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

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“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

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3 Improved cookstoves (ICS) have long been promoted by a variety of actors as a solution to
4 the environmental and health problems associated with the traditional use of biomass fuels
5 (primarily wood and charcoal, but also relatively inferior fuels such as animal dung and crop
6 waste) (Barbara Saatkamp, Omar Masera, and Daniel Kammen 2000). Women and girls
7 often disproportionately bear the physical burden of gathering these fuels, sometimes over
8 long distances and difficult terrain, with adverse implications for their wellbeing and
9 economic productivity (Jyoti Parikh 2011). Fueled by these concerns, concerted ICS
10 promotion efforts began in the 1970s, largely led by traditional development actors such as
11 state and donor agencies (Rob Bailis, Amanda Cowan, Victor Berrueta, and Omar Masera
12 2009). The ICS field has since widened to include market-oriented actors, reflecting an
13 eschewal of the widely critiqued subsidy-enabled regime of the 1970s and 1980s and a more
14 recent embrace of neoliberal ideology in the field and in international development generally
15 (Douglas Barnes, Keith Openshaw, Kirk Smith, and Robert van der Plas 1994; Marcos
16 Adrianzen 2010). The common aim uniting these approaches is the goal of realizing
17 widespread ICS uptake in the poor regions that are most affected by the hazards of
18 traditional biomass use. However, notwithstanding the diversity of efforts and the
19 demonstrated benefits of many ICS technologies (notably, from a user standpoint, significant
20 reductions in fuel requirements), rates of uptake and use have remained obstinately low
21 (Gunther Bensch, Michael Grimm, and Jörg Peters 2015).
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45 Against the background of increasing global-level attention to increased female agency in
46 ICS enterprise (GACC 2012) and local-level narratives (like the quote by the Tanzanian
47 entrepreneur above) that suggest a more nuanced picture on the ground, this paper takes a
48 closer look at how and where women are involved in the East Africa ICS value chain,
49 particularly relative to men.
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58 Gender has been recognized as an important variable influencing the experiences of various
59 actors within value chains (Stephanie Barrientos, Catherine Dolan, and Anne Tallontire
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3 2003). Nevertheless However, existing research on the gender-differentiated experiences of
4 workers in value chains – especially at the local level – is inadequate (Lone Riisgaard, Anna
5 Maria Escobar Fibla, and Stefano Ponte 2010), making further inquiry into specific value
6 chains a necessary knowledge enterprise. The dearth of gender analysis is particularly acute
7 in the ICS value chain where, with the exception of research commissioned by a few major
8 industry stakeholders (see, for example, ENERGIA 2015; GACC undated), attention has
9 been scant. This deficit is all the more significant given the sheer magnitude of the economic
10 payoff that is expected to result from women’s involvement in the chain (Corinne Hart and
11 Genevieve Smith 2014).
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24 Our paper addresses this gap by examining the content and outcomes of participation for
25 women and men in the East Africa ICS value chain. In doing so, we challenge the dominant
26 narrative regarding women’s empowerment in the sector and identify opportunities for
27 advancing more substantive modes of participation among them. As Tali Mendelberg and
28 Christopher Karpowitz (2016) recognize, the difference between the *symbolic* and
29 *substantive* representation of women in groups can mean that women are physically present
30 at the table but have less influence than men over the outcomes that are realized. It is
31 therefore important to tease out, as our paper does, the value that is added to women in
32 particular by their participation in specific enterprises. Our findings indicate that the global
33 ICS narrative needs to move away from simplistic assumptions about the inevitability of ICS
34 entrepreneurship resulting in women’s empowerment, and give greater consideration to
35 value chain configurations that might better align the global goal of increased ICS uptake
36 with local expectations of benefit maximization.
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54 **Gender, energy and ICS entrepreneurship: A multi-layered analytical framework**

