"We learnt that being together would give us a voice": Gender perspectives on the East Africa improved cookstove value chain

Journal:	*Feminist Economics*
Manuscript ID	RFEC-16-Aug-144.R2
Manuscript Type:	Articles
Keywords:	East Africa, Energy, Entrepreneurship, gender, Improved cookstoves, Value chain
JEL codes:	B54 - Feminist Economics < B5 - Current Heterodox Approaches < B - Schools of Economic Thought and Methodology, D21 - Firm Behavior < D2 - Production and Organizations < D - Microeconomics, L26 - Entrepreneurship < L2 - Firm Objectives, Organization, and Behavior < L - Industrial Organization

"We learnt that being together would give us a voice": Gender perspectives on the East Africa improved cookstove value chain

Abstract

Improved cookstoves (ICS) have been promoted for several decades, with little success. Advocates looking to drive uptake encourage greater involvement of women in ICS enterprise, on the largely unproven premise that women's participation in the value chain will enhance their financial bottom line while giving a boost to ICS sales. This paper tests the validity of that premise, using qualitative evidence from East Africa. The analysis shows gender-differentiated outcomes for enterprises across the value chain. Female-led enterprises are significantly underrepresented at higher levels of the chain where sale volumes are highest. Value chain positioning also influences access to key inputs like finance, potentially reinforcing the gender divide in enterprise performance. The findings challenge the dominant narrative in the ICS field about the inevitability of the link between market participation and economic empowerment for women, and indicate a need to look beyond conventional market models to enhance financial outcomes for women.

Keywords: East Africa, Energy, Entrepreneurship, Gender, Improved cookstoves, Value chain

Introduction

> "Women are involved in all stages of [the] ICS supply chain. We are trying to demystify this myth that ICS only is for men… Access to finance is a main issue owing to the traditional perception that women are supposed to be home makers." – Male ICS entrepreneur, Tanzania

Improved cookstoves (ICS) have long been promoted by a variety of actors as a solution to the environmental and health problems associated with the traditional use of biomass fuels (primarily wood and charcoal, but also relatively inferior fuels such as animal dung and crop waste) (Barbara Saatkamp, Omar Masera, and Daniel Kammen 2000). Women and girls often disproportionately bear the physical burden of gathering these fuels, sometimes over long distances and difficult terrain, with adverse implications for their wellbeing and economic productivity (Jyoti Parikh 2011). Fueled by these concerns, concerted ICS promotion efforts began in the 1970s, largely led by traditional development actors such as state and donor agencies (Rob Bailis, Amanda Cowan, Victor Berrueta, and Omar Masera 2009). The ICS field has since widened to include market-oriented actors, reflecting an eschewal of the widely critiqued subsidy-enabled regime of the 1970s and 1980s and a more recent embrace of neoliberal ideology in the field and in international development generally (Douglas Barnes, Keith Openshaw, Kirk Smith, and Robert van der Plas 1994; Marcos Adrianzen 2010). The common aim uniting these approaches is the goal of realizing widespread ICS uptake in the poor regions that are most affected by the hazards of traditional biomass use. However, notwithstanding the diversity of efforts and the demonstrated benefits of many ICS technologies (notably, from a user standpoint, significant reductions in fuel requirements), rates of uptake and use have remained obstinately low (Gunther Bensch, Michael Grimm, and Jörg Peters 2015).

Against the background of increasing global-level attention to increased female agency in ICS enterprise (GACC 2012) and local-level narratives (like the quote by the Tanzanian entrepreneur above) that suggest a more nuanced picture on the ground, this paper takes a closer look at how and where women are involved in the East Africa ICS value chain, particularly relative to men.

Gender has been recognized as an important variable influencing the experiences of various actors within value chains (Stephanie Barrientos, Catherine Dolan, and Anne Tallontire

2003). Nevertheless However, existing research on the gender-differentiated experiences of workers in value chains – especially at the local level – is inadequate (Lone Riisgaard, Anna Maria Escobar Fibla, and Stefano Ponte 2010), making further inquiry into specific value chains a necessary knowledge enterprise. The dearth of gender analysis is particularly acute in the ICS value chain where, with the exception of research commissioned by a few major industry stakeholders (see, for example, ENERGIA 2015; GACC undated), attention has been scant. This deficit is all the more significant given the sheer magnitude of the economic payoff that is expected to result from women's involvement in the chain (Corinne Hart and Genevieve Smith 2014).

Our paper addresses this gap by examining the content and outcomes of participation for women and men in the East Africa ICS value chain. In doing so, we challenge the dominant narrative regarding women's empowerment in the sector and identify opportunities for advancing more substantive modes of participation among them. As Tali Mendelberg and Christopher Karpowitz (2016) recognize, the difference between the *symbolic* and *substantive* representation of women in groups can mean that women are physically present at the table but have less influence than men over the outcomes that are realized. It is therefore important to tease out, as our paper does, the value that is added to women in particular by their participation in specific enterprises. Our findings indicate that the global ICS narrative needs to move away from simplistic assumptions about the inevitability of ICS entrepreneurship resulting in women's empowerment, and give greater consideration to value chain configurations that might better align the global goal of increased ICS uptake with local expectations of benefit maximization.

Gender, energy and ICS entrepreneurship: A multi-layered analytical framework

The need for gender planning approaches that take account of the structural and practical differences between men and women in the design and delivery of projects is widely acknowledged in the literature (Caroline Moser and Caren Levy 1986; Cecile Jackson 1996,

Andrea Cornwall 2003; UNDP 2004; Wilma Dunaway 2014). Not only are women and men recognized as having different needs that require different resource levels, they are also acknowledged as having different roles that are regarded and compensated differently by society (Moser and Levy 1986; Cecile Jackson 1993). Sylvia Chant and Matthew Gutmann (2000) point out that these differing roles, and their implications for access to resources by men and women respectively, take on greater significance when they are considered in relation to one another and within the broader societal context.

This notion of relativity is particularly important because gender relations do not occur on a level playing field, but on one in which the balance of power is often tilted towards men (Robert Chambers 1997; Irene Guijt and Meera Shah 1998). This is particularly problematic from an international development standpoint because, according to the United Nations WomenWatch, women make up “the great majority” of the global poor. Men are generally acknowledged as having a higher starting point than women at similar socio-economic levels in critical areas such as access to finance, technical know-how, ownership and control of assets, freedom of movement, and access to energy (Joy Clancy, Soma Dutta, Nthabiseng Mohlakoana, Anna Rojas, and Margaret Matinga 2015).This means that they are often better positioned than women to access the benefits of development programs targeted at households, groups and communities. The same situation holds for more entrepreneurial interventions: Patrick Kariuki and Phyllis Balla (2011) note that while men and women face similar challenges in trying to set up businesses, the head start possessed by the former often puts them in better stead to overcome those challenges.

These gender disparities are evident in levels of access to employment in the energy sector, where women form a negligible percentage of technical staff (6 percent) and an even lower percentage of managerial staff (1 percent) (Bipasha Baruah 2015). At the entrepreneurial level, women’s participation in the sector is constrained by many of the gender-specific

challenges (notably access to credit and ownership of property and other assets) identified above (ibid.).

In the ICS sub-sector, where women have long been accepted as active users of the technology, their integration into the value chain has been less straightforward (Anita Shankar, Mary Onyura, and Jessica Alderman 2015a). This is in spite of an array of programmatic efforts that have been targeted at realizing greater involvement of women in supply-side operations (K. Ramani and Enno Heijndermans 2003). These efforts have registered a degree of success as measured by rates of female participation in energy enterprise; however, as Mipsie Marshall, David Ockwell, and Rob Byrne (2017) point out, there is still a long way to go in designing market and policy initiatives that neutralize the influence of repressive gender norms on the implementation and outcomes of clean energy projects in developing-country contexts.

