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Original research article

Inclusiveness by design? Reviewing sustainable electricity access and entrepreneurship from a gender perspective

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ABSTRACT

There is a substantial literature analysing the role of electricity as a catalyst for economic development. However, there are significant knowledge gaps in whether such systems are or can indeed be designed in a gender sensitive way to promote equal opportunity for socially inclusive entrepreneurship at the local level. We make three main contributions with this paper. First, we carry out a literature review to unpack the gender-electricity-entrepreneurship nexus by identifying the agenda of the gender-energy and gender-entrepreneurship literature respectively and how they intersect and understand gender over time. Second, we synthesise key factors identified as hindering and driving empowerment in relation to electricity and entrepreneurship and identify the weaknesses of the respective literature. Third, we outline the contours of the conceptual intersection and develop a framework which shows how electricity systems can be designed to become favourable and economically empowering for both men and women. Furthermore, we demonstrate how local value chains can benefit from this electric inclusiveness. Finally, with our framework, we develop recommendations for strategic action and identify points of intervention in policy, planning, design and operation of electricity systems.

1. Introduction

Basic service provision and construction of infrastructure is a longstanding component of international aid and government-led welfare programs. In the last decade, however, we have witnessed increasing attention to universal electricity access as a development objective. Providing access to “modern, reliable and sustainable energy for all” [1] is considered a prerequisite for economic growth and inclusive development [2]. Therefore, governments and international donor organisations have begun to support the deployment of small and large-scale electricity systems—actively targeting entrepreneurial and ‘productive uses’ of electricity [3]. It is an established insight that electricity access cannot, by itself, boost local economies or initiate industrialisation [4,5]. From an entrepreneurial perspective, centred on the daily realities of small-scale entrepreneurs in newly electrified neighbourhoods or villages, most of the significant challenges for running a successful business do not disappear with electricity access. Still, there are reasons to believe that thoughtful design of electrification programs can affect the degree of economic activities that emerge.

A key factor that could potentially enhance the development impacts of electrification programs is gender equality. Within policy

discussions, it is increasingly recognised that gender inequality has a negative effect on, first, the attempts to provide universal access to electricity services, and, second, the translation from electricity use to wider societal benefits. The energy sector, as well as research on energy and development, is male dominated and—despite current evidence indicating that gender relations permeate the dynamics of energy supply and demand—there is still an unfortunate lack of gender sensitive analysis and design [6]. In parallel, the international literature on entrepreneurship and gender provides unsettling evidence that female entrepreneurs operate much below their potential, due to gender specific barriers and discrimination. Female entrepreneurs (both emerging and already established business owners) still grapple with a number of challenges such as lack of access to socio-political networks and finance, restrictive regulative environment, and cognitive inhibitions while struggling to fit into societal ascriptions of gender [7]. In a similar vein, these female entrepreneurs have also been at the back of the line in terms of access to electricity for productive uses [8]. Connecting the dots, Marshall et al. propose that electricity access may be one of the key levers to unlocking their entrepreneurial path [9].

Considering the established gender gap in business and entrepreneurship and the estimated huge economic gains that improved

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gender parity would bring different economies around the world [10], the question arises, if, in the context of low-income communities, gender-sensitive design and strategies for enhancing entrepreneurial activities through the provision of renewable, affordable and reliable electricity access could result in better development impacts? Motivated by this empirical question, this article reviews the scientific literature on the nexus of electricity-gender-entrepreneurship to assess the current level of knowledge, in order to establish the conceptual and empirical state of the art and identify knowledge gaps to be addressed through further research. Our review shows how, over the years, the gender and energy literature on the one hand, and gender and entrepreneurship literature on the other, have proposed different pathways and agendas in solving the persistent gender gaps in their respective field [11–13]. Although both literatures have evolved in parallel, and have undergone a comparable theoretical shift from a focus on women to a focus on gender, the volume of research that explicitly integrates them, or empirically investigate the linkages between them, is very limited. We find that the literature is devoid of a conceptual framework or theory that explains the linkages and feedback loops between energy-gender-entrepreneurship, nor have we found an analysis of the conceptual overlaps between the two streams of literature. More importantly, our review shows that there is hardly any literature that takes a gendered approach to electricity entrepreneurship. If there are, as we may reasonably expect, gender dimensions to entrepreneurial uses of electricity then these are blatantly overlooked and unexamined. These theoretical and empirical black holes leave us in a situation where there is not sufficient research to underpin a review of the causal linkages of the nexus of concern. Hence, our approach is to review respective literature to identify similarities and possible overlaps, and based on that, sketch the contours of the space in between that needs to be further researched.

Given the difficulties in mapping a terrain that is barely studied, the aim of our article is to make explicit the implicit linkages between electricity, gender and entrepreneurship in order to help (re)design socially inclusive electricity systems that tackle gender barriers to entrepreneurship at local and national levels. To achieve this aim, we not only review the two streams of literature but draw on their theoretical and empirical insights to provide a theoretical framework that can guide empirical investigations. We believe that while the current diagnoses of scholars writing on gender and entrepreneurship differ from those working on gender and electricity, there seems to be shared expectations that if women are ‘empowered’ then improved gender parity will also bring positive development impacts.

This article is structured as follows. Section 2 describes our methodological approach. Section 3 starts by unpacking the different theoretical strands and conceptual developments of each literature. We identify the main factors creating gendered opportunities and barriers for electricity access and entrepreneurship. Based on this analysis, Section 4 outlines the conceptual space where electricity, gender and entrepreneurship intersect. Here, we present our integrated framework of analysis—an assemblage of heuristics that show how entrepreneurship can benefit from electric inclusiveness. Section 5 provides further research directions and questions.

2. Methodology

Identifying the nexus between electricity-gender-entrepreneurship is challenging. This is because studies on electricity-gender are few, and more importantly, the electricity-gender literature is embedded within the energy-gender studies and cannot be separated. An examination of the energy-gender literature will thus provide the basis for understanding the relationship between gender and electricity and help us to identify how the current energy mix—with a high share of traditional energy services—conditions electricity-related entrepreneurship. Probing these interfaces, we are able to identify the impacts of electricity interventions and their gendered meanings from the individual

level to the wider society. Therefore, throughout this article when we refer to gender-energy this also covers the gender-electricity discourse and vice-versa.

To provide a foundation for this review, we began by examining papers in the gender-energy field. We were selective in which papers to include from the gender-energy field based on how they help explain the linkages between gender, entrepreneurship and electricity. We took a global perspective, and the literature search covered theoretical and empirical studies on gender and energy as well as gender and entrepreneurship. To really capture the influence of electricity access on gender and local entrepreneurship, we ended up focusing on middle and low income countries (countries with low industrialisation and economic performance), especially rural areas, with little or no electricity access where survivalist¹ entrepreneurs are predominant. In our bid to ensure a comprehensive review, we adopt principles from both the systematic literature review (SLR) approach and the scoping methodology. It is critical to note that we do not necessarily follow the prescribed structure of the two methods, just the principles which underscore them. Both approaches are guided by clear sets of principles such as comprehensiveness in research coverage, transparency in data synthesis and attention to the quality of empirics—all which help to refine research questions and highlight areas for future research [14–18].

Building on the SLR and scoping principles, our search was: (i) designed to be as comprehensive in its literature coverage as possible; (ii) we paid specific attention to the quality of evidence presented by each paper examined; and (iii) we also focused on papers that were transparent and systematic in their synthesis of data. For quality control, we mainly chose peer-reviewed journal articles (original research papers and review papers) from the electronic bibliographic databases Science Direct, Scopus and Web of Science. The review covers publications from the 1980s up to and including the year 2018. We excluded conference papers, PhD thesis, grey literature and all forms of experimental studies (see Table 1 for a summary of the review steps).

We chose the Boolean search approach and used search and string terms to find studies which engaged with “electricity OR energy AND female OR women OR gender”, “entrepreneurship AND female OR women OR gender”. Other key terms searched were “electrification and entrepreneurship”, “women’s empowerment”, “social inclusiveness”, “productive usage”, “rural development” etc. While, admittedly, using a journal-led search rather than a broader literature search approach would have provided a more focussed result, we chose the Boolean search because there were no journals specifically addressing the linkages between entrepreneurship, gender and energy.