55 The need for gender planning approaches that take account of the structural and practical
56 differences between men and women in the design and delivery of projects is widely
57 acknowledged in the literature (Caroline Moser and Caren Levy 1986; Cecile Jackson 1996,
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3 Andrea Cornwall 2003; UNDP 2004; Wilma Dunaway 2014). Not only are women and men
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5 recognized as having different needs that require different resource levels, they are also
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7 acknowledged as having different roles that are regarded and compensated differently by
8
9 society (Moser and Levy 1986; Cecile Jackson 1993). Sylvia Chant and Matthew Gutmann
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11 (2000) point out that these differing roles, and their implications for access to resources by
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13 men and women respectively, take on greater significance when they are considered in
14
15 relation to one another and within the broader societal context.
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20 This notion of relativity is particularly important because gender relations do not occur on a
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22 level playing field, but on one in which the balance of power is often tilted towards men
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24 (Robert Chambers 1997; Irene Guijt and Meera Shah 1998). This is particularly problematic
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26 from an international development standpoint because, according to the United Nations
27
28 WomenWatch, women make up “the great majority” of the global poor. Men are generally
29
30 acknowledged as having a higher starting point than women at similar socio-economic levels
31
32 in critical areas such as access to finance, technical know-how, ownership and control of
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34 assets, freedom of movement, and access to energy (Joy Clancy, Soma Dutta, Nthabiseng
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36 Mohlakoana, Anna Rojas, and Margaret Matinga 2015). This means that they are often better
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38 positioned than women to access the benefits of development programs targeted at
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40 households, groups and communities. The same situation holds for more entrepreneurial
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42 interventions: Patrick Kariuki and Phyllis Balla (2011) note that while men and women face
43
44 similar challenges in trying to set up businesses, the head start possessed by the former
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46 often puts them in better stead to overcome those challenges.
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51 These gender disparities are evident in levels of access to employment in the energy sector,
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53 where women form a negligible percentage of technical staff (6 percent) and an even lower
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55 percentage of managerial staff (1 percent) (Bipasha Baruah 2015). At the entrepreneurial
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57 level, women’s participation in the sector is constrained by many of the gender-specific
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3 challenges (notably access to credit and ownership of property and other assets) identified
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5 above (ibid.).
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9 In the ICS sub-sector, where women have long been accepted as active users of the
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11 technology, their integration into the value chain has been less straightforward (Anita
12
13 Shankar, Mary Onyura, and Jessica Alderman 2015a). This is in spite of an array of
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15 programmatic efforts that have been targeted at realizing greater involvement of women in
16
17 supply-side operations (K. Ramani and Enno Heijndermans 2003). These efforts have
18
19 registered a degree of success as measured by rates of female participation in energy
20
21 enterprise; however, as Mipsie Marshall, David Ockwell, and Rob Byrne (2017) point out,
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23 there is still a long way to go in designing market and policy initiatives that neutralize the
24
25 influence of repressive gender norms on the implementation and outcomes of clean energy
26
27 projects in developing-country contexts.
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32 The imperative to engage women in energy entrepreneurship is especially great due to an
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34 essentialist belief that “energy is women’s business” (Clancy et al. 2015: 25). This is
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36 especially the case in the area of household energy – the “reproductive” domain (V.
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38 Peterson 2003; United Nations 2003) – where women are traditionally ascribed a greater
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40 role than men. Women are the most negatively affected by energy deficits in this area, the
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42 logic goes, so they ought to be the most effective at promoting solutions to those deficits.
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44 Importantly, women, by virtue of their traditional roles, are thought to have higher social
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46 capital and relevant networks through which they can disseminate household energy
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48 products more effectively than men (Soma Dutta and Tjarda Muller 2015; Neha Misra 2015).
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53 This narrative of women-as-energy-purveyors is particularly potent in the ICS sub-sector
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55 where, in addition to their general role as household energy “managers”, women are mostly
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57 recognized and recruited for their role as “primary cooks” (Gunnar Köhlin, Erin Sills,
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3 Subhrendu Pattanayak, and Christopher Wilfong 2011; Shankar, Onyura, and Alderman
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5 2015a).

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9 The current drive to increase women's participation in the ICS value chain signals a
10
11 transition from the previous paradigm of seeing women mainly as passive users of the
12
13 technology to envisioning them as active participants, and even leaders, in its provisioning
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15 (Soma Dutta 2015). Historically, gender analysis of ICS interventions has been focused on
16
17 power dynamics within households, particularly as they influence decision making about
18
19 cookstove purchase. Less has been done to scrutinize gender relations on the supply side,
20
21 at least prior to the recent wave of discussions around the potential that women's
22
23 involvement in the value chain has to meet their economic ("productive") and broader
24
25 ("strategic") empowerment needs (Moser and Levy 1986; GACC 2013). The two goals
26
27 envisaged in the current female-centric movement – women's empowerment and increased
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29 ICS uptake (GACC 2011; Clancy et al. 2015) – are assumed to be complementary, or at
30
31 least mutually inclusive.
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36 The Global Alliance for Clean Cookstoves (GACC)¹ (hereafter, "the Alliance") has been
37
38 particularly active in promoting the agenda of increased female participation in the
39
40 cookstoves value chain. Established in 2010 to "save lives, improve livelihoods, empower
41
42 women, and protect the environment", the Alliance sees women as being instrumental to its
43
44 ambitious goal of distributing 100 million improved (and "clean") cookstoves through market
45
46 channels by 2020 (Anita Shankar, Mary Onyura, and Jessica Alderman 2015b). The Alliance
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48 is not unaware of the gender-specific challenges that stand in the way of this lofty goal;
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50 indeed, it has attempted to address some of those challenges through evidence-based
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52 interventions. One of such interventions was a 2013 randomized controlled trial in Kenya in
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54 which the treatment group received, in addition to conventional entrepreneurship training,
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¹The GACC changed its name to the Clean Cooking Alliance in October 2018.

