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If you can't stand the heat, get into the kitchen: obligatory passage points and mutually supported impediments at the climate–development interface

Gregory L Simon

Department of Geography and Environmental Sciences, University of Colorado Denver, Denver, CO 80217-3364, USA

Email: gregory.simon@ucdenver.edu

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This paper examines the recent integration of cookstove dissemination activities into the global carbon economy. The concepts mutually supported impediments and obligatory passage points are used to advance our understanding of win–win outcomes at the climate–technology–development interface. Focusing on the recent integration of cookstove dissemination activities into the global carbon economy, these concepts provide a theoretical foundation for advancing geographical perspectives on the spatial allocation of control over technology-based development projects. Each concept highlights household cooking spaces as informal sites for activating alternative development potentials under carbon financing. Given that programme success – in both development and climate objective areas – ultimately rests on the willingness of female stove-users to adopt improved cooking technologies and commit to their long-term use, this paper articulates a clear framework that emphasises the need for close and substantive dialogue between project officers, local manufacturers and targeted households; hence the need for diverse programme decision makers to 'get into the kitchen' when generating strategies that improve both household-scale development and carbon-reduction outcomes.

Key words: *carbon, cookstoves, development, household, technology, win–win*

Introduction

For nearly half the world's population, rudimentary cookstoves are essential and culturally significant technologies. They contribute to the organisation of rural household matters ranging from domestic architecture and familial division of labour to fuel collection activities and cooking practices. Traditional cooking technologies in developing nations are also blamed for smoke-induced respiratory illnesses, elevated levels of deforestation, women's exposure to unsafe environments, slowing rates of human development, and climate forcing black carbon and greenhouse gas emissions (Smith *et al*. 2000). In response to these concerns, numerous government and non-profit ventures are working to transition whole regions away from traditional stoves and towards cleaner and more modern cooking devices (Simon *et al*. 2014). Today, a number of multi-million dollar international programmes are expediting this transition through large-scale stove replacement interventions (Simon *et al*. 2012).

It is in the context of these increasingly widespread activities that this paper intervenes. Using the concepts mutually supported impediments and obligatory passage points, the following pages advance theoretical insights that refine our understanding of (a) the allocation of control within development programmes under the emerging investment paradigm of carbon finance and (b) the role of cooking spaces as geographical sites for crafting alternative household-acceptable development trajectories.

In order to advance theories on how 'win–win' objectives are achieved at the climate–development interface, this paper builds on scholarship examining the political spatialities of carbon-financing and technology-based development (Bumpus and Liverman 2008; Newell and Bumpus 2012; Simon *et al*. 2012). Through this analysis we are able to refine our understanding of capital flows for 'clean development' and their implications for articulated programme beneficiaries (Newell and Paterson 2010). Cookstoves, in particular, are one of the few explicit technology-based development interventions experiencing an inflow of carbon finance (Limmeechokchai and Chawana 2007). Accordingly, this analysis articulates the role of cookstoves in international carbon markets and assesses how mitigation responsibilities are distributed under carbon offsetting activities (Wolf *et al*. 2009; Marino and Ribot 2012).

Use of the concepts mutually supported impediments and obligatory passage points helps advance geographical perspectives on the spatial allocation of control over technology-based development projects (Simon 2010) and extends the work of others who have highlighted the influence of local exigencies in determining programme outcomes (Bakker and Silvey 2008; Gibson *et al*. 2010; Silvey and Rankin 2011). This paper argues that households – informed by their stove preferences – function as informal sites for activating alternative technology design and development potentials and suggests that household-scale spaces require greater attention (e.g. Biehler and Simon 2011) when illuminating efforts to resist and limit the unfettered global carbon economy.