For the gender and energy literature, a total of 321 studies were found to have broadly discussed gender/women in relation to energy, electricity, productive use enterprises and or empowerment (see Table 2) with some analysing two or three of our Boolean search words together. Of the 321 found, 12 dealt with the concept of electricity and gender empowerment. 46 articles analysed the influence of energy/electrification on gender (this included: time savings and labour, income from non-electrified work). 13 articles discussed electricity and entrepreneurship/enterprise growth. 134 articles discussed women and energy use at the household level (topics include: dealing with drudgery, cooking, fuel and biomass use, lighting and impact on health). 39 articles analysed energy impacts on communities, finance, policy and sustainability issues. 38 articles discussed the impacts of energy poverty. 34 articles analysed the role of renewable energy and microgrids in addressing energy access. Only 5 articles were found to explicitly

¹ Survivalist entrepreneurs are mostly predominant in the informal sector. These group of entrepreneurs get into entrepreneurship out of necessity and survival, hence they lack the motivation for business expansion or growth (see Banerjee and Duflo [14]). Based on empirical evidence, a vast number of people classified as survivalist entrepreneurs in Africa are women (Grimm et al. [15])

Table 1
Review steps.

Stages	Description
Article title, the sector of focus; the region of coverage	Designed to be as comprehensive in its literature coverage as possible especially for developing countries.
Research question/focus; the perspective of analysis; quality of evidence presented	We targeted papers which covered key epistemological, ontological and methodological shifts in both the gender-energy and gender-entrepreneurship literature.
Method (qualitative vs quantitative, sampling, descriptive/narrative; single cases vs comparative analyses)	We also focused on papers that were transparent and systematic in their synthesis of data.
Data sources; journal types	For quality control, we mainly chose peer-reviewed journal articles (original research papers and review papers) from the electronic bibliographic databases Science Direct, Scopus and Web of Science.
Publication year and type	The review covers publications from the 1980s up to and including the year 2018. We excluded conference papers, PhD thesis, grey literature and all forms of experimental studies.

Table 2
Summary of the search process for gender and electricity.

Search terms for energy* and gender	Number of hits
energy-gender-electricity-women-productive use-enterprise-empowerment	321
Electricity and gender empowerment	12
Electricity and enterprise growth/productive use	13
Energy/electrification on gender (drudgery, labour)	46
Women and energy use at the household	134
Energy impacts on communities, finance and sustainability issues	39
Energy poverty	38
Renewable energy and microgrids in addressing energy access	34
Linkages between electricity, gender and entrepreneurship	5

discuss the relationship between electricity, gender and entrepreneurship [6,8,9,19,20].

Since we are mainly interested in electricity, the review includes studies of electric power systems of different sizes and types of ownership, such as centralised (large-scale), decentralised (small-scale), privately owned, community-owned and publicly owned electricity systems. We included all these types as electricity is often not the end-product, but a resource that enables other activities. From an entrepreneurial point of view, the entire chain from supply to demand offers entrepreneurial possibilities—from supply side activities to use of electricity as input/ supporting service for other sectors, such as telecommunications and agriculture [21]. Our search for electricity in relation to gender was thus focussed around the provision and use of electricity as both end product and social service, a business venture in itself and applicative business tool.

For the entrepreneurship and gender literature, our search was delimited to studies that discussed entrepreneurial motivations and intentions, contexts and entrepreneurial performance. For the gender and entrepreneurship literature, a total of 279 articles were found (see Table 3) to have broadly discussed gender/women in relation to entrepreneurship, feminism and empowerment with some analysing two or three of our Boolean search words together. Of the 279, 100 articles dealt with women's intention, engagement in entrepreneurship, networking capacities, attitudes and traits. 90 articles analysed contextual influences, institutional structures, gender characterisation and

Table 3
Summary of the search process for gender and entrepreneurship.

Search terms for entrepreneurship and gender	Number of hits
entrepreneurship-gender-feminist-SMEs	279
Women's intentions, engagement, networking capacities	100
Women's context and performance	90
The transition from women to feminist discourse on gender in entrepreneurship	53
Small-scale entrepreneurship	28
Technologies	6
Electricity as a tool for gender-sensitive entrepreneurship	2

entrepreneurial identity on performance. 53 articles critiqued the male/female dichotomy in the entrepreneurship literature and proposed a feminist approach to gendering entrepreneurship. In the context of previously un-electrified communities in low-income countries, the potential customer base for electricity services consists mainly of micro, small and medium enterprises. We found 28 articles which dealt with small-scale enterprises. To explore the extent to which technologies (representative of electricity here) are discussed within the gender and entrepreneurship field, our search produced a total of 6 articles that addressed technologies generally and 2 [8,9] which addressed electricity and gender. In sum, the observed lack of theoretical and empirical connection between gender, energy (electricity) and entrepreneurship posed a big problem. Thus, after a general review of the 321 articles found in the gender and energy literature and the 279 articles found in the gender and entrepreneurship literature, we decided to reference in this review those articles that highlighted phases of theoretical development in respective literature and those that dealt with the concept of empowerment². This is done in order to map the theoretical landscape, find overlapping elements and develop a theoretical framework.

3. Mapping the theoretical landscape

This section reviews and synthesizes diverse perspectives in the literature on the intersection between, first, gender and energy (electricity), and second, gender and entrepreneurship, as this allows us to develop a theoretical model which not only identifies the agendas of each literature stream and how they intersect but, also, helps us understand how causal linkages between electricity-gender-entrepreneurship can potentially empower female entrepreneurs and result in development of local economies. Our review is organised to (a) describe the development of each literature's understanding of gender, over time; (b) synthesise the key factors identified by the literature as hindering and driving women's empowerment in relation to energy/ entrepreneurship; (c) identifying some gaps and weaknesses of respective literature.

3.1. Gendering energy and electricity

The gender and energy literature has significantly evolved over the last four decades. In this regard, there has been an epistemological shift

² For us, empowerment is defined as the capacity of men and women to equally influence energy-related decisions at the household or enterprise level, their equal engagement in the design, development and supply of energy interventions, equal access to and control over resources necessary for gaining and maintaining electricity access over time, as well as their equal participation in the design and redesign of previous and new energy policies which affect them). Importantly, there seems to be shared expectations from the gender-entrepreneurship and gender-electricity literature that if women are 'empowered' then improved gender parity will also bring positive development impacts.

from a ‘gender-neutral’ perspective, where energy access was mainly discussed in relation to women’s access to energy fuels and less in terms of *gender*, to a more gender-aware approach where power relations and intra-household decision-making capabilities in relation to energy and electricity are examined [22]. Below, we will discuss factors that characterised the shift in perspective.

3.1.1. Phase 1: focus on women, energy and development

From the early 1980s, the development of energy architectures, policies and institutions have been hinged on the promotion of economic growth and the alleviation or eradication of global poverty [23]. For energy practitioners, alleviating poverty signified addressing energy poverty and creating access to electricity and modern fuels for the marginalised within the society. Also, firmly locked within this agenda was the provision of energy and electricity services for women, especially at the household level, as numerous statistics showed that women were (and still are) more affected by the lack of access to energy services and this made them vulnerable to more forms of poverty [24,25]. This narrative led to a number of studies exploring the interaction between women’s access to electricity services, efficient cookstoves or gas stoves in the home, and gender dynamics within the household. This empirical tradition began in the early eighties but was further bolstered by Elizabeth Cecelski’s influential work on women’s labour and its importance for scales of production. Cecelski’s article [26] raised critical questions on the linkages between gender, energy, and poverty, showing the economic and political implications of activities at the household level. This led to the conceptualisation of energy and electricity services from a ‘developing country’ perspective where a large portion of the population depended on biomass and fuelwood [26]. Yet, Cecelski later noted that both scientific and policy inquest in the energy field remained largely fixated on the ‘capital-intensive large-scale electricity projects’ and thus continued to ignore projects for low-scale household use and development of local economies [27].

3.1.2. Phase 2: energy policy in focus

Following Cecelski’s work, a number of models were developed to integrate gender into energy policy and planning. Of critical note are the Gender Roles Framework (GRD) developed in 1991 (see Skutsch [28]) and the Development Planning Unit model (DPU) [29] of 1993. The GRD framework was centred on the premise that in the design of development projects, there are some central variables of priority in terms of gender: first, one needs to consider gendered **work roles** and unequal **time contributions** by men and women respectively to the formalised ‘productive’ economic sphere and informal ‘reproductive’ activities (i.e. necessary but unpaid work activities like housekeeping). Second, this model also emphasises the importance of **access and control over resources** as key factors in gendering energy services. Following suit, the DPU model adopted these variables but went a step further by introducing the concept of ‘**practical gender needs**’ (defined as commodities and things needed to improve the daily lifestyle of women) and ‘**strategic interests**’ (defined as things needed to change or upgrade women’s social strata) [30]. Table 4 provides an overview of the factors identified by these models [28,31]. Building on the GRD and DPU models, subsequent analyses focused on key technological applications such as electricity for lighting, heating and cooling, cooking, and mechanical power and connected these to women’s time, labour, health, lifestyle and livelihood activities (forgone due to the absence of electricity services) [19,32]. It was expected that women’s access to

electricity services would lead to the acquisition and use of new electric appliances for previously manualised tasks specifically designated to women and that this would reduce the work burden and thus, contribute to empowering women.