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3 “agency-based” empowerment training aimed at overcoming the deeply rooted psychosocial
4 inhibitions that prevent women in particular from maximizing opportunities open to them
5 (Susan Pick and Jenna Sirkin 2010; Shankar, Onyura, and Alderman 2015a). The findings of
6 the RCT indicate that a significant increase in agency was achieved for both male and
7 female participants and that this was a strong predictor of higher ICS sales - suggesting that
8 the Alliance’s psychosocial approach ultimately led to economic empowerment for the
9 women.
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20 Our paper contends, however, that the gains enabled by the Alliance’s psychosocial
21 approach to empowerment training, with its focus on recruiting women as ICS retailers,
22 come at the risk of losing sight of another critical dimension of empowerment – the economic
23 dimension – that is consistent with its overall objective of increasing women’s influence in
24 the ICS value chain. The rhetoric of empowerment in all its forms (social, political, economic,
25 psychological, relational, and so on) fits especially well with gender equality objectives, as it
26 presupposes a capacity to overcome the deficits that women in particular start out with in
27 marketplace and other societal arrangements (Naila Kabeer 1997; Florence Arestoff and
28 Elodie Djemai 2016; Shanuga Cherayi and Justin P. Jose 2016). Notwithstanding the visions
29 of radical transformation it conjures, however, empowerment is often difficult to realize and
30 measure in practice, and – as we will show in the case of the Alliance – gains made in one
31 sphere or setting can be offset by losses or setbacks in another (John Kuumuori Ganle,
32 Kwadwo Afriyie, and Alexander Yao Segbefia 2015; Monkogoi Lenao and Biki Basupi 2016).
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51 Crucially, as Shonali Pachauri and Narasimha Rao (2013) point out, the notion of economic
52 empowerment is relative – particularly for women – and dependent on their positioning within
53 larger occupational structures. This prompts closer scrutiny of where women are located
54 within the ICS value chain and the implications of this positioning for how economically
55 empowered they are relative to men.
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5 Following the call by Marshall, Ockwell, and Byrne (2017) for “urgent” research into the
6 ramifications of clean energy initiatives from a gender perspective, this paper examines the
7 gender-differentiated outcomes of market-based efforts to promote widespread uptake of
8 ICS in three East African countries – Kenya, Uganda, and Tanzania. In juxtaposing the
9 experiences of female-led and male-led ICS enterprises in the study countries, the paper
10 evaluates the extent to which the normative goal of empowerment-through-market
11 participation expressed in the ICS literature is a reality for women entrepreneurs in the
12 sector. We consider empowerment in a strictly economic sense, in response to the dearth of
13 gender-differentiated analyses of the distribution of financial gains in the sector. Marie Golla,
14 Anju Malhotra, Priya Nanda, and Rehka Mehra (2011) define economic empowerment as a
15 “complex process” encompassing women’s access to resources (including skills, capital,
16 assets, and networks), their ability to appropriate those resources competitively in the
17 marketplace, and the degree of control they have over the inputs and outputs of their
18 enterprise. Our analysis indicates that the focus on economic empowerment is warranted, as
19 the financial outlook for the majority of female-led enterprises in the study appears more
20 modest than the mainstream rhetoric would suggest.
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41 **Methods**

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

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3 for the preceding year, organizational structures and norms regarding gender, external
4 support structures, access to finance, and operational enablers/constraints.
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9 Along the lines of the household interviews conducted in the larger study, the enterprises in
10 the value chain sample were selected to be representative of those located in urban as well
11 as rural areas. Small-, medium- and large-scale enterprises (defined as businesses with
12 annual sale volumes of less than 5,000, 5,000 – 10,000, and more than 10,000 ICS
13 respectively) were selected to represent the range of operational capacities available in each
14 country. (Detailed sales data were only collected for the immediate past year, however,
15 regardless of size of enterprise.) The final sample included a total of thirty-eight enterprises
16 (nine in Kenya, nine in Tanzania, and twenty in Uganda). The much larger sample size in
17 Uganda is reflective of a recent surge in ICS enterprise activity in the country, partly enabled
18 by the presence of a relatively vibrant and accessible carbon finance market. Table 1 below
19 shows the breakdown of the final sample according to the main sampling criteria employed.
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35 *Insert Table 1 about here (original size).*
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39 The interviews targeted the owners or production managers of each enterprise in the
40 sample. A total of thirty-eight owner-managers (twenty-seven men and eleven women, a
41 ratio of more than 2:1) were ultimately interviewed. The gender composition of the resulting
42 sample is important because gender was not explicitly used as a criterion in enterprise or
43 interviewee selection. The gender-neutral criteria of location and scale of enterprise
44 employed make it possible to therefore draw valid gender-specific inferences from the data
45 collected. The analysis of gender-differentiated patterns of specialization at firm level
46 provided here constitutes an important first step towards understanding the extent and
47 substance of female representation in the ICS sector.
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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).