Win-wins, carbon financing and the Global Alliance for Clean Cookstoves

Mediating the climate–development interface: cookstoves as hub technologies

Over half the world's population rely on traditional biomass burning stoves for heating and cooking activities (World Health Organization 2009). In many countries, 80–90 per cent of rural residents use rudimentary stoves and solid fuels such as wood, crop residue, charcoal, coal and animal dung. These traditional stone and clay cookstoves emit toxic fumes and fine particles that lead to severe health problems and lower respiratory illnesses for exposed household members (Prüss-Üstün and Corvalán 2007; Lim *et al*. 2013). These fumes contribute to nearly 2 million deaths per year, primarily among women and children (Lim *et al*. 2013).

To confront this global health crisis, the Global Alliance for Clean Cookstoves (henceforth, the Alliance) was created in 2010 to support the dissemination and adoption of clean cookstoves and fuels in 100 million homes by 2020.[1] Under the Alliance, the cookstove is treated as a hub technology capable of confronting and solving not only the problem of noxious indoor air pollution, but also a broad array of other development and environmental issues (see Table 1). In its first few years of operation, the Alliance has achieved considerable success leading to the installation of tens of thousands of stoves. As such, this paper should certainly not be read as an indictment of programme policies.

The win–win scenario debate

Win-win objectives are routinely deployed in development projects to generate benefits for one group while simultaneously advancing the desired goals of other entities. These corollary wins are referred to as 'co-benefits' because they enable projects to deliver assistance to diverse groups. The rapid advancement of win–win objectives has not come without its detractors, however. Many in geography have viewed such scenarios with

Table 1 Delineation of wins in the Global Alliance for Clean Cookstoves

Issue	Description
Gender and development	• Women and girls spend up to 20 hours searching for fuel wood in areas with diminishing resources, leaving less time for other tasks and income-generating activities. • The collection of fuel wood can put women and girls in dangerous and isolated environments far away from home.
Human health	• Wood, coal, dung and crop residues produce smoke and toxic fumes that cause acute health effects such as child pneumonia, lung cancer and obstructive pulmonary disease. • Traditional stoves with uncontained flames can cause burn injuries, disfigurements, infections and even death.
Forest protection	• Elevated reliance on wood fuel for cooking can place pressure on local forests. • Unsustainable harvests can contribute to mudslides, watershed damage, desertification and decreased food security.
Outdoor air pollution	• Biomass and coal-fired stoves that vent into outdoor settings make significant contributions to, and exacerbate, poor ambient air quality in towns and cities.
Climate change	• Inefficient combustion of solid carbon-based fuels contributes to climate change through the release of gases including methane, carbon monoxide and nitrous oxide and small particulate matter such as black carbon.

Source: Global Alliance for Clean Cookstoves (2011) considerable scepticism (Forsyth 2007; Marino and Ribot 2012). Here, proposed outcomes where 'everyone wins' are seen simply as rhetorical strategies for mollifying counter concerns in order to advance a single privileged agenda (Campbell 2009).

Carbon mitigation programmes, in particular, have been shown to produce programme benefits and burdens that accumulate in geographically and socially uneven ways (Simon *et al*. 2012). These patterns are particularly evident where wins accumulate in developed nations comprised by carbon emitters, while burdens (or at least far fewer benefits) reside in developing nations (Bridge 2011). This paper however, does not assume that wins and losses accumulate in a polarising manner or that such dichotomous outcomes are predetermined. Nor does it presume that actors in carbon emitting nations necessarily determine the allocation of benefits. Rather, this study suggests that targeted households are influential mediating agents capable of shaping programme success, and that it is precisely because objectives are presented as win–wins that allow control over programme outcomes to reside within households.

Through this analysis we are able to articulate the emergence of alternative development trajectories (Sheppard *et al*. 2009) that comply with, and indeed are generated through, informal spaces of social engagement (Bakker and Silvey 2008). In the case of cookstoves under carbon finance, these tactics reflect the priorities of female household members in rural settings. By considering home environments as spaces that are simultaneously acted upon and activated in the development process (Gibson-Graham 2006), we can generate fine-grained interpretations of carbon-based development 'wins' (Lovell and Liverman 2010). Connecting household-scale stove performance imperatives with global-scale flows of carbon finance allows us to challenge the frequent characterisation of the international carbon economy as a hegemonic and inviolable force (Wolf *et al*. 2009; Dowling 2010; Bridge 2011).

