

Multiple Temporalities of Household Labour: The Challenge of Assessing Women's Empowerment

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ABSTRACT

The economic empowerment of women remains a central feature of development projects worldwide. This article explores these empowerment aspirations by examining various temporal complexities related to two development projects in South India targeting individual cooking and fuel-collection routines. It argues that three temporal considerations of household labour — polychronic time, collectivized time and hybrid labour/leisure time — are largely overlooked, thus challenging the appropriateness of empowerment strategies from the outset. By highlighting key household dynamics this study argues that efforts to pursue economic empowerment by members of the clean cookstove sector devalue unpaid labour and glorify waged work that is often tedious and mediated by powerful men. Further, waged work can be burdensomely added to pre-existing unpaid domestic labour responsibilities. This common portrayal of empowerment by the clean cookstove sector can be viewed as facilitating the advancement of a neoliberal vision of rural women's livelihoods where empowerment and agency are reconfigured and incorporated into the problematic wage relations of capitalist economies. This view of empowerment, which privileges market participation, also overlooks many of the *actually experienced* positive effects of improved stoves; benefits which tend to be domestic, communal, routine, non-economic and difficult to quantify. The article argues that conventional definitions and visions of 'empowerment' should be re-evaluated to include forms of 'mundane agency'.

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INTRODUCTION

The twin goals of unburdening women from domestic labour activities while providing opportunities for saved time to be spent engaging in more economically ‘empowering’ work figure centrally within many development projects worldwide. These goals are particularly evident in the clean cookstove sector, and certainly within the Indian context (Smith and Sagar, 2014), where ‘clean’ stoves (also referred to as ‘improved stoves’ by participating organizations within the sector) are designed and distributed in order to reduce smoke emissions during the cooking process, to limit the amount of wood fuel required to meet household energy demands, and to promote the empowerment of women (Simon et al., 2014).¹ In addition to the health and environmental benefits, proponents of clean cookstoves argue that they provide an opportunity for households to reduce the amount of time and labour spent cooking and collecting fuel — a time-saving derived, in large part, because clean stoves burn hotter and require less fuel than more traditional devices. It is argued that these acquired time-savings may translate into new household routines, social activities and employment opportunities, which will in turn empower women throughout the developing world.

Unlike health and environmental benefits, however, social benefits like time-savings and empowerment are much more difficult to define or measure and appear to be more complicated than is suggested by popular development discourse. This article aims to illuminate the temporal complexity of these purported social benefits by exploring the effects of improved stoves on women’s daily labour routines. We do so with the help of three concepts: polychronic time, collectivized time and hybrid labour/leisure time. Polychronic time reveals the non-linear, multitasking nature of household labour while collectivized time illustrates its shared and reciprocal nature. Hybrid time exposes the multifaceted and dual purpose of many domestic activities. Collectively, these temporal modalities help us to question the accuracy of ‘time-savings’ and associated ‘women’s economic empowerment’ claims, and challenge some of the basic assumptions used to construct these popularized development tropes.

We begin by briefly discussing theories of women’s economic empowerment and examining them in the context of improved cookstove projects. We then consider various temporal complexities as well as ‘mundane’ considerations related to individual daily cooking and fuel-collection routines that

1. Over the past decade, the international clean cookstove sector has expanded considerably. The Global Alliance for Clean Cookstoves (GACC), developed by the United Nations in 2010, has spearheaded this growth. The GACC now oversees diverse aspects of the international clean cookstove sector including awareness raising, technology innovations, sector investment growth, international partnership generation and market capacity development. Women’s empowerment figures centrally in these various sector growth strategies.

help frame our analysis.² Next, findings from surveys, interviews and focus groups, conducted during the period January to September 2017 in the Indian states of Andhra Pradesh and Karnataka, are used to show how development objectives tend to oversimplify or understate the complexity of these cooking-related labour activities. By highlighting key household dynamics concerning cooking and other forms of household labour we hope to both challenge some of the taken-for-granted assumptions underlying improved cookstove projects and promote a nuanced understanding of stove adoption that may lead to more culturally compatible and long-lasting development outcomes. We conclude by suggesting the cookstove sector's emphasis on employment as a principal vehicle for empowerment³ distorts the realities of waged labour while overlooking a woman's capacity for choice (Kabeer et al., 2013), crucial forms of individual 'mundane agency', as well as other positive effects of new cooking technologies traditionally undervalued by market-centric evaluative criteria. We argue that illuminating multiple temporalities of household labour challenges conventional understandings of empowerment and exposes their incongruence with the non-linear, reciprocated and hybrid work practices and social relations of individuals engaging with clean-cooking technologies.

WOMEN'S EMPOWERMENT IN THE CLEAN COOKSTOVE SECTOR

For more than three decades, improved cookstove projects have sought to deviate from historical gender biases found in other development sectors. Stove projects explicitly target common tasks and routines performed by women (by reducing 'toilsome' labour associated with cooking and fuelwood collection) (Wiedinmyer et al., 2017), and connect the adoption of 'clean' and efficient stoves to women's empowerment (e.g. Rehfuess et al., 2006). Stove-sector programmes thus closely follow the Women in Development initiatives of the 1970s, where gender vulnerability became a cornerstone for intervention by international development agencies (Ghertner, 2006); an ambition that has since gained traction with the 2000 Millennium Development Goals followed by the more recent United Nations' Sustainable Development Goals. The emergence of the Global Alliance for Clean Cookstoves (GACC) in 2010 has carried the women's empowerment mantle forward (Goetz and Jenkins, 2016; Simon et al., 2014) and follows broader

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2. While scholars have differentiated between acts of work and labour, we use these terms synonymously. In this article, we use the phrase labour because it evokes manual labour as opposed to 'work', which evokes waged employment — a more uncommon use of time in this context.
 3. We recognize that attention is given by the stove sector to non-employment benefits derived from clean cookstoves such as increased leisure, periods of rest, and time with friends and family (see, for e.g., GACC, 2018). However, this is typically associated with improved 'quality of life' not empowerment.

considerations of empowerment within rural development settings (Alkire et al., 2013; Alsop et al., 2005; Kabeer, 1999; Kabeer et al., 2013; Kishor and Subaiya, 2008) and informal, household work contexts (Boeri, 2018; Bose, 2007; Kantor, 2003).