The imperative to engage women in energy entrepreneurship is especially great due to an essentialist belief that "energy is women's business" (Clancy et al. 2015: 25). This is especially the case in the area of household energy – the "reproductive" domain (V. Peterson 2003; United Nations 2003) – where women are traditionally ascribed a greater role than men. Women are the most negatively affected by energy deficits in this area, the logic goes, so they ought to be the most effective at promoting solutions to those deficits. Importantly, women, by virtue of their traditional roles, are thought to have higher social capital and relevant networks through which they can disseminate household energy products more effectively than men (Soma Dutta and Tjarda Muller 2015; Neha Misra 2015).

This narrative of women-as-energy-purveyors is particularly potent in the ICS sub-sector where, in addition to their general role as household energy "managers", women are mostly recognized and recruited for their role as "primary cooks" (Gunnar Köhlin, Erin Sills,

Subhrendu Pattanayak, and Christopher Wilfong 2011; Shankar, Onyura, and Alderman 2015a).

The current drive to increase women's participation in the ICS value chain signals a transition from the previous paradigm of seeing women mainly as passive users of the technology to envisioning them as active participants, and even leaders, in its provisioning (Soma Dutta 2015). Historically, gender analysis of ICS interventions has been focused on power dynamics within households, particularly as they influence decision making about cookstove purchase. Less has been done to scrutinize gender relations on the supply side, at least prior to the recent wave of discussions around the potential that women's involvement in the value chain has to meet their economic ("productive") and broader ("strategic") empowerment needs (Moser and Levy 1986; GACC 2013). The two goals envisaged in the current female-centric movement – women's empowerment and increased ICS uptake (GACC 2011; Clancy et al. 2015) – are assumed to be complementary, or at least mutually inclusive.

The Global Alliance for Clean Cookstoves (GACC)[1] (hereafter, "the Alliance") has been particularly active in promoting the agenda of increased female participation in the cookstoves value chain. Established in 2010 to "save lives, improve livelihoods, empower women, and protect the environment", the Alliance sees women as being instrumental to its ambitious goal of distributing 100 million improved (and "clean") cookstoves through market channels by 2020 (Anita Shankar, Mary Onyura, and Jessica Alderman 2015b). The Alliance is not unaware of the gender-specific challenges that stand in the way of this lofty goal; indeed, it has attempted to address some of those challenges through evidence-based interventions. One of such interventions was a 2013 randomized controlled trial in Kenya in which the treatment group received, in addition to conventional entrepreneurship training,

[1]The GACC changed its name to the Clean Cooking Alliance in October 2018.

"agency-based" empowerment training aimed at overcoming the deeply rooted psychosocial inhibitions that prevent women in particular from maximizing opportunities open to them (Susan Pick and Jenna Sirkin 2010; Shankar, Onyura, and Alderman 2015a). The findings of the RCT indicate that a significant increase in agency was achieved for both male and female participants and that this was a strong predictor of higher ICS sales - suggesting that the Alliance's psychosocial approach ultimately led to economic empowerment for the women.

Our paper contends, however, that the gains enabled by the Alliance's psychosocial approach to empowerment training, with its focus on recruiting women as ICS retailers, come at the risk of losing sight of another critical dimension of empowerment – the economic dimension – that is consistent with its overall objective of increasing women's influence in the ICS value chain. The rhetoric of empowerment in all its forms (social, political, economic, psychological, relational, and so on) fits especially well with gender equality objectives, as it presupposes a capacity to overcome the deficits that women in particular start out with in marketplace and other societal arrangements (Naila Kabeer 1997; Florence Arestoff and Elodie Djemai 2016; Shanuga Cherayi and Justin P. Jose 2016). Notwithstanding the visions of radical transformation it conjures, however, empowerment is often difficult to realize and measure in practice, and – as we will show in the case of the Alliance – gains made in one sphere or setting can be offset by losses or setbacks in another (John Kuumuori Ganle, Kwadwo Afriyie, and Alexander Yao Segbefia 2015; Monkgogi Lenao and Biki Basupi 2016).

Crucially, as Shonali Pachauri and Narasimha Rao (2013) point out, the notion of economic empowerment is relative – particularly for women – and dependent on their positioning within larger occupational structures. This prompts closer scrutiny of where women are located within the ICS value chain and the implications of this positioning for how economically empowered they are relative to men.

Following the call by Marshall, Ockwell, and Byrne (2017) for "urgent" research into the ramifications of clean energy initiatives from a gender perspective, this paper examines the gender-differentiated outcomes of market-based efforts to promote widespread uptake of ICS in three East African countries – Kenya, Uganda, and Tanzania. In juxtaposing the experiences of female-led and male-led ICS enterprises in the study countries, the paper evaluates the extent to which the normative goal of empowerment-through-market participation expressed in the ICS literature is a reality for women entrepreneurs in the sector. We consider empowerment in a strictly economic sense, in response to the dearth of gender-differentiated analyses of the distribution of financial gains in the sector. Marie Golla, Anju Malhotra, Priya Nanda, and Rehka Mehra (2011) define economic empowerment as a "complex process" encompassing women's access to resources (including skills, capital, assets, and networks), their ability to appropriate those resources competitively in the marketplace, and the degree of control they have over the inputs and outputs of their enterprise. Our analysis indicates that the focus on economic empowerment is warranted, as the financial outlook for the majority of female-led enterprises in the study appears more modest than the mainstream rhetoric would suggest.

Methods

The qualitative interviews that provided the primary material for this analysis were part of a larger study, from 2013 to 2016, of barriers to the adoption of ICS in East and Southern Africa in which cookstove users were the primary focus of investigation. The ICS enterprises involved in this "value chain" component of the work were selected to reflect a broad range of widely available, bestselling ICS in each country (the Kenya Ceramic Jiko, Jiko Kisasa, and rocket stove in Kenya; the Kenya Ceramic Jiko and LPG stove in Tanzania; and the Smart Jiko, LPG stove, and Ugastove in Uganda), as well as a handful of stove types in lower demand (such as the Envirofit stove in Tanzania and the Burn stove in Kenya). Questions were asked about the enterprises' product profiles, target markets, sale volumes

for the preceding year, organizational structures and norms regarding gender, external support structures, access to finance, and operational enablers/constraints.

Along the lines of the household interviews conducted in the larger study, the enterprises in the value chain sample were selected to be representative of those located in urban as well as rural areas. Small-, medium- and large-scale enterprises (defined as businesses with annual sale volumes of less than 5,000, 5,000 – 10,000, and more than 10,000 ICS respectively) were selected to represent the range of operational capacities available in each country. (Detailed sales data were only collected for the immediate past year, however, regardless of size of enterprise.) The final sample included a total of thirty-eight enterprises (nine in Kenya, nine in Tanzania, and twenty in Uganda). The much larger sample size in Uganda is reflective of a recent surge in ICS enterprise activity in the country, partly enabled by the presence of a relatively vibrant and accessible carbon finance market. Table 1 below shows the breakdown of the final sample according to the main sampling criteria employed.

Insert Table 1 about here (original size).