Carbon finance and the shift towards distribution scale-up and technology standardisation

In order to strengthen supply chains, pursue production efficiencies and maintain sustainable distribution markets, the Alliance supports several market-oriented distribution strategies that reflect, in part, the influence of black carbon and carbon-based greenhouse reduction objectives. Over the past 10 years, the stove sector has seen a steady rise in carbon-financed stove projects.[2] As of May 2013, carbon finance supported approximately 75 cookstove clean development mechanism (CDM) projects.[3] Along with greenhouse gas emission reductions, researchers estimate that solid fuel cookstoves emit roughly 18 per cent of global black carbon emissions, which were recently recognised as a major climate change contributor (Ramanathan and Carmichael 2008; Bond *et al*. 2013).

Carbon finance frameworks bring greater urgency to shape stove dissemination around the themes distribution scale-up and technology standardisation because carbon investors hold responsibility for unrealised results and thus have an incentive to increase stove uptake rates. Delivering stoves at scale and with levels of technological consistency has become a prominent dissemination strategy (Bailis *et al*. 2009; GVEP International 2009), and particularly under carbon financing (Kuteesa 2009) because carbon markets require (a) high-volume projects to reduce total transaction costs and generate sufficient greenhouse gas reductions, (b) technologies designed to achieve specified carbon reduction performance requirements and (c) standardised emissions inventories and reduction calculations that accurately measure greenhouse gas emission offsets (Simon *et al*. 2012).

Mutually supported impediments and obligatory passage points

Scale-up and design standardisation: anatomy of a mutually supported impediment

The case of improved stove distribution under carbon financing presents an opportunity to examine mutually supported impediments (MSIs) and their influence on programme success. MSIs arise when the conditions and requirements for attaining one set of project goals directly undermine progress towards achieving another set of goals (Simon *et al*. 2012). Like other programmes constructed around tightly woven climate–development implementation strategies, cookstove programmes may trigger MSIs that negate success in multiple programme areas. The likelihood of inciting MSIs is particularly high in modern stove projects because both climate and development goals are routed through a single technology – the cookstove. Each goal is at risk of undermining the other if one set of objectives leads to a rejection of the cooking device by households (see Figure 1).

With many thousands of stoves allocated under a single programme of activities, carbon-financed projects must contain a high level of technological standardisation to generate certifiable and cost-effective emissions measurements. Standardisation generates simple and reliable accounting procedures while also producing cost efficiencies derived from supply side economies of scale (Martinot *et al*. 2002). The pursuit of scale-up and technology standardisation does not merely reflect a preference for cost-efficient distribution. Rather, these approaches are required to attract financiers and fulfil minimum carbon reduction requirements that ensure project certification (Johnson *et al*. 2010; Global Alliance for Clean Cookstoves 2011; Simon *et al*. 2012).