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3 As indicated in the tables, many of the enterprises in the sample are engaged in multiple
4 value chain functions, lending support to the widespread observation (for example, by ILO
5 2009) that many different types of activity can be concentrated within individual firms. The
6 summary in Table 4 below shows that the female-led enterprises in the sample are
7
8 overwhelmingly involved in retail – with over half the sample (six of 11) engaged exclusively
9 in retail. Many male-led enterprises also perform retail functions; however, only seven of 27
10 enterprises – about a quarter – work exclusively in retail. Conversely, male-led enterprises
11 are significantly better represented than their female-led enterprises counterparts at the
12 higher levels of the value chain.
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28 It is also clear from Tables 2 and 3 that low sale volumes correlate with “lower” functions in
29 the value chain, especially retail. With a few exceptions (notably UG_M4 and UG_F3),
30 enterprises that deal solely in retail were more likely than others to have recorded sales in
31 the tens and low hundreds. This effect seems to hold even when retailers channel their
32 wares through local supermarkets and stores: one enterprise (UG_F6), for example, sold
33 only 192 units of a particular type of ICS in the past year through “supermarkets and
34 exhibitions”. In their analysis of the charcoal value chain in Uganda, G. Shively, P. Jagger,
35 D. Sserunkuuma, A. Arinaitwe, and C. Chibwana (2010) highlight the importance of scale
36 (defined in terms of sale volumes) for the profitability of different functions in the value chain.
37
38 In general, the greater the number of units a firm or individual can sell, the higher the
39 financial returns they can receive. The implication here is that the female-led enterprises in
40 the sample, with their high rate of representation in low-volume retail, reap lower returns
41 overall than the enterprises in the male-led category.
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58 *2. Female-led enterprises are relatively small in size, but socially centered forms of*
59 *organization can boost their productivity and sales*
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3 The ICS enterprises in the sample generally have small numbers of staff: the majority of
4 them have 20 workers – the maximum number for the female-led enterprises – or less.
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6 However, seven of the enterprises, all of them male-led, run relatively larger operations,
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8 hiring between 30 and 120 workers each. Firm size matters because, in the context of
9
10 developing countries, energy businesses that have fewer staff– have been shown to be at a
11
12 disadvantage relative to their higher-staffed counterparts in terms of the proportion of
13
14 benefits that accrues to them – even when they operate at higher levels of the value chain
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16 (see, for example, Sophia Baumert, Ana Catarina Luz, Janet Fisher, Frank Vollmer, Casey
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18 M. Ryan et al. 2016).
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24 The data presented in the tables above further suggest that having women in leadership
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26 roles does not necessarily translate into greater employment opportunities for their peers:
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28 among the 11 female-led enterprises in the sample, only two (KE_F1 and KE_F2) have more
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30 women than men working in them.
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35 It is perhaps instructive that the two female-friendly employers identified above are the only
36
37 ones in the female-led enterprise category that are structured as community-based
38
39 organizations (CBOs), rather than as conventional businesses. It is also instructive that
40
41 these two enterprises are the largest in the female-led category both in terms of size and
42
43 sale volumes, suggesting that the model does give a boost to substantive female
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45 participation, relative to other types of organization. The male-led enterprises in the sample,
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47 on the other hand, seem to thrive under a variety of organizational models, including the
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49 CBO model.
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54 CBOs, by definition, are formalized social networks which bring members together with the
55
56 explicit aim of advancing a set of shared goals which, though often socio-economic in
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58 nature, tend to be mediated by their focus on “bonding” relationships (Catherine Molyneux,
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60 Beryl Hutchison, Jane Chuma, and Lucy Gilson 2007). A CBO may be set up in the first