The interviews targeted the owners or production managers of each enterprise in the sample. A total of thirty-eight owner-managers (twenty-seven men and eleven women, a ratio of more than 2:1) were ultimately interviewed. The gender composition of the resulting sample is important because gender was not explicitly used as a criterion in enterprise or interviewee selection. The gender-neutral criteria of location and scale of enterprise employed make it possible to therefore draw valid gender-specific inferences from the data collected. The analysis of gender-differentiated patterns of specialization at firm level provided here constitutes an important first step towards understanding the extent and substance of female representation in the ICS sector.

Results: Gender as a driver of opportunity in the ICS value chain

The Alliance conceptualizes the ICS value chain as being separated into four main functions: research and design; manufacturing (or production); distribution and retail (including marketing activities); and end-user adoption (GACC website). However, as the International Labor Organization recognizes, value chains (including some that span multiple countries and continents) often start with producers, many of whom are located in rural areas of developing countries (ILO 2011). The present study focuses on the supply-side actors in the local ICS value chains in Kenya, Uganda and Tanzania. The fieldwork conducted unearthed four distinct, albeit overlapping functions generally performed by ICS enterprises in these countries: production; (wholesale) distribution; marketing; and retail (including stove installation services).

While ICS retailing is a pivotal part of the value chain in the context of reaching "last-mile" communities in developing countries (Natural Capital Partners, undated), there is little evidence that it occurs on a scale that is sufficient to deliver exponential financial gains to the actors involved. The findings reported below shed light on the magnitude and distribution of these gains by gender.

1. *Female-led enterprises are overwhelmingly involved in the retail function of the value chain, where sale volumes and revenues are lowest*

Tables 2 and 3 below show the distribution of the four main value chain functions among the male-led and female-led enterprises in the sample.

Insert Table 2 about here (original size).

Insert Table 3 about here (original size).

As indicated in the tables, many of the enterprises in the sample are engaged in multiple value chain functions, lending support to the widespread observation (for example, by ILO 2009) that many different types of activity can be concentrated within individual firms. The summary in Table 4 below shows that the female-led enterprises in the sample are overwhelmingly involved in retail – with over half the sample (six of 11) engaged exclusively in retail. Many male-led enterprises also perform retail functions; however, only seven of 27 enterprises – about a quarter – work exclusively in retail. Conversely, male-led enterprises are significantly better represented than their female-led enterprises counterparts at the higher levels of the value chain.

Insert Table 4 about here (original size).

It is also clear from Tables 2 and 3 that low sale volumes correlate with "lower" functions in the value chain, especially retail. With a few exceptions (notably UG_M4 and UG_F3), enterprises that deal solely in retail were more likely than others to have recorded sales in the tens and low hundreds. This effect seems to hold even when retailers channel their wares through local supermarkets and stores: one enterprise (UG_F6), for example, sold only 192 units of a particular type of ICS in the past year through "supermarkets and exhibitions". In their analysis of the charcoal value chain in Uganda, G. Shively, P. Jagger, D. Sserunkuuma, A. Arinaitwe, and C. Chibwana (2010) highlight the importance of scale (defined in terms of sale volumes) for the profitability of different functions in the value chain. In general, the greater the number of units a firm or individual can sell, the higher the financial returns they can receive. The implication here is that the female-led enterprises in the sample, with their high rate of representation in low-volume retail, reap lower returns overall than the enterprises in the male-led category.

2. *Female-led enterprises are relatively small in size, but socially centered forms of organization can boost their productivity and sales*

The ICS enterprises in the sample generally have small numbers of staff: the majority of them have 20 workers – the maximum number for the female-led enterprises – or less. However, seven of the enterprises, all of them male-led, run relatively larger operations, hiring between 30 and 120 workers each. Firm size matters because, in the context of developing countries, energy businesses that have fewer staff– have been shown to be at a disadvantage relative to their higher-staffed counterparts in terms of the proportion of benefits that accrues to them – even when they operate at higher levels of the value chain (see, for example, Sophia Baumert, Ana Catarina Luz, Janet Fisher, Frank Vollmer, Casey M. Ryan et al. 2016).

The data presented in the tables above further suggest that having women in leadership roles does not necessarily translate into greater employment opportunities for their peers: among the 11 female-led enterprises in the sample, only two (KE_F1 and KE_F2) have more women than men working in them.

It is perhaps instructive that the two female-friendly employers identified above are the only ones in the female-led enterprise category that are structured as community-based organizations (CBOs), rather than as conventional businesses. It is also instructive that these two enterprises are the largest in the female-led category both in terms of size and sale volumes, suggesting that the model does give a boost to substantive female participation, relative to other types of organization. The male-led enterprises in the sample, on the other hand, seem to thrive under a variety of organizational models, including the CBO model.

CBOs, by definition, are formalized social networks which bring members together with the explicit aim of advancing a set of shared goals which, though often socio-economic in nature, tend to be mediated by their focus on “bonding” relationships (Catherine Molyneux, Beryl Hutchison, Jane Chuma, and Lucy Gilson 2007). A CBO may be set up in the first

instance by members of a community with common interests or problems (Abigail Barr, Marleen Dekker, and Marcel Fafchamps 2015), or at the prompting of external development actors responding to identified challenges within the community (A. R. Yakubovich, L. Sherr, L. D. Cluver, S. Skeen, I. S. Hensels et al. 2016). The ubiquitous women's groups in Kenya in particular and East Africa in general are examples of the former (Mary Gugerty and Michael Kremer 2002; Maria Nzomo 2005).

The case of KE_F2 illustrates how such a model works in practice. The group started out in the early 1980s as a rotating savings and credit association with five women. Membership quickly grew to 25 women, at which point the group was registered with the Kenyan government as a CBO. When asked why the women in KE_F2 opted to formalize their group into a CBO, the group representative responded:

> "We realized and we learnt that being together would give us a voice, would give us some bargaining power in our activities and in whatever we do." – Female ICS entrepreneur, KE_F2

Subsumed within the broad notions of solidarity and collective empowerment suggested by the quote above are more specific expressions of cooperation that link directly to the productivity and profitability of individual members:

> "There are cases where maybe your stuff is not ready from the kiln and a customer comes. So another advantage of the group is, you can go and borrow from somebody and then you use until, when yours is ready you can pay back. So that your customer doesn't go away because your stuff is not ready." – Female ICS entrepreneur, KE_F2

> "Like now we're in a group and I can ask you to assist me, we will finish faster. But if it is just me alone, it could even take me a week." – Female ICS entrepreneur, KE_F2

The quotes above highlight a very important dimension to the CBO model: that although individuals take responsibility for their productivity and profits in principle, the social component leaves room for members to fall back on one another for support when it is needed – in the process helping to fill gaps occasioned by the women's inadequate access to important inputs such as labor. As the International Labor Organization highlights, this kind of cooperation is particularly beneficial for small-scale enterprises in rural areas operating within value chains dominated by more powerful external players (ILO 2011).

The advantage for the female-led CBOs in our sample is heightened by the observation that, although production and distribution functions typically suggest access to mass markets and consequently high sale volumes (Mark C. Thurber, Himani Phadke, Sriniketh Nagavarapu, Gireesh Shrimali, and Hisham Zerriffi 2014), it would appear that it is not sufficient for female-led enterprises to simply be involved in those functions – or indeed in other "lower" ones: outside of the two female-led CBOs, sale volumes are generally low for women, both in absolute and relative terms.

These observations are important for ICS practice as they indicate that, notwithstanding the current enthusiasm among donors and practitioners over the possibilities of empowering women through market-based enterprise, more socially centered models may be better equipped to achieve the goal.