As visionary as the GRD and DPU framework were, most of the analyses done within this period, especially in developing economies and rural areas, were fixated on the shift from fuelwood to cleaner cookstoves. Only a few research articles addressed electrification for cooking or large-scale machinery use by women. More importantly, gender discourses in the energy literature were mostly conceptualised from a biological/women lens—and not from a socially constructed view of gender. In this sense, household electricity choices were analysed as homogenous and the power dynamics and gender roles were not really considered. In the policy arena, women’s inclusion was promoted but energy interventions remained gender ‘neutral’.

3.1.3. Phase 3: from women to gender (electricity choices in focus)

By the early 2000s, feminist scholars in the energy stream began to question gender-neutral policies related to energy, households and enterprises as they argued that ‘neutrality’ was, in fact, a bias as the programs brought more benefits for men than women. Women face greater restrictions in engaging energy services beyond household use, and more often than not, women are excluded from energy planning. Drawing on post-structuralist understanding of gender, scholars proposed that, first, analyses of household energy/electricity choices and decision making must consider that women are not a homogenous group, that gender relations are socially constructed, and that gender intersects with other categories of social differences, such as class, ethnicity and age, with important effects. Second, at the program and policy levels, energy and electricity access shouldn’t be considered a question of only practical needs or strategic interest, but a question of how to also foster women’s empowerment through participation in system design, implementation management and use. We will now elaborate on these two arguments in the literature and identify the main factors at play.

Household electricity choices reflect the heterogeneity of women’s situations and socially constructed norms and institutions: Feminist scholars [31,33–36] within the energy stream began to see the danger in categories hiding the differentiated experiences of women and men—such as the use of the ‘household’ as unit of analysis. This attention to difference created a significant shift in the energy-gender discourse, away from simplistic group categories to the richness of individual experiences. Specifically, these scholars argued that masculine and feminine behaviours, characteristics and experiences are neither homogeneous nor given by nature, but enabled and constrained based on contextually and historically specific values, ideas, norms and material conditions, which influence energy and electricity choices at the household level [31,33–35,37]. In societies that attribute less value to the lives and experiences of women, more often than not, women—individually and collectively—exercise and have less control over the decisions in their personal lives and resources, both at the home-front and within the community, compared to the men they share lives with [38]. Women are disempowered *in relation* to men, and thus to focus on women, rather than dynamic gender relations, misses the process whereby inequality is reproduced on a daily basis.

Norms and institutions impede many women’s access to resources or assets, which is considered one of the main reasons for the high poverty rate among women [39–41]. This scale of female poverty is further

Table 4
Means of Gender Empowerment through electricity services.

Early models developed in the energy field to foster women’s empowerment	GRD model	DPU model
	Access to resources Control over resources	Practical gender needs Strategic interest

exacerbated by house-work burdens leaving little or no time for the pursuit of income-generating activities [42–44]. For instance, in a survey conducted in sub-Saharan Africa, Charmes [45] found that women spent on average 3–5 times more on domestic activities like fuelwood picking and cooking than men. Could these factors influence the energy preferences of individuals? This question prompted scholars to analyse intra-household decision-making processes. For example, Pachauri argues that there are multiple levels of decisions when it comes to electricity services. First, a decision must be made to pay for the connection and second, a decision is made when payments are made for its continual use [22]. The latter does not only involve supply costs, but also additional expenditure on complementary appliance purchase. Choosing which appliance to buy is influenced by gender as appliances have different impacts and purchases may be driven by different factors and actors within the household [46–48]. For example in India, women were found to have more control over cookstove purchases than electricity oriented appliances. Pachauri further argues that women who control acquired or inherited assets are better able to bargain their way in this situation, a control which is often constrained by legal institutions, norms, and social relations to in-laws, siblings and senior household member and their preferences [22]. These findings mirror the argument by Köhlin et al. [50] that the preferences of women with lower status, combined with the lower perceived opportunity cost of time, will likely carry less weight in household decision-making processes, especially in male-dominated and financially controlled households.

Hence, the de-prioritization of women's technological preferences is mainly attributed to **socio-cultural norms** and **institutions**, which places less value on women, sometimes also internalised by women and influencing their choices when confronted with technologies that might benefit them [49]. The effects of these socio-cultural norms and regulatory institutions on gender interactions with new and diverse forms of electricity systems are, more often than not, complicated by numerous factors meshed together to shape the social possibilities and use of technologies. This social complexity counteracts linear assumptions that the mere “provision of electricity services” buffered by the use of certain financial vehicles will yield economic development and break gender barriers [22,51]. What the more recent literature shows is that, clearly, electricity access and use is complicated by more than gender relations and one cannot analyse the gender-electricity interactions as taking place ‘outside’ the unique geographical, historical and societal **context** that shape and is reshaped by these relations and practices [17,34,52].

Electricity access must be designed to foster women's empowerment: In a bid to redirect the analysis on gender and energy, the literature has significantly shifted towards the concept of **women's empowerment**. Clancy suggests that “the notion of women's empowerment” is used to aggregate women's power within and outside of their individualism [12]. This is conceived as the ability to wield power to organise with others who share common goals, and the capacity to assert, be self-expressive and be self-aware on issues of strategic interest to oneself. From a feminist poststructuralist perspective, transcending the dichotomy of power-from-within and power-to [52] leads to an evaluation of men and women's “equal rights, access to and ownership over resources and their power or influence on matters that affect them” [17] pg. 407. In this regard, disentangling the relational exercise of power between men and women means understanding how gender roles are moulded by a range of formal and informal, social, economic, and political institutions and how the more and less direct pressures from society translate to empowerment or disempowerment [31,53]. Longwe's and Kabeer's frameworks on empowerment [54,55] (see Table 5) wraps this succinctly by defining empowerment as the access to welfare, attainment and control of resources and factors of production (human, material and social), agency (individual degree of control over life choices), and conscientisation about gender masculinities and femininities. Drawing on Kabeer's framework, Winther et al. provides a

detailed conceptualisation of how electricity access at the household level can result in women's empowerment [17,38] (see Table 5).

For electricity access, this understanding of empowerment thus involve multiple dimensions, such as the capacity of men and women to equally influence electricity-related decisions at the household or enterprise level, their equal engagement in the design, development and supply of electricity interventions, equal access to and control over resources necessary for gaining and maintaining electricity access over time, as well as their equal participation in the design and redesign of previous and new energy/electricity policies which affect them. However, the importance of electricity, or women's participation, must not be overstated as access to resources does not mean automatic social change. This is clearly evident in numerous studies that show that even when projects are focused on increasing gender participation, or income by including women in energy management or decision-making bodies of local electricity utilities, their decisions can still be undermined by men. Wong [53, pg 101] explains how women were included in projects: “Men are working outside. Women are living for 24 h in the community, so they are nominated. Worse still, the decisions made by women in the absence of men were considered provisional. When men return, they could challenge the decisions and make amendments” [56]. The example illustrates how women's participation in an electrification project resulted in short-term empowerment that was then reversed as men exerted power over women based on their privileged position.

The table represents the most important factors enabling and hindering women's empowerment identified by key feminist energy scholars [8,17,31,54,55].

3.1.4. Summary

To summarise the current state of the art in this literature, there has been a fruitful turn from a focus on women to studies of gender relations. Based on this shift, the gender and energy literature has been able to disentangle the gender barriers experienced by women due to personal and societal dynamics and, especially, how this configures women's interactions with electricity systems. It becomes interventionist in its method of tackling the identified barriers to electricity access, and as such, pivots towards the concept of empowerment and the development of capabilities. By tilting towards empowerment, the literature pays attention to the individual, social and cultural factors required to convert electricity access to a useful resource which can then become a capability [12]. It seemingly acknowledges that electricity access, when gender sensitive, can create transformations that transcend the traditional locus of analysis (households) to complex economic spaces (entrepreneurial spaces) [8,22].