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3 instance by members of a community with common interests or problems (Abigail Barr,
4 Marleen Dekker, and Marcel Fafchamps 2015), or at the prompting of external development
5 actors responding to identified challenges within the community (A. R. Yakubovich, L. Sherr,
6 L. D. Cluver, S. Skeen, I. S. Hensels et al. 2016). The ubiquitous women's groups in Kenya
7 in particular and East Africa in general are examples of the former (Mary Gugerty and
8 Michael Kremer 2002; Maria Nzomo 2005).
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18 The case of KE_F2 illustrates how such a model works in practice. The group started out in
19 the early 1980s as a rotating savings and credit association with five women. Membership
20 quickly grew to 25 women, at which point the group was registered with the Kenyan
21 government as a CBO. When asked why the women in KE_F2 opted to formalize their group
22 into a CBO, the group representative responded:
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30 "We realized and we learnt that being together would give us a voice, would give
31 us some bargaining power in our activities and in whatever we do." – Female
32 ICS entrepreneur, KE_F2
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39 Subsumed within the broad notions of solidarity and collective empowerment suggested by
40 the quote above are more specific expressions of cooperation that link directly to the
41 productivity and profitability of individual members:
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47 "There are cases where maybe your stuff is not ready from the kiln and a
48 customer comes. So another advantage of the group is, you can go and borrow
49 from somebody and then you use until, when yours is ready you can pay back.
50 So that your customer doesn't go away because your stuff is not ready." –
51 Female ICS entrepreneur, KE_F2
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3 “Like now we’re in a group and I can ask you to assist me, we will finish faster.

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5 But if it is just me alone, it could even take me a week.” – Female ICS

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7 entrepreneur, KE_F2
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11 The quotes above highlight a very important dimension to the CBO model: that although
12 individuals take responsibility for their productivity and profits in principle, the social
13 component leaves room for members to fall back on one another for support when it is
14 needed – in the process helping to fill gaps occasioned by the women’s inadequate access
15 to important inputs such as labor. As the International Labor Organization highlights, this
16 kind of cooperation is particularly beneficial for small-scale enterprises in rural areas
17 operating within value chains dominated by more powerful external players (ILO 2011).
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28 The advantage for the female-led CBOs in our sample is heightened by the observation that,
29 although production and distribution functions typically suggest access to mass markets and
30 consequently high sale volumes (Mark C. Thurber, Himani Phadke, Sriniketh Nagavarapu,
31 Gireesh Shrimali, and Hisham Zerriffi 2014), it would appear that it is not sufficient for
32 female-led enterprises to simply be involved in those functions – or indeed in other “lower”
33 ones: outside of the two female-led CBOs, sale volumes are generally low for women, both
34 in absolute and relative terms.
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45 These observations are important for ICS practice as they indicate that, notwithstanding the
46 current enthusiasm among donors and practitioners over the possibilities of empowering
47 women through market-based enterprise, more socially centered models may be better
48 equipped to achieve the goal.
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55 The CBO model has been critiqued for its tendency to exacerbate existing socio-economic
56 inequalities within groups and consequently skew benefits towards more privileged
57 individuals (see, for example, Temilade Sesan 2014 and Mohammad Shahidul Hasan
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3 Swapan 2016). The evidence presented here however, though based on a limited sample,
4 provides support for recent calls in the literature to adopt “a push through community based
5 organizations” (Manjushree Banerjee and Rakesh Prasad 2015: 37) and an emphasis on
6 “community centric institutional arrangements” (Akanksha Chaurey, P. Krithika, Debajit Palit,
7 Smita Rakesh, and Benjamin Sovacool 2012: 54) if the benefits of energy access initiatives
8 are to reach the poorest.
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18 Whatever the specific shortcomings of the CBO model, the analysis here points to the need
19 to reimagine the forms of organization that are suitable for the women who are often the
20 subject of ICS entrepreneurship initiatives, rather than campaigning for their participation in
21 the market on the basis of externally conceived imperatives to increase ICS adoption rates
22 among their peers.
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30 *3. ICS sales are determined more by value chain hierarchy than by gender*