The CBO model has been critiqued for its tendency to exacerbate existing socio-economic inequalities within groups and consequently skew benefits towards more privileged individuals (see, for example, Temilade Sesan 2014 and Mohammad Shahidul Hasan

Swapan 2016). The evidence presented here however, though based on a limited sample, provides support for recent calls in the literature to adopt "a push through community based organizations" (Manjushree Banerjee and Rakesh Prasad 2015: 37) and an emphasis on "community centric institutional arrangements" (Akanksha Chaurey, P. Krithika, Debajit Palit, Smita Rakesh, and Benjamin Sovacool 2012: 54) if the benefits of energy access initiatives are to reach the poorest.

Whatever the specific shortcomings of the CBO model, the analysis here points to the need to reimagine the forms of organization that are suitable for the women who are often the subject of ICS entrepreneurship initiatives, rather than campaigning for their participation in the market on the basis of externally conceived imperatives to increase ICS adoption rates among their peers.

3. ICS sales are determined more by value chain hierarchy than by gender

As highlighted above, KE_F2, one of two female-led CBOs in Kenya which produces ICS wholesale and sells to distributors across provincial lines, is one of the most productive and profitable enterprises in the sample. However, this is the only female-led enterprise in the sample that operates at that scale and level; the other enterprises in the category are generally further down in the value chain, i.e., at the level of retail. The volume of production for the preceding year reported by this CBO was exceeded by only one other enterprise in the sample – a male-led international organization (KE_M1) that also uses a distributorship model for its sales. The CBO is composed of 14 full-time members, bringing its reported sales volume of 36,350 ICS to nearly 2,600 stoves per person in the past year.

That the sales performance of the female-led CBO highlighted above was significantly higher than those of all but one of the 19 male-led enterprises operating at the same level suggests the lack of a gender-based advantage for the latter. As alluded to in earlier sections, what does seem to matter for performance is an enterprise's position in the value chain: when we

compare the sales of all enterprises at producer/distributor level with those of all enterprises only retailing to individual customers, we find that the former sold more stoves in the immediate past year (in the thousands and high hundreds), though there is considerable disparity in the distribution of sales among them. This indicates that the position of an enterprise in the value chain is a better predictor of sales, and by extension, profits, than the gender of its owner-manager.

The question that arises from a gender perspective, then, is: are male-led enterprises more likely to be operating at producer level than female-led ones, or vice versa? The evidence presented in Tables 2 and 3 above appears to support the former: 19 out of the 27 male-led enterprises (well above two-thirds) have a production and/or distribution component to their business. This is compared to just over half of the enterprises in the female-led category that produce and/or distribute ICS on some scale.

While it is clearly useful to have men and women working synergistically within particular job functions, it is important to pay attention to the types of arrangement that could potentially deliver equitable benefits across both genders. As discussed above, CBOs would appear to offer one such platform, particularly for the substantive employment of women across roles. The evidence further suggests that these CBOs, whether they are male- or female-led, tend to employ relatively high proportions of women in the role: the two CBOs in the sample involved in production (KE_M2 and KE_F2) employ more women than men in the role – in the case of KE_M2, thirty women to ten men. This is in contrast with only one of 35 conventional enterprises in the sample (UG_M1) that involves far greater numbers of women than men in production roles (84 women to 36 men), though it is not clear from the data how much of the economic gains accrue to individual women in the organization. This distinction is important to make because, as described earlier, higher-up, production roles have the potential to deliver greater economic benefits to men and women alike – and are thus important for fulfilling expectations of economic empowerment for both genders.

4. Access to credit is a corollary of the relationship between gender and value chain hierarchy

Limited access to credit for business expansion is a cross-cutting theme among all the enterprises in the sample: all the interviewees, whether or not they had obtained some form of credit in the past, cited inadequate financing as a major barrier to increasing their production and/or sales volumes.

The enterprises that have gained access to credit have been able to do so in spite of the considerable difficulties experienced: the excessive bureaucracy involved in applying for formal loans; the high cost of such loans; short repayment periods; "unreasonable" collateral requirements; and slow turnaround times. Some of these challenges are evident in the following quote from a male interviewee in Tanzania:

> "I have borrowed from a commercial bank but the interest rate was too much… The process was cumbersome and lengthy and in the end they provided 50 percent of what I was requesting… The collateral required to get financing and the cost of that credit to small entrepreneurs like us is punitive." – Male ICS entrepreneur, TZ_M2

Four out of the 11 female-led enterprises in the sample have accessed microfinance or some other form of credit in their history. The corresponding access numbers for the male-led category are 10 out of 27. This ratio (slightly more than one in every three male-led enterprises) is roughly equal to that for the female-led enterprises, providing no evidence of gender bias in access negotiation. Rather, the factor that unites both subsets is that the majority (three out of four female-led and eight out of 10 male-led enterprises) are producers and/or distributors, which is to say that they are relatively high up in the value chain. While the relationship between value chain hierarchy and access to credit is not a deterministic

one (two female-led producer enterprises in the sample have not succeeded in gaining access, while one retailer has gained access, for instance), it is apparent that the majority of the enterprises in the sample that have obtained credit at some point operate at higher levels of the chain. This indicates that, while there are stringent barriers to entry across the board, it is even more difficult for enterprises near the bottom of the value chain to gain access to finance, whether they are male-led or female-led. Nevertheless, since the data show that male-led enterprises are more likely than female-led ones to be ICS producers/distributors, it follows that the former are more likely than their female counterparts to be able to access credit for business expansion.

This credit bias is reflected in the broader picture of external support given to female-led versus male-led enterprises in the sample: while the former overwhelmingly receive in-kind support from mostly international donor organizations in such areas as entrepreneurial training, marketing and transportation, the latter receive support from a broader range of sources, including government and academic institutions, with more of a credit component (such as the facilitation of commercial loans and the extension of credit lines for stock acquisition) to the support. Indeed, the two enterprises in the sample that cited access to credit as having enabled expansion of their production/distribution operations are male-led producers (KE_M6 and TZ_M3), both of which operate on a relatively large scale (defined in terms of sale volume and firm size respectively). While the direction of causality is not clear from the data, it is interesting to note the correlation between access to credit and business expansion apparent here.

This correlation is borne out by the findings from a recent study conducted in East Africa (including in our three study countries of Kenya, Uganda, and Tanzania) by the Global Village Energy Partnership (now Energy 4 Impact), in which the effects of loans on the performance and sustainability of ICS and other energy enterprises were evaluated (Laura Nolan 2016). The study found that enterprises that received commercial loans in addition to

entrepreneurial training geared towards improving their financial literacy were more likely to expand, and to do so by a wider margin, than those that received other elements of entrepreneurial support but no loans.