3.1.5. Gaps in the existing literature

Despite the positive turn in the energy/electricity and gender research, seven main conceptual weaknesses plague this stream of literature. (a) The gender and energy literature remains narrowly focused on, primarily, the policy and household levels. The linkages between gender, electricity and entrepreneurship are largely ignored, with some exceptions. For example, in South Africa, Annecke [57] found that women considered “soap operas” as sources of knowledge on how to become entrepreneurs, while also dealing with daily relational problems. For others, TV stories about women with careers and business were inspirational and showed that like the women they watched, they could become independent of men's financial support [32,58]. (b) Even when gender and electricity are analysed beyond the household, the narrative is mostly within the “productive use” realm. This linguistic choice is often used when scholars refer to women's labour and income activities that are mostly low or non-electricity related businesses. In fact, the 13 papers found to have discussed entrepreneurship within the energy literature demonstrated a weak understanding of entrepreneurship, with most papers only providing quantitative evidence on the impact of electricity on business activities. While it is relevant to

Table 5
Summary of how gender empowerment is defined within the energy and electricity literature.

Factors enabling and hindering women's empowerment	Operationalised as
Context/ welfare/rights	The context and hegemonic identities constructed around each gender define the scope of opportunities available to them, and their experiences with oppression, exclusion and privilege.
Resources and capabilities are cogent	The human, social and material resources available, accessed and controlled influences the patterns in which gender is produced and gender inequality is embedded within the society.
Conscientisation/Agency	Women becoming active participants and decision makers in the scope, scale and price of electricity consumed allows them to identify and tackle gender barriers arising from the sociotechnical system
Participation/ socio-technical system for all	The equal capacity of men and women to become involved in the planning, design, implementation, ownership and management of deployed electricity interventions.
Institutional support for gender-sensitive supply	Institutional support for gender-sensitive supply might likely affect who gets involved in the supply of electricity and how this affects impacts and sustainability
Policy and regulatory support	Policies and regulations which support equity in access will likely create a gender balance at the supply level as well as the decision-making sphere

document the number of extra hours gained for businesses, such analyses, however, do not capture the influence of electricity in creating new processes within the business value chain. (c) Also, by focusing on close to home businesses, the gender and energy literature portray women as users but overlook gender influences on the supply side of electricity and fuel provision, including non-traditional—in terms of new opportunities as well as traditionally ‘male’ jobs—organisational or entrepreneurial roles along the energy value chains. The problem with this framing is discussed in depth in [9] and it reinforces the demarcation of entrepreneurship as a male domain and attributes more importance to men’s economic activities. Seeing men as entrepreneurs while women merely engage in productive uses of energy downplays women’s economic contribution to society and echoes a discursive bias that feminist scholars of entrepreneurship have highlighted and critiqued in entrepreneurship literature. (d) Only a few scholars address the relational dynamics, more often than not, energy studies are still focused on women and not the gender construct or structures in which people operate. As such, there is no explicit approach on how gender barriers within complex economic spaces can be negotiated via access to electricity or how observed power dynamics can be re-configured to favour those disadvantaged due to gender. (e) Although the current literature reveals how electricity might create new spaces of empowerment, it remains unclear how such “empowerment” might be disruptive to the existing social order, embody new forms of authority and power or change both individual and collective experiences in the society. (f) Similarly, it doesn’t provide answers on how the physical arrangements and the political qualities of electricity infrastructure moulds gender interactions with entrepreneurial activities and affect women’s choice of industry. (g) Lastly, there is still not enough attention to how electricity systems and society co-constitute one another and change over time. As electricity access open up new social and economic spaces and people draw on resources and institutions to make use of these, slight shifts occur in multiple dimensions of daily life [52,59]. These may destabilize social hierarchies and enlarge the symbolic and material space for people to contest restrictive norms and rules. As marginalised women and men venture into new roles and activities, they press against the boundaries for ‘appropriate’ behaviour and trouble stereotypical ideas about what they can and should do [9]. Women’s economic independence and social status in society tend to nurture one another. But also, a positive cycle develops between entrepreneurial (and household) uses of electricity/ energy and the positive outcomes these bring for individuals as well as positive impacts on the local economy. This benign feedback cycle will also influence the energy supply system as this system would evolve to accommodate new actors, infrastructures, institutions— all of which would create more demand for services. In sum, electricity services are certainly not neutral, yet, how they shape entrepreneurial pursuits and their wider developmental impacts on gender is a vital question for critical empirical analysis. In the next section, we explore what the gender and

entrepreneurship literature has to say about these complex interactions.

3.2. Gendering entrepreneurship

In the last thirty years, gender and entrepreneurship studies have been characterised by significant ontological, methodological and epistemological shifts. First, there has been a substantial shift in how gender narratives around entrepreneurial identities and performance are understood and analysed [60]. Second, this has led to methodological reorientation from a primarily positivist perspective, dominated by statistics, to a more narrative and descriptive oriented perspective, where entrepreneurship is analysed from a constructivist view [61,62]. Finally, epistemologically, there has been a significant shift from sex being considered as a variable—where women entrepreneurs were primarily discussed for group visibility—to a gender-sensitive approach, which treats women as a heterogeneous group with differential experiences, or, recently, a post-structural feminist approach which argues that the gendered experience of entrepreneurship is socio-culturally performed and rooted in power hierarchies [63]. Below, we will focus on this epistemological shift and identify key factors that are perceived as enabling or hindering the empowerment of female entrepreneurs.

3.2.1. Phase 1: Entrepreneurial “visibility for women”

The entrepreneurial literature of the 1980s was characterised by questions centred around the role of personality traits and identity and how this influenced the entrepreneurial performances of men and women. At this point, studies that disaggregated data for sex were mostly concerned with different entrepreneurial outcomes between men and women and how to explain these [60,64,65]. This trajectory of inquest was encapsulated in dominant ideas of the time, laid out in foundational studies on entrepreneurship, from Schumpeter to Kirzner, that conceptualised entrepreneurship according to a masculine ideal: i.e. a male pragmatic hero with initiative-taking capacity, yet open-minded to take risks that would result in ground-breaking innovation and success [66,67]. This characterisation of the heroic entrepreneur led to studies of socio-cognitive factors potentially underlying the behaviour of male and female entrepreneurs [65,66,68]. In short, the overarching purpose of this research direction was to understand what constitutes an ideal profile of a successful entrepreneur. The focus on personality profiles precluded structural explanations [69]. For example, Nelson [70] argued that the observed (male/female) differences in business performance could be attributed to the *irrational behaviour* of female entrepreneurs, as they would rather rely on unqualified family members for daily business operations than employ others to do these jobs. Within this realm, sex as a biological construct dominated the discourse and as such, research conducted during this period was mostly centred on analysing women rather than gender [71]. This school of thought had a significant male bias and women’s

Table 6
Phases of gender awareness in the entrepreneurship literature.

Gender neutral (1980-1999)	Liberal Feminist (2000-2005)	Post-structuralist (2006-)
Household (family businesses)	Household (motherhood and roles in the family)	Household (identities/Masculinities and Femininities)
Socio-cognitive attributes (Man vs woman)	Socio-cognitive attributes (individualism)	Socio-cognitive attributes (gender as being socially performed)
Resources	Networks/resources	Institutions (cognitive, normative, regulative)
Performance/capabilities	Institutions (cognitive, normative, regulative)	Power hierarchies/patriarchy

entrepreneurial activities were often portrayed in a negative way. In response, ‘gender’ research at the time centred on mapping and making visible women’s entrepreneurial activities and conditions.

3.2.2. Phase 2: Gender-sensitive entrepreneurial analyses—Institutions matter

The gender-sensitive school of thought, mostly championed by liberal feminists, emerged in the early 1990s as a counter to the narrative which had pervaded the 80’s. The liberal feminists argued that personality traits were overestimated and could not significantly explain the observed gaps in entrepreneurship because other pivotal endogenous and exogenous (macroeconomic and socioeconomic) factors were not taken into account. These other factors are entrenched in the environment in which women entrepreneurs operate [62,64,72] and a proper understanding of the unique experiences of women thus requires a gender-sensitive framework. For these scholars, the nexus between gender and entrepreneurship must be analysed from a **multi-level/institutional perspective** [11]. This involved studying women’s entrepreneurship within the multiple loci in which they interact with society. Brush, de Bruin, and Welter [11] posited that focusing on the multiple spaces in which women entrepreneurs interact with society will mean a revision of the previous model of venture creation, which emphasised money, market, and management, to include motherhood (household), and the “meso and macro environment”. **At the household level of analysis:** Brush, de Bruin, and Welter [11] suggested that, by examining motherhood, we are able to evaluate the intrinsic gender and power dynamics that are operational at the household level. Essentially, the authors believed that for women entrepreneurs, husbands and children matter, as there is evidence that family support (emotional and financial) enhances women’s entrepreneurial confidence [11,73–75]. A downside to strong family embeddedness is that women-run businesses that are situated proximate to the household raise issues of legitimacy and credibility as these businesses might be seen as leisure activities by customers and creditors.