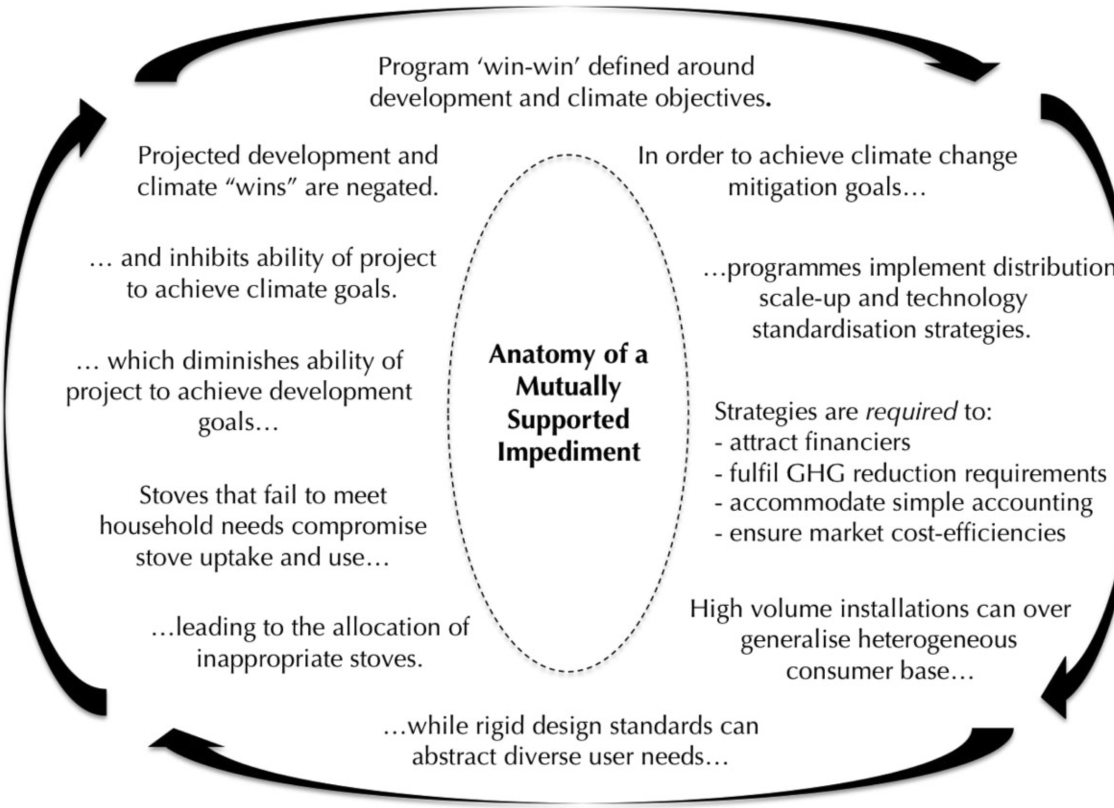

Figure 1 Anatomy of a mutually supported impediment. Attempts to achieve one win (carbon mitigation objective) may compromise ability of project to achieve second win (development objective), which in turn undermines pursuit of first objective
Source: Author

Technology standardisation at scale raises the possibility for high-volume installations that may over-generalise a heterogeneous consumer base. This raises a potentially devastating outcome for all parties involved: failure to distribute stoves that meet consumer needs has been sited as the most common barrier to sustained stove uptake (Bailis *et al*. 2009; Lewis and Pattanayak 2012; Whittington *et al*. 2012).

Cookstoves as boundary objects

Cookstoves may be productively viewed as boundary objects for their ability to accommodate a high diversity of development and environmental objectives. An Actor Network Theory concept, boundary objects represent ideas or things that interface with diverse interest groups even though they are utilised and ascribed meaning in ways that differ for each party. They are objects malleable enough to accommodate assorted programmatic strategies and policy objectives, yet also firm enough (ontologically speaking) to maintain legibility and coherence as a discreet object (Star and Griesemer 1989).

This paper argues that household members play a crucial role in determining how cookstoves are actually mobilised in practice (Kimble *et al*. 2010). According to Bowker and Star, boundary objects 'are weakly structured in common use and become strongly structured in individual-site use' (1999, 297). Indeed, stoves are viewed broadly during Alliance strategy-setting stages as objects intended to fulfil a number of general end-goals. Conversely, they become more explicitly defined objects at the site of application in order to meet very precise, household-specific needs. The challenge for programme implementers is to conform to the particular parameters of acceptable stove functionality defined by households. Failure to meet the design and performance preferences of individual households renders improved cookstoves unused and climate–development objectives unfulfilled (Jeuland and Pattanayak 2012).