It is noteworthy that the CBO model described previously can provide an advantage to enterprises in this regard, especially those that do not have sufficient collateral to access conventional forms of credit. As the quote below from KE_F2 illustrates, individuals can use the social capital inherent in group membership to obtain credit for their businesses in lieu of financial or material resources:

> "So I'll go to the [microfinance] bank and say I want a loan to boost my business, they'll have to come and check and see the business, what I'm doing. And then use the group as security. So it's like once they see what I'm doing, then on the basis of that, like, okay, I'm in an established group and all. And you know what I sell, a certain percentage goes to the group. You work as an individual, yes, but you give a certain percentage to the group. So it is easier for them when they come and see that I'm a member of the group and the group is active then it will be easier for me to access the loan. Then the group is sort of security." – Female ICS entrepreneur, KE_F2

The utility of this model for establishing access to group-based loans is illustrated by the observation that all three CBOs in the sample (KE_M2, KE_F1 and KE_F2) have obtained this sort of credit at some point in the past and paid back with at low interest rates (1 percent in the case of KE_F1). Mixed results have trailed the establishment of group credit platforms in various developing country contexts (see, for example, Thierry van Bastelaer and Howard Leathers 2006, Xavier Giné and Dean S. Karlan 2014, and Indra Widiarto, Ali Emrouznejad, and Leonidas Anastasakis 2017); nonetheless, the data in this case show that they can provide some improvement over

the absolute lack of access to finance experienced by many small-scale enterprises in those contexts. Importantly, the relative affordability of group-based loans can give such enterprises an opportunity to compete more favorably with bigger ones in the value chain while keeping their businesses viable (Christopher Ksoll, Helene Bie Lilleør, Jonas Helth Lønborg, and Ole Dahl Rasmussen 2016).

Discussion and conclusions

This paper has critically examined the current emphasis in the ICS sector on leveraging the relational and entrepreneurial skills of women in the global campaign to achieve widespread uptake of improved cookstoves. Advocates see an opportunity to empower women economically by engaging them actively in supply-side operations, particularly marketing and retail – effectively casting them in the role of "last-mile" entrepreneur. The premise of this focus on women is that they have greater influence over female users who traditionally do most of the cooking and are assumed to have greater relevance in ICS adoption decisions. A number of recent interventions have attempted to bolster the capacity of female ICS entrepreneurs, one of the most notable being an Alliance-sponsored "empowerment training" program that addressed the psychosocial roots of individual agency (or the lack of it), with encouraging results for the women involved (Shankar, Onyura, and Alderman 2015b). The paper argues that this approach to empowerment, while innovative and important, does not reflect crucial dimensions of gender-based disparities in the sector – notably, where female-led enterprises are placed relative to male-led enterprises in the value chain. This is important because, as our analysis shows, value chain hierarchy is positively correlated with sale potential, and female-led enterprises are underrepresented at the higher levels of the chain (i.e. production and distribution) where mass markets are more likely to drive higher sales and revenues.

There are a number of limitations to the study. First, the analysis was done on the basis of a relatively small but geographically representative sample of ICS enterprises in East Africa.

Further, it focused on comparison at the level of the firm, leaving unexamined important intra-firm dynamics that could shed light on how gains are distributed among male and female workers within those firms. And finally, while the analysis has shown that more needs to be done by mainstream actors to expand opportunities for female-led enterprises in the ICS sector, what is less clear from the data set is how the women themselves conceive of empowerment, and the tensions with established social norms that may become apparent in the process (see, for example, Linda Mayoux 1998; Meena Khandelwal, Matthew E. Hill, Paul Greenough, Jerry Anthony, Misha Quill, Marc Linderman, and H. S. Udaykumar 2016). Nevertheless, the analysis is novel for the contribution it makes to the understanding of female entrepreneurs' relative positioning and potential for growth in the ICS sector.

Drawing on data from three East African countries – Kenya, Uganda, and Tanzania – the paper analyzed the inputs (especially finance) and outputs (measured in sale volumes for the immediate past year) of 38 ICS enterprises through the lens of gender – specifically, the gender of the owners or managers of those businesses. Our findings show that gender does seem to matter for performance, but only so far as it relates to the ability of individual entrepreneurs to enter the ICS value chain at the higher levels, which in turn influences key outcomes such as access to mass markets and access to finance for business expansion. The findings indicate that greater attention needs to be paid to where female-led enterprises in particular are located in the value chain, as it is this relative positioning – rather than the gender of individual managers *per se* – that determines the profitability (and, by extension, the efficacy as a tool of for economic empowerment) of ICS enterprise.

The finding of the study that male-led enterprises are better represented than female-led ones at every level of the value chain (with the exception of retail) could be interpreted as providing justification for just getting more women into sector, like mainstream actors advocate. The argument in this paper goes a step further: if economic empowerment for

women is a corollary objective of engaging them in ICS enterprise, then greater emphasis should be placed on involving them at higher levels of the value chain.

The association between positioning and profitability is an important one to make given that many of the recent efforts to integrate women into ICS markets have been focused on engaging them in last-mile operations, a strategy which inevitably situates them at the lower end of the value chain (Nozipho Wright 2013; Gill et al. 2015, Shankar, Onyura, and Alderman 2015a, b). To better harmonize the economic empowerment goals of global advocates and the profit aspirations of local entrepreneurs, this focus on the bottom needs to be complemented by a greater push towards the top of the chain for women.

It is perhaps noteworthy that a closer reading of the findings of the Alliance-sponsored randomized controlled trial described earlier suggests that the Alliance's emphasis on employing women as last-mile agents may not be as essential for increased ICS uptake as assumed, as the study found the effect of location on sales to be similar to that of gender. Though the results show that "[w]omen outsold men by a margin of nearly 3 to 1" (Shankar, Onyura and Alderman 2015a: 67), this finding takes on less significance when a distinction is made between "active" sellers (men and women who sold more than eight ICS over the eight-month monitoring period) and "non-active" sellers (those who sold just one ICS or none at all over the same period). According to the authors, the primary predictor of participants emerging as active sellers was empowerment training: those who had gone through the treatment were nearly thrice as likely as the control group to sell more stoves, regardless of gender. Gender did have an effect – women were more likely than men to be active sellers overall – but it seemed to be the same as the effect of operating in an urban context: "being female *or* living in an urban area more than doubled the likelihood of being an active seller" (Shankar, Onyura and Alderman 2015a: 73).

The above argument does not detract from the thesis that women have an advantage in selling ICS to their peers. Indeed, the Shankar et al. study cited above highlights what may be the most convincing case for involving women in ICS marketing and sales: they found that customers had more positive impressions and experiences of the product in the immediate and long term when they purchased it from a female (rather than a male) entrepreneur. It is important, however, to distinguish the qualitative impacts evident here from expectations of an exponential increase in ICS adoption rates delivered by women working on the home stretch. Once this distinction is made, it becomes clear that the widely acclaimed peer-to-peer sales model may not be the short cut to simultaneously achieving the twin goals of economic empowerment and widespread ICS uptake that many mainstream actors believe it to be. To reiterate, women do make an important contribution to the sector as last-mile purveyors of ICS technologies, but the most significant impacts on uptake appear to be qualitative and may not necessarily be compatible with the goal of economic empowerment simultaneously targeted by mainstream ICS actors.

Indeed, the most productive and prosperous female entrepreneurs in the study sample work in a group with access to markets beyond their immediate locality, selling mostly to regional and national distributors rather than to their peers in neighboring villages. This arrangement has resulted in greater evidence of economic empowerment for the women (as well as far-reaching stove diffusion) than that shown by the peer-to-peer model. It is worth noting that this has taken place in the context of a community-based organizational structure that encourages flexibility and mutual support at work while protecting profits for the women. Further research would go beyond making the case for individual agency to scrutinizing the broader societal and structural frameworks that circumscribe participation in ICS enterprise, as entrenched inequalities at this level can constrain women's ability to benefit from seemingly inclusive community-based schemes (see, for example, Cornelia Fraune 2015). This would be an especially valuable addition in an era where market orthodoxy dominates the ICS discourse regardless of how the gains are being distributed.

Declaration

All personal information that would allow the identification of any person or person(s) described in the article has been removed.