At the meso level of analysis: liberal feminists argue that access to powerful social networks is an indispensable tool for both male and female entrepreneurs [64,76–78]. Social networks are regarded as game changers for entrepreneurs as these serve as platforms for information exchange, a pool for meeting new employees and gaining other social resources for businesses. The key function of powerful networks is that they serve as pointers to new business and innovation corridors and can be drawn upon for operational, financial and political support, especially by new start-ups [77]. Evidence indicates that most women entrepreneurs are not privy to powerful networks of the same degree as men [20,79,80], and their denial into this clique of cool business kids can potentially harm their capacity to venture into new business areas or grow. Women often compensate for this non-access by leveraging and relying on their own social capital and personal relationships, hence enhancing the capacity to negotiate for a share of the economic resources and markets [20,79].

At the macro level of analysis: the liberal feminists argued for the exploration of the institutional context in which entrepreneurs operate. Jepperson ([81]p.145) define institutions as “social structures which have reached a high degree of resilience (and are) composed of cognitive, normative and regulative elements, associated activities and resources, all which collectively aim to provide meaning to social life”.

In this regard, the institutional analysis is grounded in understanding the cognitive, regulative and normative spaces in which entrepreneurial activities exist in order to unpack the seemingly pervasive grip of formal and informal institutions on entrepreneurs [82]. By understanding the normative, cognitive and regulative spaces in which entrepreneurs operate, we are able to observe how rules, regulations, routines, cultural agendas, narratives and power structures continuously shape and reshape social behaviour [82–86].

Although the multi-level perspective was able to disaggregate the multiple societal levels at which female entrepreneurs operate, these studies still often assumed essential differences between men and women, commonly sorting women as the caring, ethical and relationally-oriented ones. Also consistent with the 80 s, ‘performance’ was again highly researched, however, expanded to explore performance in relation to networking activity, entrepreneurial orientation, risk, entrepreneurial capital and new venture growth. Still, the question of how patriarchal power extended into the realm of entrepreneurship remained unanswered. Table 6 illustrates the shifts that have occurred since the 1980s.

3.2.3. Phase 3: Feminist critique: Gender is performed entrepreneurially

In the early 2000s, the post-structuralist feminist perspective started to influence the scholarly debate on how patriarchal power structures extended into entrepreneurship³. This perspective agrees with the importance of institutions but cautions that the essentialist understanding of gender (presupposing a biological dichotomy of male vs female) must be replaced by seeing gender as socially constructed and, hence, contingent [16,63,78,88,89]. This is because gender interactions are socially performed, practised and accomplished, and such practices vary over time and space [63]. By focusing on gender as a process—as being performed—the analyst is able to transcend the sex dichotomy and this opens up a room for non-traditional sexual identities, i.e. entrepreneurs who are members of the lesbian, gay, transgender, bisexual, queer communities to become visible. Transcending the sex dichotomy also reduces the tendency to create a separate women discourse, which explores women entrepreneurs out of context and/ or ignores the heterogeneity of the context and plurality of positions in which they are situated (i.e. considering how gender intersects with class, ethnicity, religion, legal status etc. to shape entrepreneurial practices) [63,88]. They further argue that by creating spaces for women narratives, which only focus on providing better access to resources like finance⁴ [90–92]

³ Feminist scholars have criticised the epistemological foundations of the entrepreneurship literature. They have argued against the concept of individualism which analyses women’s performance and business growth as a thing to be fixed. They argue that such epistemological position has created a scale which objectifies and measures women experiences by men’s experiences while totally ignoring the multiple levels of exclusion placed by the constructs of power and gender that structure society’s interaction with women. By attempting to fix women as individual objects and not-knowable subjects, the gender and patriarchal structures that conscripts and inhibits them remain unchallenged. Hence, scholars like Vossenbergh [87] argue that by individualising women to provide solutions to their entrepreneurial challenges, we run the risk of mainly problematizing the masculine entrepreneurship behaviour but not addressing it.

⁴ The feminist literature on microfinance provides a strong critique on how gender construction on entrepreneurial identity effectively creates difficulties

Table 7

summarises the factors identified by well-known scholars as critical for the empowerment of female entrepreneurs.

Factors enabling and hindering women's entrepreneurship	Description
Motherhood /Household/family context	The household provides a picture to evaluate the scale of family embeddedness and how this intricately affects entrepreneurial motivation.
Access to resources/ Money	Access to resources plays a significant role in women's perception of their capacity to engage in entrepreneurship.
Market /Social networks	Markets encapsulate opportunities. However, the entry and survival within the market require social networks.
Management/ Access to psycho-social capabilities	Access to human and organisational capital affects opportunity recognition and the decision to set up new ventures.
Meso-level (social, institutional and political)	Institutions are strongly mediated by normative, cognitive and regulative framings which produce rules, regulations, routines, cultural agendas, that shape entrepreneurial identity
Patriarchal power	The social subtleties and complexities of gender in entrepreneurship can only be understood in relation to the gatekeepers and controllers of resources.

and education, we run the risk of ignoring power hierarchies and structures that undermine the entrepreneurial capabilities of women—thereby failing to address, or worse, unknowingly reinforcing and reproducing, the systems and contexts that inhibit women from pursuing entrepreneurship [93–97]. For instance, in developing economies where women-run ventures largely underperform, the most prevalent response from donors and policymakers to this problem is an attempt to ‘fix’ underperformance without tackling the fundamental causes of the problem [98]. The urge to fix “women's underperformance” at the ‘base of the pyramid’ persistently reproduces systems of inequality, and may further subordinate women to ascriptions of femininity while bestowing power to men who perform masculinity [98,99]. Women entrepreneurs who seek to defy norms deemed as contextually acceptable risk being penalised for their defiance [100]. The post-structuralist narrative thus demands that the locus of analysis should be the mechanisms by which patriarchal power is claimed and preserved by men and internalised by women, and how this, in turn, conditions their inclination for entrepreneurship [93].

The table represents the most important factors enabling and hindering women's entrepreneurship identified by key gender-entrepreneurship scholars [11,73,82].

3.2.4. Gaps in the existing literature

To summarize, the post-structuralist perspective has advanced the understanding of gender in the field, by bringing attention to how power relations shape and are reproduced through or contested in the entrepreneurial process, and grasping the social subtleties and complexities of entrepreneurial empowerment (Table 7). This has opened up additional spaces for interventions aiming at enhancing women's capacity for entrepreneurship. However, the literature has very little to say about energy: first, as a catalyst for closing the gender gap by encouraging women to engage in entrepreneurial activities; second, as an industry or sector where women are active; and third, as a technology that can affect the entrepreneurial performance. We do not find any guidance regarding the role development of technologies and infrastructures, such as electric power systems, may play in breaking the reproduction of male privilege and power within society.

While the lack of explicit attention to electricity as an enabler for entrepreneurial possibility is indeed limiting for our study, its recognition of technologies as a tangible resource implicitly acknowledges electricity as a tool that has the potential to shape gender motivation and engagement in entrepreneurship. This is especially evident in the literature's focus on the influence of societal infrastructure on entrepreneurship and its demand that such infrastructures (electricity) are examined not only from their point of use but also evaluated by their scope of design and deployment [21]. Its feminist focus on the heterogeneity of context [101] also pushes us to study how

technological systems like electricity infrastructures consciously or unconsciously are chosen by actors to reify habits, rules and norms which in turn affect women's choice of industry and their degree of entrepreneurial growth and performance. However, to perceive electricity ‘just’ as another input or resource is to miss out on how infrastructures are dynamic (rather than passive or stable) and produce sociotechnical and political effects on local communities [52,59]. Existing relations of power shape the introduction of new infrastructures—producing inclusion and exclusions—but electricity embodies the potential to transform human capabilities and thus destabilise and generate shifts in social hierarchies, which again feeds back as pressures for the sociotechnical electricity system to expand or be modified.

4. Towards a conceptual approach: Electricity, gender and entrepreneurship

In the previous section, we presented the development and current state of the art in the two literatures. There are multiple conceptual similarities and overlaps, as well as complementary insights, which leads us to suggest that these can be synthesised conceptually to provide an outline of the nexus between entrepreneurship, electricity and gender. In the following, we outline the contours of the conceptual intersection⁵ before we present our integrated framework of analysis regarding how entrepreneurship can benefit from electric inclusiveness. Here, we present the key characteristics and how these literatures converge using sectoral examples as case points. Fig. 1 visualises the two fields and the key factors they identify.

