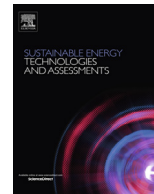




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Original article

## Sawdust pellets, micro gasifying cook stoves and charcoal in urban Zambia: Understanding the value chain dynamics of improved cook stove initiatives

Iva Peša

Centre for Frugal Innovation in Africa, African Studies Centre, Leiden University, PO Box 9555, 2300 RB Leiden, The Netherlands

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## ABSTRACT

In urban Zambia one initiative for sustainable energy provision has been the introduction of micro gasifying cook stoves and sawdust pellets to replace cooking on charcoal. From 2010 onward several commercial companies – with various organisational structures – have been trying to market these stoves to low-income households, with varying degrees of success. This paper will explore the value chain dynamics of these improved cook stove initiatives to see whether organisational set-up influences stove adoption and market penetration. It is argued that initiatives to market improved cook stoves can, paradoxically, learn a lot from the existing charcoal value chain and its marketing structure. Improved cook stove initiatives have to be understood within a technical, social and economic context, as people, markets and locality matter and one size does not fit all.

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## Introduction

Zambian urban cooking has been dominated by charcoal (*mala-sha*) and iron braziers (*mbaula*) since at least the 1930s [14]. Even if among some wealthier households cooking on electricity has gained sway, charcoal braziers are still retained as a backup in case of electricity outages and for cooking ‘slow’ dishes, such as beans or dried fish [6]. Nonetheless, due to the health hazards posed by indoor air pollution and the environmental effects of high levels of deforestation, charcoal use has started to receive severe criticism from various ‘social innovations’, which have aimed to substitute charcoal with sawdust pellets and micro gasifying cook stoves [7,6]. Although improved cook stoves (ICS) have been tested and disseminated in Zambia since the 1970s, a new impetus was given from 2010 onward when the combination of sawdust pellets and micro gasifying cook stoves was first successfully marketed (Interview with Mattias Ohlson, Lusaka, 01 October 2014). Several commercial companies – in collaboration with NGOs, charity foundations, donors and government institutions – have been trying to market this technology to low-income households, claiming environmental, health and financial benefits upon adoption (Interview with Samuel Bell, Lusaka, 05 October 2014). The introduction and promotion of ICS has been framed within discourses of ensuring ‘Sustainable Energy for All’ at the ‘Bottom of the Pyramid’

[6; [www.se4all.org](http://www.se4all.org)]. These initiatives can be seen as examples of ‘social entrepreneurship’, as they create ‘new models for the provision of products and services that cater directly to basic human needs that remain unsatisfied by current economic or social institutions’ [24: p. 243–4]. Because ICS promotion primarily aims to create social, rather than purely economic, value, it requires novel business models, organisational structures and strategies [13]. ICS promotion necessitates social innovation, which entails multi-stakeholder partnerships, networks and value chains, as well as innovations in organisational form and operational models [22].

Yet attempts to promote ICS in urban Zambia have enjoyed varying degrees of success. Zambia thus provides an excellent case to study whether institutional infrastructure and organisational set-up influence the adoption of ICS initiatives [7]. Looking at organisational aspects is important for understanding the adoption of an innovation, because an innovation must always ‘integrate itself into a network of actors who take it up, support it, diffuse it’ [2: p. 203–4]. Essentially, ‘the fate of an innovation depends on the active participation of all those who have decided to develop it (...) [This is an] immense collective undertaking which assumes the active support of all participating actors’ [3: p. 208]. It is useful to follow the ICS value chain, as this ‘describes the full range of activities which are required to bring a product or service from conception, through the intermediary phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final

E-mail address: [iva.pesa@history.ox.ac.uk](mailto:iva.pesa@history.ox.ac.uk)

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disposal after use' [15: p. 8]. Zambian examples endorse that 'the sustainable adoption of low-carbon technologies is conditioned not only by the technologies themselves, and on how they are provided, but also depends on how processes of technology development, financing, transfer and adoption connect with the institutional infrastructures at the local level' [19]. Whereas technologically Zambian ICS initiatives do not differ markedly from one another, they do differ in organisational set-up and value chain dynamics [16]. It is therefore crucial to examine how initiatives to introduce ICS attempt to 'build the social structure of a market' [20]. Whereas one company has focused on becoming a for-profit, self-sustaining business by marketing high-quality but expensive stoves, another company has partnered with NGOs and donors and has tried to serve the low-income market ([www.emerging.co.zm](http://www.emerging.co.zm); [www.aaaa.no/home-energy](http://www.aaaa.no/home-energy)). Despite their very different approaches, these initiatives face numerous struggles. This paper will explore the value chain dynamics of several ICS initiatives to see whether organisational set-up influences stove adoption and market penetration.