References

Adrianzen, Marcos Agurto. 2010. The Role of Social Capital on Improved Cooking Stoves Usage Decisions in the Northern Peruvian Andes. http://www.inesad.edu.bo/bcde2010/contributed/b11_03.pdf (accessed May 2014).

Arestoff, Florence and Elodie Djemai. 2016. "Women's Empowerment Across the Life Cycle and Generations: Evidence from Sub-Saharan Africa." World Development 87, 70–87.

Bailis, Rob, Amanda Cowan, Victor Berrueta, and Omar Masera. 2009. “Arresting the Killer in the Kitchen: The Promises and Pitfalls of Commercializing Improved Cookstoves.” World Development 37(10): 1694–1705.

Banerjee, Manjushree and Rakesh Prasad. 2015. “Engaging Community Based Organisations in Marketing of Improved Cookstoves in a Hill State of India.” Boiling Point 66: 37–39.

Barnes, Douglas F., Keith Openshaw, Kirk R. Smith, and Robert van der Plas. 1994. “What Makes People Cook with Improved Biomass Stoves? A Comparative International Review of Stove Programs.” World Bank Technical Paper No. 242.

Barr, Abigail, Marleen Dekker, and Marcel Fafchamps. 2015. "The Formation of Community-Based Organizations: An Analysis of a Quasi-Experiment in Zimbabwe." World Development 66, 131–153.

Barrientos, Stephanie, Catherine Dolan, and Anne Tallontire. 2003. “A Gendered Value Chain Approach to Codes of Conduct in African Horticulture.” World Development 31: 1511–1526.

Baruah, Bipasha. 2015. “Creating Opportunities for Women in the Renewable Energy Sector: Findings from India.” Feminist Economics 21(2): 53–76.

Baumert, Sophia, Ana Catarina Luz, Janet Fisher, Frank Vollmer, Casey M. Ryan, Genevieve Patenaude, Pedro Zorrilla-Miras, Luis Artur, Isilda Nhantumbo, and Duncan Macqueen. 2016. “Charcoal Supply Chains from Mabalane to Maputo: Who Benefits?” Energy for Sustainable Development 33: 129–138.

Bensch, Gunther, Michael Grimm and Jörg Peters. 2015. “Why Do Households Forego High Returns from Technology Adoption? Evidence from Improved Cooking Stoves in Burkina Faso.” Journal of Economic Behavior & Organization 116: 187–205.

Bonilla, Juan, Rosa Castro Zarzur, Sudhanshu Handa, Claire Nowlin, Amber Peterman, Hannah Ring, and David Seidenfeld. 2017. "Cash for Women’s Empowerment? A Mixed-Methods Evaluation of the Government of Zambia’s Child Grant Program." World Development, http://dx.doi.org/10.1016/j.worlddev.2017.02.017

Bryceson, Deborah Fahy and Michael K. McCall. 1997. “Lightening the Load on Rural Women: How Appropriate is the Technology Directed towards Africa?” Gender, Technology and Development 1(1): 23–-45.

Cecelski, Elizabeth, Tieho Makhabane, Waldheim Ndevashiya, and Tuvoye Hasheela. 2001. Gender and Biomass Energy Conservation in Namibia: A Case Study with Special

Reference to GTZ/ProBEC. http://energia.org/wp-content/uploads/2015/06/73-Gender-and-Biomass-Energy-Conservation-in-Namibia.pdf (accessed October 2015).

Chambers, Robert. 1997. Whose Reality Counts? Putting the Last First. London: Intermediate Technology Publications.

Chant, Sylvia and Matthew Gutmann. 2000. Mainstreaming Men into Gender and Development: Debates, Reflections and Experiences. Oxford, England: Oxfam GB.

Chaurey, Akanksha, P.R. Krithika, Debajit Palit, Smita Rakesh, and Benjamin K. Sovacool. 2012. “New Partnerships and Business Models for Facilitating Energy Access.” Energy Policy 47: 48–55.

Cherayi, Shanuga and Justin P. Jose. 2016. "Empowerment and Social Inclusion of Muslim Women: Towards a New Conceptual Model." Journal of Rural Studies 45, 243–251.

Clancy, Joy S., Soma Dutta, Nthabiseng Mohlakoana, Anna Victoria Rojas, and Margaret Njirambo Matinga. 2015. “The Predicament of Women,” in Lakshman Guruswamy, ed. International Energy Poverty: The Emerging Contours, pp 24–38. Abingdon, Oxon: Routledge.

Cornwall, Andrea. 2003. “Whose Voices? Whose Choices? Reflections on Gender and Participatory Development.” World Development 31(8):1325–1342.

Dunaway, Wilma A. 2014. “Introduction,” in Wilma A. Dunaway, ed. Gendered Commodity Chains: Seeing Women's Work and Households in Global Production, pp. 1–24. Stanford, CA: Stanford University Press.

Dutta, Soma and Tjarda Muller. 2015. Editorial: “Women, Energy and Economic Empowerment.” Boiling Point 66: 1.

Dutta, Soma. 2015. “Unlocking Women’s Potential towards Universal Energy Access.” Boiling Point 66: 2–5.

ENERGIA. 2015. Baseline Gender Assessment Report: Upscaling Improved Cookstove Dissemination in Myanmar. https://cleancookstoves.org/binary-data/RESOURCE/file/000/000/405-1.pdf (accessed July 2016).

Fraune, Cornelia. 2015. "Gender Matters: Women, Renewable Energy, and Citizen Participation in Germany." Energy Research & Social Science 7, 55–65.

GACC. 2011. Igniting Change: A Strategy for Universal Adoption of Clean Cookstoves and Fuels. http://www.cleancookstoves.org/resources/fact-sheets/igniting-change.pdf (accessed July 2016).

GACC. 2012. Enabling Markets Worldwide 2011–2012. http://cleancookstoves.org/resources_files/alliance-second-annual-report-enabling-markets-worldwide.pdf (accessed May 2017).

GACC. 2013. Scaling Adoption of Clean Cooking Solutions through Women’s Empowerment: A Resource Guide. https://cleancookstoves.org/binary-data/RESOURCE/file/000/000/223-1.pdf (accessed December 2015).

GACC. undated. Global Alliance for Clean Cookstoves: Gender Strategy. https://energypedia.info/images/6/69/Jennifer_Tweddell_(GACC)_-_Gender_and_Improved_Cookstoves.pdf (accessed July 2016).

GACC website. “Use of Carbon Revenues.” http://carbonfinanceforcookstoves.org/implementation/cookstove-value-chain/carbon-revenues/ (accessed May 2017).

Ganle, John Kuumuori, Kwadwo Afriyie, and Alexander Yao Segbefia. 2015. “Microcredit: Empowerment and Disempowerment of Rural Women in Ghana.” World Development 66, 335–345.

Giné, Xavier and Dean S. Karlan. 2014. "Group versus Individual Liability: Short and Long Term Evidence from Philippine Microcredit Lending Groups." Journal of Development Economics 107, 65–83.

Golla, Anne Marie, Anju Malhotra, Priya Nanda, and Rehka Mehra. 2011. Understanding and Measuring Women's Economic Empowerment: Definitions, Framework and Indicators. Washington, DC: International Center for Research on Women.

Gugerty, Mary Kay and Michael Kremer. 2002. “The Impact of Development Assistance on Social Capital: Evidence from Kenya,” in Christiaan Grootaert and Thierry van Bastelaer, eds. The Role of Social Capital in Development: An Empirical Assessment, pp. 213–233. New York: Cambridge University Press.