So what are the intersections? As we can see from the listed key factors for spaces A and B in Fig. 1, four key factors fundamentally link the two literatures: (i) context where humans and non-human objects interact; (ii) access to and control over key resources; (iii) participation and influence in wider processes of decision-making; and (iv) the emphasis on institutions and policies that facilitate or hinder developments towards gender equality.

First, the electricity-gender-entrepreneurship nexus cannot be understood out of *context*, i.e. we must account for situational and temporal boundaries shaping the where and when of how electricity configurations and entrepreneurship processes unfold. Contextual factors can be enabling or restraining, such as the geographical, social, cultural and political sphere in which an individual or a group of people operate. A progressive context may empower women entrepreneurs to enter technological domains or sectors (that are often male-dominated) [52]. Contextual factors are also limiting and can generate exclusion. For instance, the geographical location of an electricity infrastructure

⁵ The concept of ‘intersectionality’ suggest that at the individual level, social positions are fluid, situated and intersect in multiple spaces. Therefore, intersectionality in this article, helps us to conceptualise social categories based on the fluidity of social positions. Essentially, this gives us insight on how we can discuss ‘women’ without reinforcing a discriminatory social order (McCall, 2005).

(footnote continued)

for women in accessing conventional bank loans (see Mayoux, Chant and Naegels in references)

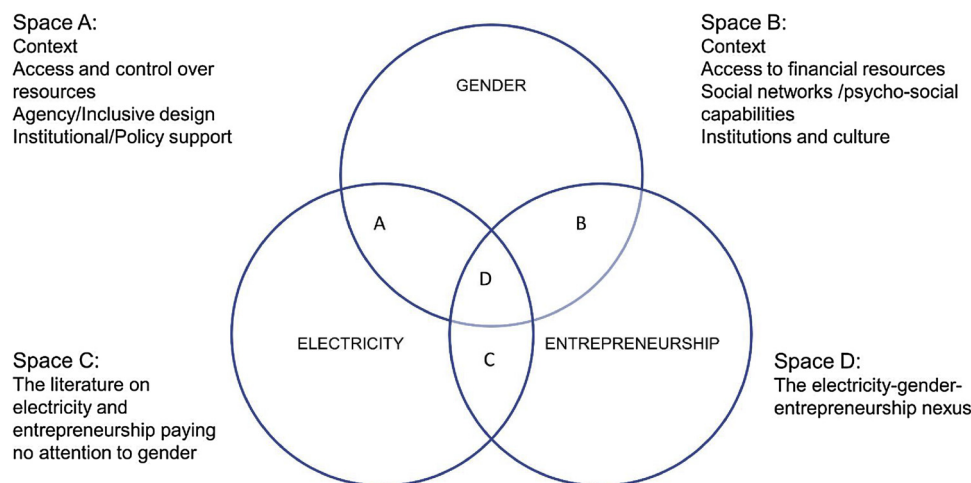


Fig. 1. Overlapping concepts of the gender and electricity and gender and entrepreneurship literature.

can significantly affect who becomes connected to it and what type of businesses benefit from it [52,102]. By examining the context, we are able to trace how entrepreneurship and access to electricity shifts from a purely individual endeavour to become socially, politically and culturally embedded within the society.

Second, access to and control over tangible and intangible *resources* such as knowledge, finance, networks, artefacts and infrastructure are vital in ensuring gender equity in electricity access and entrepreneurship. These resources are in themselves—for their specific material and symbolic characteristics—indispensable enablers for the practices of interest, yet, they are also tools by which existing power imbalances are maintained. This is because the exercise of power in order to maintain male dominance and privilege in various sociotechnical and economic spaces, draw on resources and assets to be successful. Such exercise of power and control over resources can symbolically lead to the attainment of economic and social legitimization, which are both fundamental for empowerment. Furthermore, these resources are also useful for creating shifts in structures and spaces for gender re-orientation within society. Access to new knowledge is one important mechanism that can create shifts, due to the way it can enhance individual and collective power-to, i.e. capacity to create change [103]. As people gain improved access to communication and entertainment, they are exposed to mediums like televisions and radios where existing narratives about the “maleness of entrepreneurship” may be repeated or contested and demystified. As new insights on available economic opportunities are gained [58] women may use their new knowledge and leverage existing social networks to mobilise resources for new entrepreneurial activities. Similarly, access to entrepreneurial resources facilitates the capacity to invest in new electricity services which can, in turn, spur innovation, changes in existing business structure, services and performance.

Third, *participation* in and *influence* on decisions made on a wider scale than the immediate entrepreneurial practice, such as influencing the planning, design and implementation of electricity programs and systems, or taking part in business, trade or industry associations, play a major role if the gender gap is to close. Longstanding presence in decision-making forums matter both at an individual and group level because gender plays out and is accomplished in relation to daily ongoing processes, activities and practices [52]. Practices iterate moral interpretations, individual and collective values and norms. If women are constantly ‘missing’ from the discussions, and their concerns missing from the minds of decision-makers, then such practices transform ‘gender-neutrality’ into gender-blindness. In this case, new electric power systems can become tools for economic marginalisation and gender exclusion. Kooijman [104] presents a case sample of this in her work in Bolivia where political leadership influenced which types of enterprises benefitted from electricity access. She found that local

government officials were critical facilitators of electricity deployment at the community level and these actors with considerable authority and power were able to determine which businesses were permitted to open, which in turn affected the demand and capacity for electricity as well as the yearn for entrepreneurship at the local level.

Fourth, *formal and informal institutions*—including *policies*—create cross-scale contextual pressures regulating the behaviour of individuals and sectors. As positive drivers, formal institutions may introduce gender inclusive policies on electricity services which may, in turn, encourage more women towards entrepreneurship. Likewise, on the negative front, normative ideas such as gender ascriptions on women’s role and place can be restrictive when it comes to women’s interaction with electricity and entrepreneurship [82]. For example, in a country like Uzbekistan, where women are mostly restrained by tradition and local culture to businesses that are close to the household, such women by default are excluded from interacting with electricity systems beyond the household level and by default restricted to non-electricity-oriented enterprises which usually yield less profit [82]. Similarly, at the regulative level, electricity systems that are governed by gender discriminatory rules and policies can hinder women’s participation in energy-intensive entrepreneurial activities, hence limiting women to low-growth sectors. For instance, if utility delivery systems are designed to target existing enterprises which are already mostly owned by men, connecting to such new systems might require money that new enterprises owned by women might not be able to afford, effectively shutting them out.

In short, the literature suggests multiple causal mechanisms whereby access to ‘affordable, reliable and sustainable electricity services’ may contribute to gender equality as well as to local and regional economic development. Is it possible that access to electricity—if designed in a gender sensitive way—might reconfigure existing norms and patriarchal structures to incrementally create a new class of women entrepreneurs? Speaking against this hypothesis is the existing evidence that an exclusive reliance on electricity services to solve gender equality and equity issues is not sufficient, as these are deeply ingrained societal problems.

We will now sketch out the contours of the nexus—the space D in figure 1—in the form of a theoretical framework that can guide further research efforts. In order to specify more concrete mechanisms, we will select a specific type of energy system, namely a decentralised electric power system with a local grid, which generates and distributes electricity to local communities based on localised renewable energy resources (hydro, wind, solar, biomass). The size can vary, but we are interested in systems ranging from a few 100 kW to 10 MW as this scale allows for various types of machinery and appliances used in small businesses, manufacturing and processing. This type of decentralised