Focal actors and obligatory passage points

It is here where cookstoves transition from boundary objects to household-mediated obligatory passage points. Obligatory passage points are situations or conditions that must occur in order for involved parties to achieve their desired interests (Callon 1986; see also Latour 1987). They have a funnelling effect, by forcing all actors (households, governments, finance sector, etc.) to converge around a particular problem or issue. Stove users operate as focal actors for their central role in defining these issues and establishing the obligatory passage point through which others must pass. Through a process Callon (1986) labels 'translation', stove users develop a set of interests and conditions that are consistent with their own needs. Other parties will accept this passage point if compliance with these requirements is a prerequisite for achieving their own desired goals. Here, the stove user's needs and preferences are rendered indispensable.

The danger for programmes like the Alliance is that mutually supported impediments are triggered when projects circumnavigate the obligatory passage point. One of the primary objectives of this paper is to use these two concepts to clearly articulate a theoretical foundation for interpreting programme successes and failures within stove replacement programmes under carbon finance. By obviating adequate consultation with focal actors (female stove users) and treating household preferences (i.e. obligatory passage points) as dispensable, programmes like the Alliance run the risk of impeding efforts to achieve both climate and development objectives. See Figure 2 depicting the role of obligatory passage points in a win–win programme.

Recognising obligatory passage points; averting mutually supported impediments

Despite the nascence of carbon-financed stove replacement projects and the limited amount of empirical data substantiating their successes and failures, a review of new projects can illustrate – in a very preliminary sense – the importance of identifying cooking spaces as critical sites of power that define the obligatory passages point. Table 2 presents six crucial stove design and performance attributes required to support consumer demand and sustained uptake. These characteristics were mentioned in programme reports from three carbon finance projects and were also articulated by programme officers in response to open-ended questions asking why distribution efforts may result in discarded stoves. Employees indicated that ignoring any one of these attributes could greatly reduce rates of technology adoption. Programme employees also mentioned that efforts to promote local manufacturers and geographically appropriate design considerations can increase the duration of stove use and advance programme success in both climate and development objective areas. (In fact, with sufficient local governance, these proactive and community-driven engagements may actually be enhanced by up-front credit

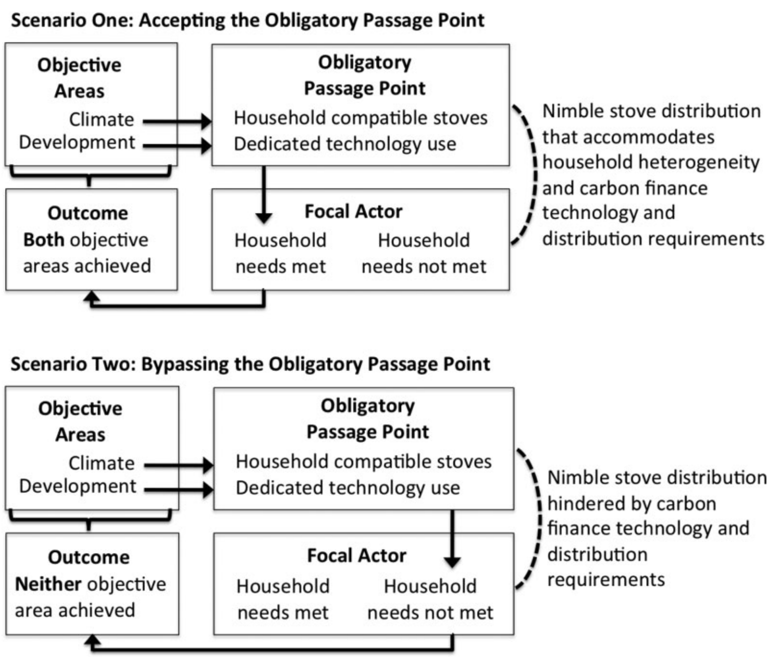

Figure 2 Cookstove as obligatory passage point at the climate–development interface
Source: Author

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Table 2 Examples of nimble stove construction and technology applications

Stove attributes that increase stove uptake
1. Accommodates household cooking practices (boiling, frying, curing, simmering etc.) and food resources in proportion to their availability.
2. Suited to home siding, roof structure and other architectural features that allow for acceptable placement and ventilation of stoves.
3. Compatible with domestic cooking location and other household stove models so that improved stove retains functional utility in multidimensional cooking environment.
4. Accommodates available fuels including some combination of wood, biomass pellets/briquettes, charcoal, liquid petroleum gas, solar, biogas, ethanol and others.
5. Meets (or at least does not deny) heating requirements and other usages for household members including generation of desirable smoke.
6. Complies with local climate through use of materials and design features that accommodate ambient moisture, wind speed/direction, solar intensity and temperature.

