Energy Research & Social Science 15 (2016) 34–44

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

Behave and save? Behaviour, energy efficiency and performance of micro and small enterprises in Uganda

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ARTICLE INFO

Article history:
Received 30 June 2015
Received in revised form 3 March 2016
Accepted 7 March 2016

Keywords:
Energy efficiency
Behaviour
MSE
Uganda
Manufacturing

ABSTRACT

This paper analyses the role of behavioural factors for the energy management of MSEs in Sub-Sahara Africa for the first time. Drawing on semi-structured interviews and focus group discussions in Uganda, it finds that behavioural barriers impeding energy efficiency contribute to the limited performance of MSEs in Uganda. Limited self-control and short-term thinking, habits, a status quo bias and a lack of trust impede the uptake of energy efficiency, while first-hand experience with efficient technology, implementation intentions and social learning can be conducive. Behavioural insights on energy efficiency therefore present another piece of the puzzle on MSE performance.

1. Introduction

Manufacturing micro and small enterprises (MSEs) such as grain millers or metal fabricators use vast amounts of energy in the production process. In developing countries, energy costs therefore often take up a large share of the business expenses that an MSE has. This should be an incentive for MSE owner-managers to invest in energy efficient technologies and/or change towards more energy efficient business practices but as many studies show they don't do it—why? Risk aversion of the poor has long been the response to this question, but it does not always hold anymore (e.g. Ref. [15]). This contribution argues that behavioural factors play an important role for energy efficiency uptake which, in turn, also influences the performance of MSEs. Up to date, economic research on the role of electricity access and energy management[1] for MSE performance has largely ignored behaviour change [25,44,51,46].

Research on behavioural insights to energy consumption in industrialised countries has shown that factors such as more explicit feedback on people's energy consumption and the framing of energy saving messages [6,1] or the endowment effect [52] may explain respective market and policy failures. These failures are known to lead to the so called energy efficiency gap, the unexploited energy and financial savings offered by investments in energy conservation [5,32]. Another behavioural explanation may be the endowment effect. It describes the situation when an individual keeps an inefficient device, even though it is costly, simply because he/she already owns it. The cognitive difficulty to forego short-term temptations and instead invest in long-term benefits relates to self-control problems [55,61] and a bias towards the present [38]. In industrialised countries, these self-control problems influence the effects of product taxes and efficiency standards [55]. It is still unclear under which conditions and how exactly these challenges apply to energy consumption in developing countries. There is no sufficient knowledge yet which factors are relevant as drivers or barriers for MSEs, how they relate to other challenges of the MSEs and how the behavioural barriers could be overcome.

This article asks if and how behavioural drivers and barriers influence the current state of energy management in Ugandan MSEs. Results will be discussed in the light of the performance of the MSEs and the non-behavioural challenges the businesses face in day-to-day operations, indicating causal links between behaviour and performance where possible. The contribution takes an innovative interdisciplinary approach combining development economics, behavioural sciences and environmental psychology. The analysis is based on 45 semi-structured interviews with both energy intensively producing MSEs and experts in Uganda as well as focus group discussions with the MSEs.

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[1] Energy management is defined here as all practices of tracking/planning energy use and energy saving.

http://dx.doi.org/10.1016/j.erss.2016.03.001
2214-6296/

2. Literature review

2.1. Entrepreneur characteristics and behaviour

Entrepreneurs' education and training levels, gender, risk taking ability, insufficient technological capacities to upgrade as well as general business skills and managerial competence are all relevant for MSE performance, both in Uganda and in other developing countries [35,41,47]. While there are indications that the motivation of entrepreneurs matters for the growth and performance of the business [11], no systematic work on the psychology of entrepreneurs' decision-making in developing countries exists.

Since many of these MSE owners/managers live in poverty, it is possible that they have limited cognitive self-control capacities due to the conditions of poverty itself [30]. As Haushofer and Fehr [30] argue, poor people are not intrinsically more risk averse and have different time preferences than richer people, but safer options simply help to alleviate the most pressing problem of liquidity constraints. This could mean that there is another underlying psychological mechanism: cognitive control. Indian sugar cane farmers show a lower cognitive control in poorer pre-harvest times than in richer post-harvest times [40]. Having to manage a limited budget reduces poor people's performance on subsequent self-control tasks such as the ability to ignore distractions [50]. The exact relationship between poverty and self-control is not yet clear. Risk aversion or limited cognitive control present two different starting points for analyses of poor people's behaviour.