Guijt, Irene and Meera Kaul Shah. 1998. “Waking Up to Power, Conflict and Process,” in Irene Guijt, and Meera Kaul Shah, eds. The Myth of Community: Gender Issues in Participatory Development, pp 1–22. London: Intermediate Technology Publications.

Hart, Corinne and Genevieve M. Smith. 2014. “Overcoming Barriers to Clean Cookstove and Fuel Adoption: Why and How Women Must Be Integrated Throughout the Value Chain.” Boiling Point 64: 20–23.

ILO. 2009. Value Chain Development for Decent Work: A Guide for Practitioners, Government and Private Sector Initiatives. Geneva, Switzerland: International Labour Organization.

ILO. 2011. Value Chains for Rural Development. Geneva, Switzerland: International Labour Organization.

Jackson, Cecile. 1993. “Environmentalisms and Gender Interests in the Third World.” Development and Change 24(4): 649–677.

Jackson, Cecile. 1996. “Rescuing Gender from the Poverty Trap.” World Development 24(3): 489–504.

Kabeer, Naila. 1997. “Resources, Agency, Achievements: Reflections on the Measurement of Women's Empowerment.” Development and Change 30(3): 435–464.

Kariuki, Phyllis and Patrick Balla. 2011. GVEP’S Experience with Working with Women Entrepreneurs in East Africa. http://www.gvepinternational.org/sites/default/files/gveps_experince_with_working_with_women.pdf (accessed July 2016).

Khandelwal, Meena, Matthew E. Hill, Paul Greenough, Jerry Anthony, Misha Quill, Marc Linderman, and H. S. Udaykumar. 2016. "Why Have Improved Cook-Stove Initiatives in India Failed?" World Development, http://dx.doi.org/10.1016/j.worlddev.2016.11.006

Köhlin, Gunnar, Erin P. Sills, Subhrendu K. Pattanayak, and Christopher Wilfong. 2011. Energy, Gender and Development: What are the Linkages? Where is the Evidence? Washington, DC: World Bank.

Ksoll, Christopher, Helene Bie Lilleør, Jonas Helth Lønborg, Ole Dahl Rasmussen. 2016. "Impact of Village Savings and Loan Associations: Evidence from a Cluster Randomized Trial." Journal of Development Economics 120: 70–85.

Lenao, Monkgogi and Biki Basupi. 2016. "Ecotourism Development and Female Empowerment in Botswana: A Review." Tourism Management Perspectives 18, 51–58.

Marshall, Mipsie, David Ockwell, and Rob Byrne. 2017. “Sustainable Energy for All, or Sustainable Energy for Men? Gender and the Construction of Identity within Climate Technology Entrepreneurship in Kenya.” Progress in Development Studies 17(2): 1–25.

Mayoux, Linda. 1998. “Participatory Learning for Women’s Empowerment in Microfinance Programmes: Negotiating Complexity, Conflict and Change.” IDS Bulletin 29(4): 39–50.

Mendelberg, Tali and Christopher F. Karpowitz. 2016. “Women’s Authority in Political Decision-making Groups.” The Leadership Quarterly 27: 487–503.

Misra, Neha. 2015. “The Business Case for Women in Clean Energy Value Chains: Insights from Solar Sister.” Boiling Point 66: 18–21.

Molyneux, Catherine, Beryl Hutchison, Jane Chuma, and Lucy Gilson. 2007. “The Role of Community-based Organizations in Household Ability to Pay for Health Care in Kilifi District, Kenya.” Health Policy and Planning 22: 381–392.

Moser, Caroline O.N. and Caren Levy. 1986. “A Theory and Methodology of Gender Planning: Meeting Women’s Practical and Strategic Needs.” University College London: Development Planning Unit Working Paper No.11.

Natural Capital Partners. Undated. Kenya: Improved Cookstoves. http://www.carbonneutral.com/images/uploads/projects/Kenya_Cookstoves_Project_Sheet_Nov15.pdf (accessed May 2017).

Niethammer, Carmen and Peter Alstone. 2012. “Expanding Women's Role in Africa's Modern Off-grid Lighting Market: Enhancing Profitability and Improving Lives.” Gender & Development 20(1): 145–157.

Nolan, Laura. 2016. Access to Loans Boosts Growth of Micro-enterprises, New Study Reveals. http://www.gvepinternational.org/en/business/news/access-loans-boosts-growth-micro-enterprises-new-study-reveals (accessed May 2016).

Nzomo, Maria. 2005. “Beyond the Women’s Decade: Women’s Political Participation in Kenya,” in Gerald J. Wanjohi and G. Wakuraya Wanjohi, eds. Social and Religious Concerns of East Africa: A Wajibu Anthology (Cultural Heritage and Contemporary Change), pp.133–140. Washington, DC: The Council for Research in Values and Philosophy.

Pachauri, Shonali and Narasimha D. Rao. 2013. “Gender Impacts and Determinants of Energy Poverty: Are We Asking the Right Questions?” Current Opinion in Environmental Sustainability 5: 205–215.

Parikh, Jyoti. 2011. “Hardships and Health Impacts on Women Due to Traditional Cooking Fuels: A Case Study of Himachal Pradesh, India.” Energy Policy 39: 7587–7594.

Peterson, V. Spike. 2003. A Critical Rewriting of Global Political Economy: Integrating Reproductive, Productive, and Virtual Economies. London: Routledge.

Pick, Susan and Jenna T. Sirkin. 2010. Breaking the Poverty Cycle. New York: Oxford University Press.

Ramani, K.V. and Enno Heijndermans. 2003. Energy, Poverty, and Gender: A Synthesis. Washington, DC: The World Bank. https://www.esmap.org/sites/esmap.org/files/Rpt_GBL_EnergyPovertyGender.pdf (accessed July 2016).

Riisgaard, Lone, Anna Maria Escobar Fibla, and Stefano Ponte. 2010. Gender and Value Chain Development. Copenhagen, Denmark: Ministry of Foreign Affairs.

Saatkamp, Barbara D., Omar R. Masera, and Daniel M. Kammen. 2000. “Energy and Health Transitions in Development: Fuel Use, Stove Technology, and Morbidity in Jaracuaro, Mexico.” Energy for Sustainable Development IV(2): 7–16.

Said-Allsopp, Muhaimina and Anne Tallontire. 2014. “Pathways to Empowerment? Dynamics of Women’s Participation in Global Value Chains.” Journal of Cleaner Production 107: 114–121.

Sesan, Temilade. 2014. "Peeling Back the Layers on Participatory Development: Evidence from a Community-Based Women’s Group in Western Kenya.” Community Development Journal, doi:10.1093/cdj/bst085

Shankar, Anita V., Mary Alice Onyura, and Jessica Alderman. 2015a. “Agency-based Empowerment Training Enhances Sales Capacity of Female Energy Entrepreneurs in Kenya.” Journal of Health Communication 20: 67–75.

Shankar, Anita V., Mary Alice Onyura, and Jessica Alderman. 2015b. Understanding Impacts of Women’s Engagement in the Improved Cookstove Value Chain in Kenya. New York: Global Alliance for Clean Cookstoves.

Shively, G., P. Jagger, D. Sserunkuuma, A. Arinaitwe, and C. Chibwana. 2010. “Profits and Margins along Uganda's Charcoal Value Chain.” International Forestry Review 12(3), 270-283.

Smith, Kirk R. 2010. “What’s Cooking? A Brief Update.” Energy for Sustainable Development 14: 251–252.

Swapan, Mohammad Shahidul Hasan. 2016. “Who Participates and Who Doesn't? Adapting Community Participation Model for Developing Countries.” Cities 53: 70–77.