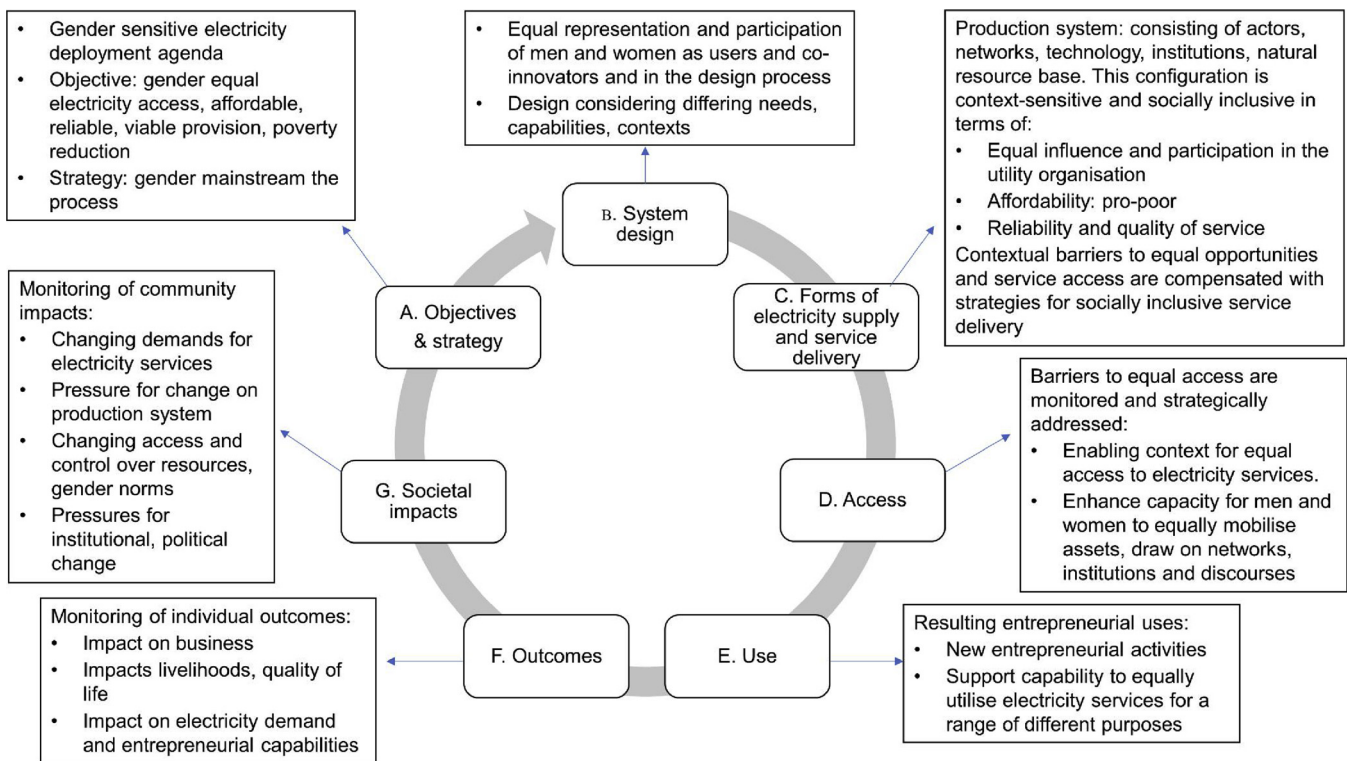


Fig. 2. The cycle illustrates the process of gender mainstreaming an electricity project for socially inclusive electricity access and use.

system is relevant especially for rural communities in countries where grid extension is not a feasible option for reaching the entire population, as is the case in most of sub-Saharan Africa, but also in parts of Asia and South America.

4.1. Framework for investigating the electricity-gender-entrepreneurship nexus in rural developing economies

In order to take a step further and map out the interfaces of the electricity-gender-entrepreneurship nexus, we will approach this space from two directions. First, we will visualise (Fig. 2) a gender sensitive electrification project, where the provision of decentralised electricity is understood as a cyclical and dynamic process with multiple possibilities to introduce strategies and components to overcome gender-specific barriers, achieve equal opportunity, access and use. We provide this process-perspective because, over the years, impact assessments of electrification projects in low-income communities have rarely considered gender and often assumed a linear process from introduction to impacts. Little cognisance has been paid to how the deployment of decentralised electricity systems are rooted within broader cultural structures and how contextual barriers undermine expected causal links, thus resulting in less micro-economic transformations than projected [35,52].

Therefore with Fig. 2 (building on previous work by the second author [52]), we intend to depict the non-linear dynamics—where diminishing or enhancing feedbacks emerge in unexpected ways over time—of decentralised electricity, and where and how actors involved in such processes may act strategically to enhance equal opportunity and address barriers to equal access for women and men. Importantly, we propose to study how electricity access and use can feedback on gender stereotypes and norms, but also on women's access to and control over resources, and incite institutional regulatory changes. Here, there is thus a causal link from electricity access and entrepreneurial use to the empowerment of female entrepreneurs, normative change, local economic development and increased demand (and possibly income) for local utilities.

Based on our conceptualisation in Fig. 2, we argue that the introduction of new electricity systems, especially decentralised systems, will create new opportunities for the development of value-chains within local economies. Importantly, it is expected that due to the heterogeneity of these systems and the production system being locally embedded, multiple spaces of value creation will emerge hence creating opportunities for more entrepreneurs (male and female) to evolve their business at the local level. However, equal access to electricity does not remove other contextual or gender-related barriers to entrepreneurship. To further outline the intersection between electricity access and the entrepreneurial cycle (Fig. 3), we use a concrete example of a female solar PV technician, identifying the opportunities brought by our imagined gender-sensitive electrification project, as well as the other conditions that significantly influence the possibility to successfully run a business. The point being that actors attempting to provide gender-sensitive electricity-related policies, electricity interventions and systems designs can influence many important conditions for this rural entrepreneur, but not all. For these actors, Fig. 3 provides guidance to strategic considerations and points of intervention.

Based on Fig. 3, we posit that gender-sensitive strategies and electricity design (step A and B in Fig. 2) would need to deal with a lot of complexity and respond to unexpected events and changing circumstance, but the cycle shows that there are many strategic entry points for attempts to enhance women's participation and influence along the cycle, which might result in a configuration (step C in Fig. 2) of production systems where women are equally represented as supply-side actors. As women enter the sector as technicians, consultants and suppliers, they may encounter barriers related to marital responsibilities and family norms, but also many stereotypes around women's (lack of) capabilities. Some challenges are related to technology being seen as a 'male' area, leading to mistrust from customers and business partners and difficulties to compete with male technicians. Since female entrepreneurs do not start with equal opportunities they may need external assistance to access training programs, certifications as technicians, finance (due to lack of access to required collateral and other resources), equipment and facilities. With such support, the likelihood

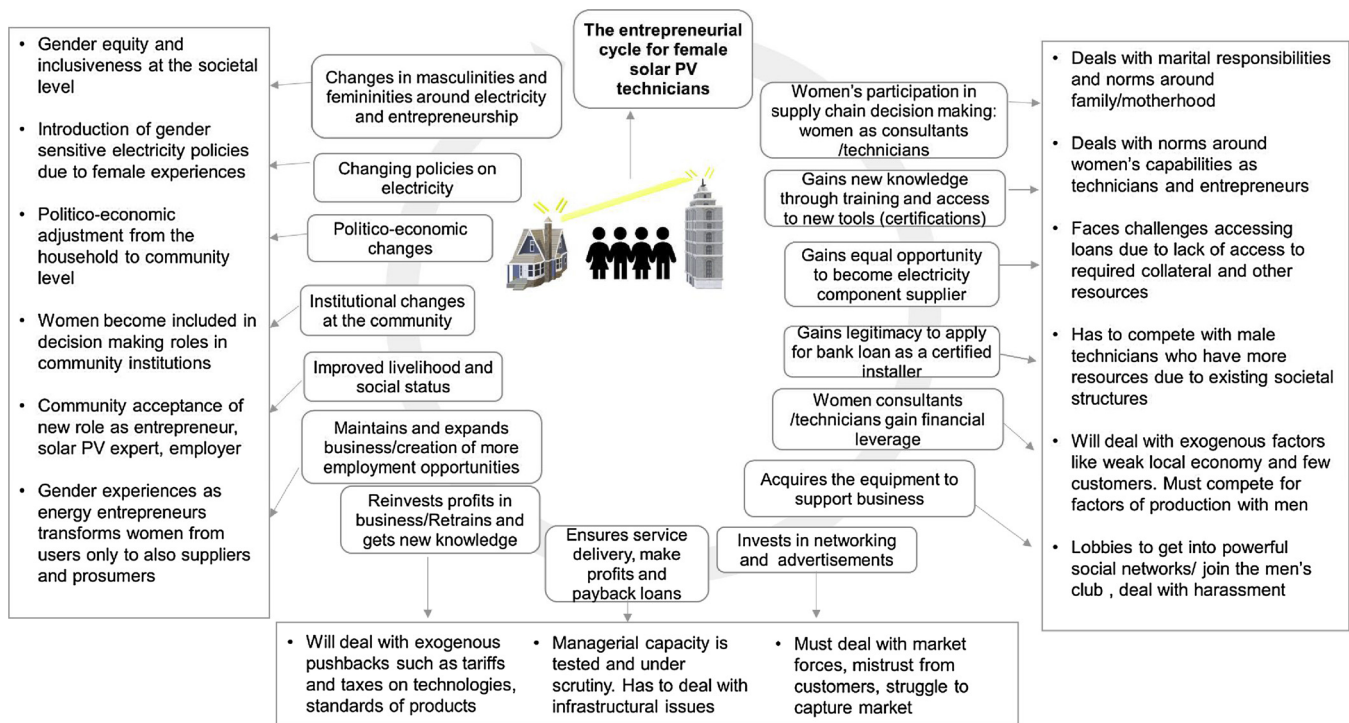


Fig. 3. provides guidance to strategic considerations and points of intervention.

increases that women technicians are able to scale the barriers and develop their skills and businesses. Once financial leverage is gained, (e.g. through access to soft loans) they still have to deal with exogenous factors like a weak local economy, few customers, competing for factors of production, market regulations, and bad roads/telecommunication (that are often equally problematic for men). They might have to lobby to get into powerful social networks/ join the men's club. Despite the struggle to capture the market, we envisage that some entrepreneurs will be able to ensure service delivery, make profits and pay back loans. At this stage, their businesses and managerial capabilities might be tested and placed under scrutiny.