To some extent, difficulties with self-control and delayed gratification explain choices for immediate benefits. The preference for smaller rewards in the near future instead of larger rewards at a later point in time is called the immediacy effect [38]. This focus on the present or the immediate future may be more strongly pronounced among the poor, leading to a neglect of other issues [30,40]. The existence of this immediacy effect among the poor has been confirmed in India [62], Ethiopia [65] and Vietnam [66]. But it is still unclear whether entrepreneurs pay a similar "cognitive tax" [40] and whether it makes a difference whether decisions concern energy management in the business or not.

Within behavioural economics, empirical work on energy efficiency in developing countries is sparse. For industrialised countries, different studies have shown that comparative feedback on energy consumption, e.g. on meters or bills, and framing of the issue [6] are conducive to energy saving choices. Additionally, wrong estimations of fuel usage among car buyers show that decision-making shortcuts leading to hyperbolic discounting exist [7]. This could influence the calculation of amortisation time for energy efficiency investments. In line with the insights of psychology, inconsistent time preferences relate to self-control problems and temptation [55].

People's stronger reaction to losses than to gains (loss aversion), the preference to keep technologies or appliances already owned (endowment effect), and simplified, up to date information (salience effect) are also likely to influence investments in energy efficient technologies [58]. Here, a research gap in both industrialised and developing countries exists, especially concerning MSEs. Ghosh and Roy [19] identified a general resistance to change as a barrier to energy efficiency among Indian MSEs. A preference for the status quo according to which every change to a situation is perceived as a loss [49] could be responsible here or a deeply engrained habit, but the authors do not provide further analysis. Providing a rare study on non-financial factors influencing energy SME upgrading in Ghana, Senegal, Tanzania and Zambia, Haselip et al. [28] stress the relevance of human capacity, entrepreneur motivations and socio-cultural factors such as the need to convince consumers of the technologies' benefits and the tendency of entrepreneurs to avoid banks for borrowing money. Trust is also not a factor in traditional economic choice theories, but it matters in the uptake of new products in developing countries [20].

2.2. The role of energy for MSE performance

Neoclassical economists and proponents of endogenous growth theories conceptualise energy as a minor issue contributing to the performance of firms, while ecological economists often see it as pivotal for development. The empirical evidence for both positions is rather thin [25]. Incentives for energy efficiency differ between business sectors and according to firm size; they depend on electricity prices [14].

Using data from the World Enterprises Survey from 29 countries (excluding Uganda), Cantore [14] finds that less energy intensively producing firms are more innovative and that energy efficiency and multifactor productivity are likely to influence each other. The commitment of top management in larger firms and micro economic factors, rather than external conditions, is found to be crucial for the promotion of energy efficiency. The study is limited to formal enterprises with at least five employees. Since the vast majority of Ugandan MSEs operate in the informal sector, these insights are only marginally useful.

Various studies have shown that electricity access does not automatically lead to better firm performance in developing countries—evidence is mixed [25,12,48,44,26]. Analysing small and medium sized enterprises in Sub-Saharan Africa with more than 10 employees, Kaulich et al. [36] find that lower levels of energy intensity are associated with export activity, foreign ownership, firm size and productivity, while higher levels of energy intensity are associated with capital intensity and the share of fuels in total energy consumption. They do not find a significant correlation with the age of capital equipment, ownership of a generator, or presence of a certified management system—which may be due to their low number of observations. Analysing survey data from 171 Ugandan firms, Reinikka and Svensson [46] show that poor electricity infrastructure reduces productive investments by firms. MSEs with energy-intensive production such as grain millers, metal fabricators or brick makers are particularly sensitive to electricity prices. For these types of business, there is clearer evidence that high electricity costs and energy intensity negatively affect performance [43,51,45].

Generally, technology adoption and upgrading by firms in developing countries is affected by a range of factors (for an overview see Ref. [29]). Rogers [64] argues that both the perceived attributes of the technology and the firms' characteristics influence adoption, outlining five factors: relative advantage, comparability, complexity, trialability and observability. The compatibility with previous, ideas, needs and beliefs could be understood as related to habits, risk and loss aversion; trialability, defined as the degree to which an innovation can be experimented with ([64]: 243), is linked to the brain's capacity to better process "real"-life objects than pictures [54]. These behavioural factors underlying Rogers' innovation characteristics may be crucial to the acceptance of a new technology.

The socio-political, community and market acceptance conditions [60] for energy technologies differ between Sub-Saharan African countries, for instance between Uganda [17,39] and Burkina Faso [10]. Investment costs can be the key barrier, overriding access to information, taste preferences and women's roles [10] or part of a combination of these factors [39]. Drawing on Rogers' diffusion theory, Eder et al. [17] show that the emphasis of the relative advantage of the technology, a viable financial system for adopters and the collaboration of foreign with local firms have been crucial to the acceptance of biogas in Tiribogo. These factors may be particularly relevant for this study. The roles and relation of behavioural and non-behavioural factors for energy efficiency improvements and