Source: Author

payments. Carbon finance can provide project developers upstream investments to support outlay costs, which may reduce production costs and lower stove prices. Carbon finance also generates opportunities for technology support and maintenance during periodic emissions monitoring activities (Bailis *et al*. 2009)).

One recent example is the Qori Q'oncha Project located in the mountainous regions of Peru. This project delivered 30 000 stoves to residents in various remote mountain villages from 2008 to 2011. With financing registered under the Voluntary Emissions Reduction market, project scale-up is expected to continue over the next decade. The Qori Q'oncha Project initially struggled to meet consumer preferences, which varied from one region to the next, but saw greater success with the participation of three local organisations – ADRA Peru, ProPeru and Sembrando. These organisations assisted installation scale-up through activities such as kitchen emission testing and stove user surveys. In the case of the Sembrando stove, for example, distribution was facilitated by the Instituto Familia y Trabajo, which solicited household feedback during field tests (Microsol 2011).

Of particular note were findings by field officers revealing discrepancies between in-lab and field stove performance. These results highlighted the need for stove design adjustments that would retain emissions reductions yet also accommodate a range of household applications. Findings from the field resulted in a diverse line-up of technologies that promotes more widespread stove use (Myclimate and Microsol 2010). According to employees at the Qori Q'oncha Project, the scale-up process is 'open and not favouring a unique stove model'. Accordingly, diverse product lines generate an 'incentive for local or household stove production that has shown to be much more sustainable than imported stoves' (Microsol 2011). This marks a shift in household satisfaction from earlier commitments favouring streamlined dissemination and low stove diversity.

In Uganda, the Ugastove project has been in operation since 2004 and was registered for carbon credits within the voluntary emission reduction market in 2009. The project has plans to deliver roughly 180 000 stoves over a seven-year period. Field employees (under the managerial umbrella of JPMorgan Climate Care) realised early on that scale-up could suppress competition among enterprises (JPMCC 2011). Direct financial payments and technical support by external agencies to only a small number of stove producers resulted in a narrow range of manufacturers and design possibilities. Inadequate consultation with villages and households resulted in rates of stove non-uptake that were of concern to programme managers (JPMCC 2011).

In response to these trends, the Ugastoves project organised an extensive entrepreneurship-training programme, which increased the pool of manufacturers and exposed them to a range of household needs. Decentralised project governance led the Ugastove project to identify areas experiencing high levels of deforestation and prioritise them for high-efficiency stove replacement intervention (JPMCC 2011). By 2010, the Ugastove project completed the transition from single business to diverse business network comprised by numerous small enterprises with access to carbon financing. As a result, a line of household-suitable product types and sizes emerged, leading to more sustained use of disseminated stoves.

A similar story unfolded in Cambodia during the mid to late 2000s with the New Lao Stove Project. Over one million stoves have been distributed under the project and the number disseminated continues to rise (GERES 2012). Geographically diverse stove manufacturing activities initially hampered the ability of Groupe Energies Renouvelables, Environnement et Solidarités (GERES) to generate consistent carbon emissions monitoring data and control product quality. With massive scale-up, stove production instead pursued an economies-of-scale approach seeking to consolidate production activities within a small number of manufacturing centres. It was believed that production efficiencies would reduce prices and free up carbon market funding for other purposes such as outlay expenditures for continued market expansion (GERES 2011).