Thurber, Mark C., Himani Phadke, Sriniketh Nagavarapu, Gireesh Shrimali, and Hisham Zerriffi. 2014. “‘Oorja’ in India: Assessing a Large-scale Commercial Distribution of Advanced Biomass Stoves to Households.” Energy for Sustainable Development 19: 138–150.

UNDP. 2004. Gender and Energy for Sustainable Development: A Toolkit and Resource Guide. New York: United Nations Development Programme.

UNIDO. 2009. Agro-value Chain Analysis and Development: The UNIDO Approach. Vienna, Austria: United Nations Industrial Development Organization.

United Nations. 2003. The World's Women 2000: Trends and Statistics. New York: Oxford University Press.

United Nations WomenWatch. http://www.un.org/womenwatch/directory/women_and_poverty_3001.htm (accessed October 2015).

van Bastelaer, Thierry and Howard Leathers. 2006. "Trust in Lending: Social Capital and Joint Liability Seed Loans in Southern Zambia." World Development 34(10): 1788–1807.

Widiarto, Indra, Ali Emrouznejad, and Leonidas Anastasakis. 2017. "Observing Choice of Loan Methods in Not-for-Profit Microfinance Using Data Envelopment Analysis." Expert Systems with Applications 82: 278–290.

Wright, Nozipho. 2013. Village Savings and Loan Associations: Market Potential for Clean Energy Products in Kenya, Rwanda and Tanzania. http://wmi.uonbi.ac.ke/sites/default/files/cavs/wmi/CARE%20wPOWER%20PROFILING%20STUDY%20FINAL%20REPORT%20(2)_0.pdf (accessed November 2015).

Yakubovich, A. R., L. Sherr, L. D. Cluver, S. Skeen, I. S. Hensels, A. Macedo., and M. Tomlinson. 2016. "Community-based Organizations for Vulnerable Children in South Africa: Reach, Psychosocial Correlates, and Potential Mechanisms." Children and Youth Services Review 62, 58–64.

List of Tables

Table 1. Final composition of ICS enterprise sample in the study countries

	Kenya		***Uganda***		***Tanzania***	
	Rural	Urban	Rural	Urban	Rural	Urban
Small-scale	3	0	9	8	2	5
Large-scale	2	1	0	2	1	1
Medium-scale	1	2	1	0	0	0
Total	**6**	**3**	**10**	**10**	**3**	**6**

Table 2. Firm descriptors, inputs (finance) and outputs (sales) for male-led enterprises in the sample

#	Enterprise code	Form of organisation	Value chain positioning	Total firm size	Number of male workers	Number of female workers	Access to finance	Units sold in the past year	Total revenue in the past year (USD)
1	KE_M1	Limited liability company	Production, Distribution, Marketing	70	Not specified	Not specified	Credit from international sources	50,000	1,250,000
2	KE_M2	Community-based organisation	Production, Retail	120	47	73	Community-based savings and loan groups	1,000	7,840
3	KE_M3	Commercial enterprise	Production, Distribution	15	7	8	No credit history	10,000	31,450
4	KE_M4	Commercial enterprise	Production, Distribution	8	5	3	No credit history	16,000	280,000
5	KE_M5	Commercial enterprise	Production	13	6	7	No credit history	10,000	24,200
6	KE_M6	Social enterprise	Production, Distribution, Retail	8	7	1	Credit facilitated by NGO	2,500	22,411
7	KE_M7	Government organisation	Production, Distribution, Marketing, Retail	28	16	12	Publicly funded	Not specified	Not specified
8	TZ_M1	Non-governmental organisation	Production, Distribution, Retail	100	Not specified	Not specified	No credit history	1,000	Not specified
9	TZ_M2	Commercial enterprise	Production, Retail	10	6	4	Commercial bank loan	Not specified	Not specified
10	TZ_M3	Commercial enterprise	Production	30	Not specified	Not specified	Commercial bank loan	Not specified	Not specified
11	TZ_M4	Commercial enterprise	Retail	1	1	0	No credit history	500	8,500
12	TZ_M5	Commercial enterprise	Retail	1	1	0	No credit history	37	629

13	TZ_M6	Commercial enterprise	Retail	2	2	0	No credit history	25	1,400
14	TZ_M7	Commercial enterprise	Retail	1	1	0	No credit history	70	438
15	UG_M1	Commercial enterprise	Production, Distribution, Retail	145	51	94	Microcredit	Not specified	Not specified
16	UG_M2	Commercial enterprise	Production, Marketing	38	36	2	No credit history	5,400	57,540
17	UG_M3	Commercial enterprise	Retail	2	1	1	No credit history	170	47, 090
18	UG_M4	Commercial enterprise	Retail	6	6	0	Commercial bank loan	6,000	49,920
19	UG_M5	Commercial enterprise	Production, Distribution	7	7	0	No credit history	125	2,150
20	UG_M6	Commercial enterprise	Production, Distribution	5	3	2	Commercial bank loan	970	1,358
21	UG_M7	Commercial enterprise	Production	1	1	0	No credit history	Not specified	Not specified
22	UG_M8	Commercial enterprise	Marketing, Retail	2	2	0	No credit history	950	1,330
23	UG_M9	Commercial enterprise	Retail	4	2	2	Commercial bank loan	120	3,000
24	UG_M10	Commercial enterprise	Production, Distribution	1	1	0	No credit history	100	278
25	UG_M11	Non-governmental organisation	Production, Distribution	41	40	1	No credit history	Not specified	Not specified
26	UG_M12	Commercial enterprise	Production, Distribution, Marketing, Retail	6	6	0	Microcredit	780	1,980
27	UG_M13	Commercial enterprise	Production	3	Not specified	Not specified	No credit history	100	600

Table 3. Firm descriptors, inputs (finance) and outputs (sales) for female-led enterprises in the sample

#	Enterprise code	Form of organisation	Value chain positioning	Total firm size	Number of male workers	Number of female workers	Access to finance	Units sold in the past year	Total revenue in the past year (USD)
1	KE_F1	Community-based organisation	Distribution, Retail	15	6	9	Low-interest community loans	3,980	27,182
2	KE_F2	Community-based organisation	Production, Distribution, Marketing	20	6	14	Group loan, individual microcredit	36,350	160,010
3	TZ_F1	Commercial enterprise	Production	6	5	1	Commercial bank loan	220	4,936
4	TZ_F2	Commercial enterprise	Retail	3	2	1	No credit history	120	3,600
5	UG_F1	Commercial enterprise	Retail	1	0	1	No credit history	100	1,940
6	UG_F2	Commercial enterprise	Production, Retail	1	0	1	No credit history	500	868
7	UG_F3	Commercial enterprise	Retail	1	0	1	No credit history	1000	8,320
8	UG_F4	Commercial enterprise	Retail	2	0	2	No credit history	120	720
9	UG_F5	Commercial enterprise	Production, Distribution	4	3	1	No credit history	70	420
10	UG_F6	Commercial enterprise	Retail	3	2	1	No credit history	312	1,872
11	UG_F7	Commercial enterprise	Retail	1	0	1	Commercial bank loan	400	2,000

Table 4. Proportion of male-led and female-led enterprises across main value chain functions

	Male-led enterprises (n=27)	Female-led enterprises (n=11)
Production	19 (70%)	4 (36 %)
Distribution	12 (44%)	3 (27%)
Marketing	5 (19%)	1 (9%)
Retail	15 (56%)	8 (73%)