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32 As highlighted above, KE_F2, one of two female-led CBOs in Kenya which produces ICS
33 wholesale and sells to distributors across provincial lines, is one of the most productive and
34 profitable enterprises in the sample. However, this is the only female-led enterprise in the
35 sample that operates at that scale and level; the other enterprises in the category are
36 generally further down in the value chain, i.e., at the level of retail. The volume of production
37 for the preceding year reported by this CBO was exceeded by only one other enterprise in
38 the sample – a male-led international organization (KE_M1) that also uses a distributorship
39 model for its sales. The CBO is composed of 14 full-time members, bringing its reported
40 sales volume of 36,350 ICS to nearly 2,600 stoves per person in the past year.
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54 That the sales performance of the female-led CBO highlighted above was significantly higher
55 than those of all but one of the 19 male-led enterprises operating at the same level suggests
56 the lack of a gender-based advantage for the latter. As alluded to in earlier sections, what
57 does seem to matter for performance is an enterprise’s position in the value chain: when we
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3 compare the sales of all enterprises at producer/distributor level with those of all enterprises
4 only retailing to individual customers, we find that the former sold more stoves in the
5 immediate past year (in the thousands and high hundreds), though there is considerable
6 disparity in the distribution of sales among them. This indicates that the position of an
7 enterprise in the value chain is a better predictor of sales, and by extension, profits, than the
8 gender of its owner-manager.
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18 The question that arises from a gender perspective, then, is: are male-led enterprises more
19 likely to be operating at producer level than female-led ones, or vice versa? The evidence
20 presented in Tables 2 and 3 above appears to support the former: 19 out of the 27 male-led
21 enterprises (well above two-thirds) have a production and/or distribution component to their
22 business. This is compared to just over half of the enterprises in the female-led category that
23 produce and/or distribute ICS on some scale.
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33 While it is clearly useful to have men and women working synergistically within particular job
34 functions, it is important to pay attention to the types of arrangement that could potentially
35 deliver equitable benefits across both genders. As discussed above, CBOs would appear to
36 offer one such platform, particularly for the substantive employment of women across roles.
37 The evidence further suggests that these CBOs, whether they are male- or female-led, tend
38 to employ relatively high proportions of women in the role: the two CBOs in the sample
39 involved in production (KE_M2 and KE_F2) employ more women than men in the role – in
40 the case of KE_M2, thirty women to ten men. This is in contrast with only one of 35
41 conventional enterprises in the sample (UG_M1) that involves far greater numbers of women
42 than men in production roles (84 women to 36 men), though it is not clear from the data how
43 much of the economic gains accrue to individual women in the organization. This distinction
44 is important to make because, as described earlier, higher-up, production roles have the
45 potential to deliver greater economic benefits to men and women alike – and are thus
46 important for fulfilling expectations of economic empowerment for both genders.
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5 *4. Access to credit is a corollary of the relationship between gender and value chain*
6
7 *hierarchy*
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9 Limited access to credit for business expansion is a cross-cutting theme among all the
10 enterprises in the sample: all the interviewees, whether or not they had obtained some form
11 of credit in the past, cited inadequate financing as a major barrier to increasing their
12 production and/or sales volumes.
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19 The enterprises that have gained access to credit have been able to do so in spite of the
20 considerable difficulties experienced: the excessive bureaucracy involved in applying for
21 formal loans; the high cost of such loans; short repayment periods; “unreasonable” collateral
22 requirements; and slow turnaround times. Some of these challenges are evident in the
23 following quote from a male interviewee in Tanzania:
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32 “I have borrowed from a commercial bank but the interest rate was too much...
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34 The process was cumbersome and lengthy and in the end they provided 50
35 percent of what I was requesting... The collateral required to get financing and
36 the cost of that credit to small entrepreneurs like us is punitive.” – Male ICS
37 entrepreneur, TZ_M2
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45 Four out of the 11 female-led enterprises in the sample have accessed microfinance or
46 some other form of credit in their history. The corresponding access numbers for the male-
47 led category are 10 out of 27. This ratio (slightly more than one in every three male-led
48 enterprises) is roughly equal to that for the female-led enterprises, providing no evidence of