This approach sparked concern among development assistance agencies and carbon financiers alike that the project would fail to deliver benefits to households and fall short on its carbon emission reductions. Indeed, according to project employees, the distribution process had a much lower rate of success in its early stages. Although the New Lao Stove production remains consolidated under a single organisation (The Improved Cookstove Producers and Distributors Association), there are now more than 30 New Lao Stove producers spread across nine provinces in Cambodia (GERES 2012). The New Lao Stove's decentralised production and distribution framework has enabled the development of diverse stove sizes and designs that comply with specific geographic contexts and local user needs (GERES 2011).

All three projects illustrate how programme success was initially threatened by scale-up and technology performance standardisation imperatives under carbon finance. A renewed commitment to localised manufacturing practices (which extended stated goals by the Alliance into actual community and even household-level engagement) helped reduce instances of mutually supported impediments (i.e. household rejection of stoves), thereby preserving the possibility of project 'wins' for all involved parties. As Figure 3 illustrates, each project transitioned to a dissemination framework comprised by global actors and nested local programme activities. This approach ensured that those with intimate knowledge of household-scale stove preferences (i.e. obligatory passage points) had substantial influence over the fabrication of cooking technologies.

Discussion: Obligatory passage points and the allocation of power in win–win projects

Critics in geography and allied fields have described the use of win–wins at the climate–development interface as a permissive strategy that accommodates surplus carbon emissions in first world economies. Here, spaces are enclosed and utilised to mitigate emissions leading to the accumulation of financial advantages by emitters, while reduction responsibilities fall to less advantageous communities (Lohmann 2005). From this vantage point, clean cookstoves can be viewed as micro-level spatial fixes for carbon polluters (Bumpus and Liverman 2008) who are 'spared the cost of actively reducing their own emissions' (Bridge 2011, 824). Meanwhile, as Marino and Ribot (2012) argue, climate mitigation efforts may also result in maladaptive measures that contravene the development interests of the communities they are ostensibly meant to serve.

This paper suggests a need for greater geographical clarification when validating or critiquing such claims of

