times gender-related terms were used explicitly. The key terms used in the search were 'gender', 'male', 'female', 'women', 'men', 'women's empowerment', 'women's participation' and 'gender equality'.

[9] The figure has been provided by FAO-Dimitra.

[10] See (http://www.fao.org/fao-stories/article/en/c/1200214/)

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Appendix 1: Summary of a review of the key FAO publications on Dimitra Clubs in Niger

Location	Activity/Issue tackled	Targeted at
Malam Koira	Use of Information, Communication Technologies as an enabler for sustainable development	Women, young people
Malam Koira	Women's exclusion from the management of the local cereal bank	Women
Kourki	Dealing with the impacts of climate change	Women, men, children
Gasseda	Building peace between livestock keepers (Peuls) and crop farmers	Women, men, children
Ko-Lamba	Water and nutrition (rehabilitation of the pond was identified as a potential solution to the challenge of increasing fish consumption)	Women, men, children
Zinder	Building a road in Rigar Djerma aimed at improving the local livelihood	Women, men, children
Tillabéry, Dosso, Maradi, Tahoua, Zinder	Gender-based violence	Women, men
Gasseda	Gender roles and relations change	Women, men, girls
Maradi, Dosso	Tackling malnutrition and taboos against consuming certain foods by women	Women
Maradi, Zinder	Joint management of cereal stocks to ensure the year-round food supply	Women, men, children
Tillabéri, Dosso	Community listener clubs	Men and women
Gasseda	Resolving an administrative issue on the issuance of birth certificates on the spot to remove the education barrier for village children	Children
Tahoua	Preventing early marriages (speaking out at a village assembly led to the introduction of financial levies/fines of 100,000 CFA on families that allow their daughters to marry before the age of 17)	Girls
Tahoua	Climate change project by DCs (access to previously unusable land) on cultivation	Women

Zinder	Combating food insecurity	Women
Dosso	Literacy centre	Women, girls
Tanda	A woman leader of DC to serve as a city councillor successfully	Women
Doubel, Kourki	Strong leadership roles	Women
Borobon	Young people as vectors of change	Young people
Gasseda	Advocacy and leadership skills	Women
Banizoumbou	Land for a century	Women
Zindigori	Leadership in Niger	Women
Tallague	Solar-powered water pump and lighting	Women

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