49 gender bias in access negotiation. Rather, the factor that unites both subsets is that the
50 majority (three out of four female-led and eight out of 10 male-led enterprises) are producers
51 and/or distributors, which is to say that they are relatively high up in the value chain. While
52 the relationship between value chain hierarchy and access to credit is not a deterministic
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3 one (two female-led producer enterprises in the sample have not succeeded in gaining
4 access, while one retailer has gained access, for instance), it is apparent that the majority of
5 the enterprises in the sample that have obtained credit at some point operate at higher levels
6 of the chain. This indicates that, while there are stringent barriers to entry across the board,
7 it is even more difficult for enterprises near the bottom of the value chain to gain access to
8 finance, whether they are male-led or female-led. Nevertheless, since the data show that
9 male-led enterprises are more likely than female-led ones to be ICS producers/distributors, it
10 follows that the former are more likely than their female counterparts to be able to access
11 credit for business expansion.
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24 This credit bias is reflected in the broader picture of external support given to female-led
25 versus male-led enterprises in the sample: while the former overwhelmingly receive in-kind
26 support from mostly international donor organizations in such areas as entrepreneurial
27 training, marketing and transportation, the latter receive support from a broader range of
28 sources, including government and academic institutions, with more of a credit component
29 (such as the facilitation of commercial loans and the extension of credit lines for stock
30 acquisition) to the support. Indeed, the two enterprises in the sample that cited access to
31 credit as having enabled expansion of their production/distribution operations are male-led
32 producers (KE_M6 and TZ_M3), both of which operate on a relatively large scale (defined in
33 terms of sale volume and firm size respectively). While the direction of causality is not clear
34 from the data, it is interesting to note the correlation between access to credit and business
35 expansion apparent here.
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51 This correlation is borne out by the findings from a recent study conducted in East Africa
52 (including in our three study countries of Kenya, Uganda, and Tanzania) by the Global
53 Village Energy Partnership (now Energy 4 Impact), in which the effects of loans on the
54 performance and sustainability of ICS and other energy enterprises were evaluated (Laura
55 Nolan 2016). The study found that enterprises that received commercial loans in addition to
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3 entrepreneurial training geared towards improving their financial literacy were more likely to
4 expand, and to do so by a wider margin, than those that received other elements of
5 entrepreneurial support but no loans.
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11 It is noteworthy that the CBO model described previously can provide an advantage to
12 enterprises in this regard, especially those that do not have sufficient collateral to access
13 conventional forms of credit. As the quote below from KE_F2 illustrates, individuals can use
14 the social capital inherent in group membership to obtain credit for their businesses in lieu of
15 financial or material resources:
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24 “So I’ll go to the [microfinance] bank and say I want a loan to boost my business,
25 they’ll have to come and check and see the business, what I’m doing. And then
26 use the group as security. So it’s like once they see what I’m doing, then on the
27 basis of that, like, okay, I’m in an established group and all. And you know what I
28 sell, a certain percentage goes to the group. You work as an individual, yes, but
29 you give a certain percentage to the group. So it is easier for them when they
30 come and see that I’m a member of the group and the group is active then it will
31 be easier for me to access the loan. Then the group is sort of security.” – Female
32 ICS entrepreneur, KE_F2
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45 The utility of this model for establishing access to group-based loans is illustrated by
46 the observation that all three CBOs in the sample (KE_M2, KE_F1 and KE_F2) have
47 obtained this sort of credit at some point in the past and paid back with at low interest
48 rates (1 percent in the case of KE_F1). Mixed results have trailed the establishment of
49 group credit platforms in various developing country contexts (see, for example,
50 Thierry van Bastelaer and Howard Leathers 2006, Xavier Giné and Dean S. Karlan
51 2014, and Indra Widiarto, Ali Emrouznejad, and Leonidas Anastasakis 2017);
52 nonetheless, the data in this case show that they can provide some improvement over
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3 the absolute lack of access to finance experienced by many small-scale enterprises in
4 those contexts. Importantly, the relative affordability of group-based loans can give
5 such enterprises an opportunity to compete more favorably with bigger ones in the
6 value chain while keeping their businesses viable (Christopher Ksoll, Helene Bie
7 Lilleør, Jonas Helth Lønborg, and Ole Dahl Rasmussen 2016).
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16 **Discussion and conclusions**