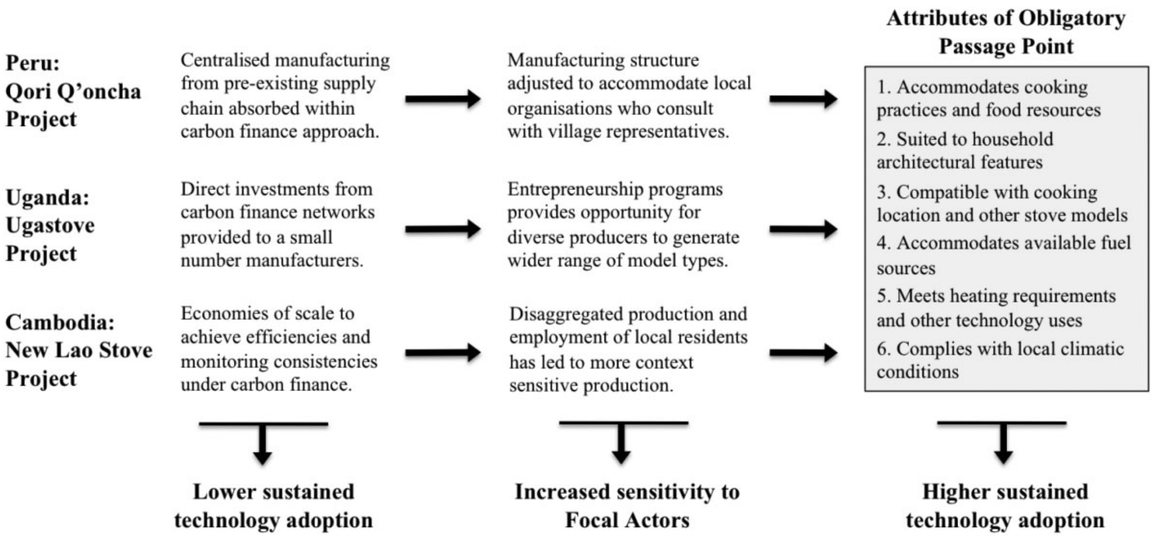

Figure 3 Triggering and averting mutually supported impediments
Source: Author

programme oversight, co-optation or avarice. This entails re-envisioning household spaces targeted for development as sites that actively shape programme possibilities and development outcomes (Silvey and Rankin 2011). It has been shown elsewhere, for example, that locally appropriate development outcomes are achieved across diverse geographies and social groups through ‘collaborative technology innovations’ (Simon 2010). In the case of cooking technologies, the presence of mutually supported impediments means that if focal actors (households) become discontented, then all involved actors in the stove dissemination process become discontented as well. In light of these dynamics, this paper illustrates how control over the development process arises within domestic spaces comprised of female stove users who influence the scope and form of project success by defining indispensable cooking technology design and performance characteristics.

By reallocating power back to households we are able to constructively build on Bridge, who asks ‘what moral economies are being constructed through and around carbon?’ (2011, 828). According to Dowling (2010), carbon-based development shapes the behaviour of individuals in developing nations through the characterisation of those individuals as carbon-emitting subjects. The formation of environmental responsibility proceeds through soft structures of power where accountability for emissions reductions is rescaled to individual households (Dobson 2003). Cookstove standardisation and scalability present a form of socio-ecological legibility for the private sector. The practice of seeing like a carbon financier illustrates how, according to Bridge, ‘carbon provides an ordering logic and mode of accounting through which space and social practices are being rewritten’ (2011, 821).

This paper illuminates limitations to this view of carbon as an ‘organising element’ for the carbon-emitting subject (Wolf *et al*. 2009). Responsible cooking behaviour is comprised by household commitments to various domestic concerns, and certainly not just a lowering of GHG emissions (Whittington *et al*. 2012). Put succinctly, households are not beholden to a carbon tyranny. Instead they frame ‘responsibility’ around diverse obligations, needs and preferences. A combination of livelihood, community, financial and environmental concerns define the underlying moral economy within which individuals strive to contribute as responsible citizens. This paper thus illustrates the ‘power of the subjects of development to re-signify the spaces they inhabit, and in so doing to rescript the geographies of development’ (Silvey and Rankin 2011, 700). Following Gibson-Graham, informal domestic spaces provide a site within which we can examine the hegemonic rollout of carbon finance projects *and* ‘contemplate its destabilization’ (2006, 23).

This analysis raises an important question: do carbon emissions organise households? Or do households organise carbon emissions? The household-compatible stove as obligatory passage point thus presents a condition that incites alternative development possibilities and presents a technological limitation to the carbon capital economy.

Conclusion

This paper is motivated by the recent integration of cookstove dissemination activities into the global carbon economy. The concepts mutually supported impediments and obligatory passage points advance our understanding of win–win outcomes at the climate–technology–development interface and serve as useful conceptual constructs for evaluating factors that influence project success and failure. These concepts provide a theoretical foundation for advancing geographical perspectives on the spatial allocation of control over technology-based development projects (Simon 2010) and highlight how household cooking spaces function as informal sites for activating alternative technology-based development potentials under carbon financing. Finally, mutually supported impediments and obligatory passage points hold broader relevance within other technology-based (from transgenics to tube-wells) development projects. This is particularly the case where projects succeed or fail depending on the end users’ willingness to commit to sustained technology use.

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Notes

1 The Alliance does not distribute cookstoves. Rather, it raises awareness, promotes standards, disseminates best practices, engages governments and advocates for market-based distribution schemes and the incorporation of carbon finance.

2 A substantial decline in the market rate of certified emission reduction (CER) credits has raised concerns about the long-term viability of carbon finance schemes within the sector. Market prices dropped from the already low level of US$3.40/CER in late 2012 to US$0.66/CER a year later (UNFCC 2012). While new programmes continue to emerge, the capacity for implementing agencies to sustain carbon credit provisions are challenged as programme costs increase due to stricter emissions monitoring and technical requirements.

3 These include 32 projects registered as Gold Standard but omit voluntary Gold Standard projects.

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