Initiatives to promote micro gasifying cook stoves and sawdust pellets strongly denounce charcoal, labelling it the 'old', 'unhealthy' and 'environmentally polluting' fuel [28]. Yet charcoal is the main competitor to ICS adoption, as the charcoal value chain is organised in a highly efficient manner and it generates livelihoods for numerous people [12]. ICS initiatives have not yet managed to replicate such a value chain and this organisational limitation is the main reason behind the non-adoption of ICS so far [8]. Micro gasifying cook stoves and sawdust pellets have insufficiently managed to create their own value chains which can generate local employment and profits. By adopting ICS, consumers would put charcoal burners, transporters, retailers and market women out of business [12]. Thus, even though adopting sawdust pellets might save costs when compared to cooking on charcoal, sawdust pellets have not managed to socially construct a marketplace which is able to compete with the moral economy of charcoal [8]. Whilst sawdust pellets and micro gasifying cook stoves might be economically rational from an individual consumer perspective, they are not rational when viewed from the perspective of the economic and social logic of the market as a whole [10]. The NGO SNV understands this paradox and has tried to market ICS and charcoal briquettes through the charcoal value chain (*mbaula* producers now manufacture ICS and market women who sell charcoal additionally offer charcoal briquettes) (<http://www.snv.org/theme/sustainable-markets-energy>). This paper aims to understand how the organisational infrastructure of charcoal influences the adoption and marketing of micro gasifying cook stoves and sawdust pellets.

The approach taken in this paper differs from existing studies on ICS, firstly by placing technology in a broader societal setting [18,11]. It will be argued that technology is only a small part of ICS adoption ([1] warns for 'technosaviorism'). Secondly, various organisational approaches and alliances to promote ICS, which can be more or less effective, are outlined, without suggesting that there is one best practice (i.e. a market-led approach or social entrepreneurship) [7]. Thirdly, it is suggested that economic rationality and organisational efficiency might be located in unexpected places – that charcoal provides an example of an efficient value chain, moral economy and market logic from which ICS initiatives have much to learn [8]. ICS initiatives have to be understood within a technical, organisational, social and economic context, as people, markets and locality matter and one size does not fit all [16]. This paper is based on research conducted in Zambia, in the cities of Kitwe and Lusaka, during September–November 2014 and July–September 2015. Next to a study of unpublished reports and secondary literature, this research has relied heavily on interviews with representatives of ICS companies (social entrepreneurs), ethnographic research among users and non-users of ICS technolo-

gies and a study of actors in the charcoal value chain.<sup>1</sup> The paper is organised as follows: The section "Organisational models for introducing ICS in urban Zambia" will provide an overview of two distinct initiatives to promote ICS, focusing on their different organisational structure and questioning whether organisation, technology or business models influence market penetration. "The Charcoal value chain as a competitor to ICS adoption" examines the charcoal value chain to see how it influences ICS adoption. The concluding section will bring ICS and charcoal together, analysing the importance of value chain dynamics to understand fuel adoption decisions. The conclusion also reflects on the developmental relevance of this study and provides some suggestions for future research on ICS.

### Organisational models for introducing ICS in urban Zambia

From the 1930s onward, when fast rates of urbanisation made cooking on wood impractical, charcoal and braziers started to dominate Zambian urban cooking [9]. Charcoal is easier to preserve and transport than wood logs, but to produce 1 kg of charcoal as much as 6–10 kg of wood are required [23]. Charcoal has thus been blamed for widespread and rapid deforestation, as well as for other social ills, such as indoor air pollution and persistent poverty and marginalisation, especially of female charcoal users [28]. Starting in the 1970s universities, government departments and NGOs have experimented with alternatives to reduce charcoal use in Zambia. Coal briquettes and various improved cook stoves (with more efficient combustion principles or less smoke production than *mbaula* stoves), such as the Kenya Ceramic Jiko, have been tried (Interview with John Banda, Kitwe, 21 November 2014). These initiatives were of limited scope, though, remaining stuck in the test phase or reaching only a handful of households.

In 2007 one environmentally minded Zambian social entrepreneur noticed that the wood processing industry on the Copperbelt produced large amounts of sawdust waste, which has limited use. On a training course abroad he learnt that sawdust can be converted into cooking energy. Realising the potential of sawdust waste as cooking energy, he got in touch with the Swedish International Development Cooperation Agency (SIDA), who have expertise in pelletising technologies (Interview with Sonta Kauti, Lusaka, 05 October 2014). SIDA contacted a Swedish company interested in pelletising sawdust in Zambia and together these Swedish and Zambian entrepreneurs started to experiment with producing fuel efficient sawdust pellets (Interview with Mattias Ohlson, Lusaka, 24 October 2014). In 2010, after prolonged experimentation and testing, the commercial company Emerging Cooking Solutions started to cater for 40 households: 'By pelletizing agro- and forestry waste we upgrade unwanted waste to a 100% renewable biofuel – and sell it cheaper than the competing unsustainable alternative: Charcoal' (<http://emerging.se>). The company has forged numerous partnerships, relying on funding from NGOs, charities and government institutions, to create a truly social innovation (<http://emerging.se/partners/>). Although the company aims to reach financial self-sustainability, it equally pursues environmental, social and economic value creation [7,13]. From the outset the target community consisted of low-income consumers in an area where charcoal use is high (St. Anthony's compound Kitwe; Interview with Mattias Ohlson, Lusaka, 24 October 2014). High-end Philips stoves (costing USD100) were marketed, but attempts were made to subsidise high stove costs through profits from pellet sales (<http://www.africancleanenergy.com/>). A charitable donation enabled subsidised stove sales for USD60 and payment in

<sup>1</sup> Interviews have been conducted by the author in Lusaka and Kitwe in English and/or iCibemba. Maria Kankondo and Lyness Mumba Lubemba provided research assistance and translated from iCibemba to English.

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