17 This paper has critically examined the current emphasis in the ICS sector on leveraging the
18 relational and entrepreneurial skills of women in the global campaign to achieve widespread
19 uptake of improved cookstoves. Advocates see an opportunity to empower women
20 economically by engaging them actively in supply-side operations, particularly marketing and
21 retail – effectively casting them in the role of “last-mile” entrepreneur. The premise of this
22 focus on women is that they have greater influence over female users who traditionally do
23 most of the cooking and are assumed to have greater relevance in ICS adoption decisions.
24 A number of recent interventions have attempted to bolster the capacity of female ICS
25 entrepreneurs, one of the most notable being an Alliance-sponsored “empowerment training”
26 program that addressed the psychosocial roots of individual agency (or the lack of it), with
27 encouraging results for the women involved (Shankar, Onyura, and Alderman 2015b). The
28 paper argues that this approach to empowerment, while innovative and important, does not
29 reflect crucial dimensions of gender-based disparities in the sector – notably, where female-
30 led enterprises are placed relative to male-led enterprises in the value chain. This is
31 important because, as our analysis shows, value chain hierarchy is positively correlated with
32 sale potential, and female-led enterprises are underrepresented at the higher levels of the
33 chain (i.e. production and distribution) where mass markets are more likely to drive higher
34 sales and revenues.
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58 There are a number of limitations to the study. First, the analysis was done on the basis of a
59 relatively small but geographically representative sample of ICS enterprises in East Africa.
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3 Further, it focused on comparison at the level of the firm, leaving unexamined important
4 intra-firm dynamics that could shed light on how gains are distributed among male and
5 female workers within those firms. And finally, while the analysis has shown that more needs
6 to be done by mainstream actors to expand opportunities for female-led enterprises in the
7 ICS sector, what is less clear from the data set is how the women themselves conceive of
8 empowerment, and the tensions with established social norms that may become apparent in
9 the process (see, for example, Linda Mayoux 1998; Meena Khandelwal, Matthew E. Hill,
10 Paul Greenough, Jerry Anthony, Misha Quill, Marc Linderman, and H. S. Udaykumar 2016).
11 Nevertheless, the analysis is novel for the contribution it makes to the understanding of
12 female entrepreneurs' relative positioning and potential for growth in the ICS sector.
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26 Drawing on data from three East African countries – Kenya, Uganda, and Tanzania – the
27 paper analyzed the inputs (especially finance) and outputs (measured in sale volumes for
28 the immediate past year) of 38 ICS enterprises through the lens of gender – specifically, the
29 gender of the owners or managers of those businesses. Our findings show that gender does
30 seem to matter for performance, but only so far as it relates to the ability of individual
31 entrepreneurs to enter the ICS value chain at the higher levels, which in turn influences key
32 outcomes such as access to mass markets and access to finance for business expansion.
33 The findings indicate that greater attention needs to be paid to where female-led enterprises
34 in particular are located in the value chain, as it is this relative positioning – rather than the
35 gender of individual managers *per se* – that determines the profitability (and, by extension,
36 the efficacy as a tool of for economic empowerment) of ICS enterprise.
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51 The finding of the study that male-led enterprises are better represented than female-led
52 ones at every level of the value chain (with the exception of retail) could be interpreted as
53 providing justification for just getting more women into sector, like mainstream actors
54 advocate. The argument in this paper goes a step further: if economic empowerment for
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3 women is a corollary objective of engaging them in ICS enterprise, then greater emphasis
4 should be placed on involving them at higher levels of the value chain.
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9 The association between positioning and profitability is an important one to make given that
10 many of the recent efforts to integrate women into ICS markets have been focused on
11 engaging them in last-mile operations, a strategy which inevitably situates them at the lower
12 end of the value chain (Nozipho Wright 2013; Gill et al. 2015, Shankar, Onyura, and
13 Alderman 2015a, b). To better harmonize the economic empowerment goals of global
14 advocates and the profit aspirations of local entrepreneurs, this focus on the bottom needs to
15 be complemented by a greater push towards the top of the chain for women.
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26 It is perhaps noteworthy that a closer reading of the findings of the Alliance-sponsored
27 randomized controlled trial described earlier suggests that the Alliance's emphasis on
28 employing women as last-mile agents may not be as essential for increased ICS uptake as
29 assumed, as the study found the effect of location on sales to be similar to that of gender.
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31 Though the results show that "[w]omen outsold men by a margin of nearly 3 to 1" (Shankar,
32 Onyura and Alderman 2015a: 67), this finding takes on less significance when a distinction is
33 made between "active" sellers (men and women who sold more than eight ICS over the
34 eight-month monitoring period) and "non-active" sellers (those who sold just one ICS or none
35 at all over the same period). According to the authors, the primary predictor of participants
36 emerging as active sellers was empowerment training: those who had gone through the
37 treatment were nearly thrice as likely as the control group to sell more stoves, regardless of
38 gender. Gender did have an effect – women were more likely than men to be active sellers
39 overall – but it seemed to be the same as the effect of operating in an urban context: "being
40 female or living in an urban area more than doubled the likelihood of being an active seller"
41 (Shankar, Onyura and Alderman 2015a: 73).
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3 The above argument does not detract from the thesis that women have an advantage in
4 selling ICS to their peers. Indeed, the Shankar et al. study cited above highlights what may
5 be the most convincing case for involving women in ICS marketing and sales: they found
6 that customers had more positive impressions and experiences of the product in the
7 immediate and long term when they purchased it from a female (rather than a male)
8 entrepreneur. It is important, however, to distinguish the qualitative impacts evident here
9 from expectations of an exponential increase in ICS adoption rates delivered by women
10 working on the home stretch. Once this distinction is made, it becomes clear that the widely
11 acclaimed peer-to-peer sales model may not be the short cut to simultaneously achieving
12 the twin goals of economic empowerment and widespread ICS uptake that many
13 mainstream actors believe it to be. To reiterate, women do make an important contribution to
14 the sector as last-mile purveyors of ICS technologies, but the most significant impacts on
15 uptake appear to be qualitative and may not necessarily be compatible with the goal of
16 economic empowerment simultaneously targeted by mainstream ICS actors.
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35 Indeed, the most productive and prosperous female entrepreneurs in the study sample work
36 in a group with access to markets beyond their immediate locality, selling mostly to regional
37 and national distributors rather than to their peers in neighboring villages. This arrangement
38 has resulted in greater evidence of economic empowerment for the women (as well as far-
39 reaching stove diffusion) than that shown by the peer-to-peer model. It is worth noting that
40 this has taken place in the context of a community-based organizational structure that
41 encourages flexibility and mutual support at work while protecting profits for the women.
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50 Further research would go beyond making the case for individual agency to scrutinizing the
51 broader societal and structural frameworks that circumscribe participation in ICS enterprise,
52 as entrenched inequalities at this level can constrain women's ability to benefit from
53 seemingly inclusive community-based schemes (see, for example, Cornelia Fraune 2015).
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58 This would be an especially valuable addition in an era where market orthodoxy dominates
59 the ICS discourse regardless of how the gains are being distributed.
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Declaration

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

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For Peer Review Only

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

	<i>Kenya</i>		<i>Uganda</i>		<i>Tanzania</i>	
	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

For Peer Review Only

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%)

For Peer Review Only