Many small rural entrepreneurs stay at a level where they make a living, but cannot expand their business. For entrepreneurs who reinvest their profits in their business, develop their skills and acquire a growing market share, business expansion and the creation of new job opportunities follow but also bring challenges related to being a female employer or company director. However, the left-hand side of the circle in Fig. 3 shows how a positive momentum develops as the success of female entrepreneurs creates community acceptance of women as income earners, technicians, perhaps also as employers and community leaders. With economic empowerment follows improved social status and influence in decision making in community institutions. Over time, an institutional representation may lead to politico-economic adjustments (new organisations, changes in social and economic order) and eventually a positive feedback to higher organisational and institutional levels and changing societal norms around gender equality and equity. In the long run, existing societal gaps in entrepreneurial engagement, industry choice and performance are also likely to close—leading to a more gender-inclusive development.

Our heuristic/framework draws attention to the structuration and materiality which firmly interlocks gender, entrepreneurship and electricity systems together to become embedded within the core of the society. While it is based on the imagined experiences of a female PV technician, we believe that further iterative refinement and empirical testing of the framework proposed is required.

4.2. Discussion

Aside from its conceptual contribution, findings from this review also highlight critical areas for further discussion. Especially within the gender-energy literature, we see a glaring need for a more synergistic conceptualisation of gender-electricity interaction beyond the household level. This is because, at the moment, the literature largely discusses gender as a household phenomenon. Even when the word “enterprise” or “entrepreneurship” is used, it descriptively matches ‘maleness’ [9,105,106] while the term “productive use” is more often applied to women's activities and small-scale close to home businesses, which do not necessarily require electricity. Such language downplays women's professional entrepreneurial engagements. Further, the choice to describe the electricity/enterprise relationship in a gender-neutral way is symptomatic of the existing narrative within the energy stream where the dominant discourse has been largely linked to the provision of energy to solve women's poverty. Based on this “women poverty” narrative, the solution provided has been to design electricity systems ‘which acknowledge women's problems’ to cater to women's use within the household for ‘productive purpose’ or what others have termed as ‘informal sectors’.

However, we believe that such narratives will only reinforce existing social norms about women's proximity to the home and the need for them to conduct businesses close to the household, which in the end might not be all that profitable for them. This feeds into Nye's [107] argument that rather than integrate society and create equality, electrification, sometimes, through its “sociotechnical translations, might aid the atomisation of individualism”. Compared to the energy/gender stream, the gender/entrepreneurship literature is better in this sense, as it moves gender beyond the household construction to the marketplace. It provides a multi-level approach to gender differences in entrepreneurship. It offers a clear conceptualisation of women's interaction with society, business, technology and infrastructure—from an individual prism to a multi-focal space—which acknowledges the relational influences of micro, meso and macro societal factors on women's entrepreneurial capabilities [11,63,72]. The gender-entrepreneurship literature also implicitly considers electricity as a

technological resource. However, the lack of attention to how technologies are dynamic and how electricity can transform human capacity to act might be its Achilles heel. This is because electricity works as a catalyst for other activities and more importantly, these infrastructures are embodiments of the social, institutional, cultural and political architecture of the society. We find that there is a need for empirical evidence and further conceptualisations of the linkages between gender, electricity and entrepreneurship, as our exercise of sketching the contours of this space indicates a richness worth exploring. This is because just as gender intersects in multiple and contingent ways with other social categories to generate inclusion/exclusion [94,101], heterogeneous objects and technologies (in our case electricity infrastructure) are also dynamic sorting devices enrolled in building order, organising behaviours and shaping socio-economic and entrepreneurial endeavours within the society [52].

5. Conclusion and avenues for further research

The aim of this research is to make explicit the implicit linkages between electricity, gender and entrepreneurship in order to help (re) design socially inclusive electricity systems that tackle gender barriers to entrepreneurship at local and national levels. Based on this objective, we presented the key characteristics of electricity-gender and entrepreneurship-gender literature, identified convergent areas using sectoral examples as case points and discussed the observed limitations of each field. Our review indicates that the two literatures overlap in important ways, however, the intersection—what we call the electricity-gender-entrepreneurship nexus—is surprisingly understudied. We propose that this lack of evidence is partly rooted in the divergence of the normative goals of the electricity-entrepreneurship and entrepreneurship-gender literature. As observed from the entrepreneurship-gender point of view, breaking entrepreneurial barriers for women is seen as a catalyst for changing social norms and promoting gender inclusiveness [69]. In contrast, from mainstream energy for development perspective, electricity access is considered as a tool in creating entrepreneurship and enhancing both women and men's productivity to attain the underlying objective of economic growth. This divergent stance on the objectives of entrepreneurship and the lack of engagement from electricity-gender scholars around entrepreneurship (outside the household) has resulted in a blind spot.

Despite the difficulties in integrating the electricity-gender and entrepreneurship-gender literature, our review highlights key areas where they connect: they both place emphasis on the role of context in shaping interventions; they both consider access and control over resources a key means of attaining economic and social legitimization; they both highlight the impact of participating in decision making and how it reifies and/or changes gender norms; and lastly they both highlight the role of institutions in empowering or restricting individual and organisational choices within the society. Understanding the roles each of these connecting elements play in the design of an electricity system for gender inclusive entrepreneurship is pivotal as they help to identify the degree to which such systems promote economic empowerment. Still, identifying how electricity systems promote empowerment is simply not enough, rather the focus should be on how such systems create equal opportunities for entrepreneurship—strong enough to trigger changes in gender repertoires within the society. Our electricity-gender-entrepreneurship framework offers an opportunity in this respect, as it is designed to show how gender inclusive sustainable electricity access interventions are configured to promote the development and transformation of local value chains; identify points of intervention in policy, planning, design and operation of electric power system; examine how these factors influence—and are influenced by—gender and class; and identify technological actors and actants that shape this process to create socio-economic and political changes within the society.

Our heuristic framework points to several avenues for further

research that will require the use of mixed methods, including ethnographic approaches in order to capture the contextual interplay between people and technologies. We propose that future analysis should: (a) Evaluate the impacts of gendered electricity systems on entrepreneurship at the local level by paying attention to entrepreneurial possibilities along the entire electricity production chain. With this approach, the focus will not only be on the direct uses of electricity or the sale of electricity as a business, but will also analyse the indirect opportunities that will open up along the value chain, from retailing of spare parts to doing services for the supplier and for the customers, to starting a transport service for goods as the need for transport grows with new manufacturing. (b) Explore both positive and negative feedback loops of gender-sensitive systems on overall societal development. Here, stronger attention to feedbacks of both benign and detrimental kind is required. This will lead to an evaluation of how more or less entrepreneurship changes the demand for electricity, how increasing access to electricity spur competition among local entrepreneurs and in cases where access to external markets are unavailable if the customer base remains the same. (c) Examine how local rural economies may grow; whether electrification will only mean that cash circulates more in the local economy (but it doesn't grow) or generate an influx of money. (d) Examine the effects of gender-sensitive electricity system on the repertoires of meaning produced as a result of social changes on gender constructs at the societal level. This will mean exploring the changes in gender structures and narratives at the societal level due to women's participation in the electricity value chain and entrepreneurial processes.

We believe these are good questions, because while we would like to imagine that gender-inclusive electricity systems might be the catalysts for the envisaged economic expansion, power and material hierarchies will by no means become obsolete, the depth of which might be optimistically underplayed when academically discussing issues of gender and economic growth at the societal level. From our perspective, the application of our framework to local context will not remain as directional as it looks on paper but birth resistance and messiness. Still, we believe that such resistance and messiness must be embraced since it might enhance social learning processes.

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Appendix A. Supplementary data

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