Within the clean cookstove sector, the objective of women's economic empowerment is presented as straightforward and uncontroversial. According to GACC's own website, the organization 'recognizes that women have critical roles to play across the entire clean cooking value chain, and has explicitly prioritized women in their mission to save lives, improve livelihoods, empower women, and protect the environment by creating a thriving global market for clean cookstoves and fuels' (GACC, 2013: 6). Specifically, women's empowerment is tied to the distribution of new technologies that (1) unburden females from time-consuming cooking and fuelwood collection activities, and (2) present opportunities for women to spend saved time engaging in more economically 'productive' work (Shankar et al., 2015). This transition from unproductive (and unpaid) domestic 'chores' to productive income-generating market participation is a critical component of women's empowerment and a central justification for stove distribution around the developing world (Ghertner, 2006; Khandelwal et al., 2017).

Several feminist critiques have been levied against this development approach. Critics suggest that empowerment goals have largely functioned as a buzzword for aid agencies without substantive political and economic influence on women (Batliwala, 2007; Cornwall and Rivas, 2015). Furthermore, many women's empowerment projects have been criticized for being stubbornly based on the same normative lenses — modernization theory (where technological innovations can remedy the problem), socio-economic considerations (prioritizing the integration of women as entrepreneurs into regional marketplaces) and androcentric viewpoints (where time spent doing 'female' domestic activities is often deemed unproductive) — that have plagued development programmes for decades (Khandelwal et al., 2017). Here, programmes promoting gender empowerment are often wrapped in colonial dualities that mark women in the global South as vulnerable and in need of assistance through modernizing global North economic intervention (Arora-Jonsson, 2011; Listo, 2018; Simon-Kumar et al., 2018). Any rejection of modernity (in this case improved cookstoves) may wind up reinforcing colonial relations that position women in the global South as 'backward', 'other' and still in need of technological intervention (Khandelwal et al., 2017; Mitchell, 2002). On a more general level, the language of 'precariousness' that is frequently used by global development initiatives has been critiqued for ignoring broader North–South relations (largely responsible for producing such precarity) that are nearly impossible to overcome through targeted technology transfers (Nagar et al., 2002; Radcliffe, 2015; Simon-Kumar et al., 2018).

In the context of improved cookstove projects, Khandelwal et al. (2017) identify several areas of concern with the empowerment concept. First, they

note that any benefits from freed-up time largely depend on what alternative employment opportunities exist. Many rural women do not necessarily view difficult physical labour, poorly paid jobs and employment resulting in low pay as a clear lifestyle improvement (Jackson and Palmer-Jones, 1999). Second, reduced household labour may render young females less productive and thus less valuable in the domestic sphere. This may lead to unintended outcomes such as male heads of household marrying off girls at a younger age. Third, fuelwood collection and cooking activities, while often considered demanding tasks, frequently provide opportunities for pleasure and socialization amongst friends and family. Fuelwood procurement particularly has been shown to generate unique opportunities for females to bond, communicate and find solidarity away from the presence of males (Gururani, 2002) whilst also exerting a level of control over resource collection, bartering and exchange (Babar, 2001). Fourth, reduced cooking times may signal a reduction in time devoted to providing for the hearth — including family and friends. This is an activity that is frequently controlled by and credited to women such that a decrease in time may be a loss of performed and valued familial care. Fifth, efforts to promote women's empowerment as a path to modernization have been shown in previous contexts to suppress rural cultural practices (such as song, dance and ritual) that functioned as vehicles for expressing individuality and contextual power (Chowdhry, 2001; Jassal, 2012; Khandelwal et al., 2017). These insights suggest that the empowerment goals of development agencies are not necessarily commensurate with, or advantageous to, the development subjects they are intended to benefit.⁴

CHALLENGING DEVELOPMENT ASSUMPTIONS: AN EXPLORATION OF THE MUNDANE

In order to better understand how new cookstoves may or may not impact recipient households, research has increasingly posed more culturally nuanced questions that examine household and individual preferences for particular types of stoves and fuels (Wiedinmyer et al., 2017). These studies acknowledge the central importance of household dynamics and priorities when designing cookstove projects (Usmani et al., 2017) and typically

4. We do not suggest that collecting fuelwood is without immense physical labour that may be difficult, demanding and at times even dangerous. Rather we suggest that, for many women, fuel collection is not viewed solely through the lens of toilsome labour. Certain elements of fuel collection — such as the camaraderie involved in cross-country travel — are considered pleasant, gratifying and even liberating. Similarly, we are careful not to imply that domestic cooking practices are void of significant maladies and gender inequities. Instead we hope to present a view that also considers cooking as an important site for women to enact individual and spiritual growth, familial love, household control and even self-empowerment.

assess these preferences under different social, cost and performance parameters (Menghwani et al., 2019).

While we are certainly sympathetic to research that ‘gets into the kitchen’ (Simon, 2014) to closely analyse domestic cooking and fuelwood collection activities, we also recognize several remaining research lacunae. For example, by focusing on how best to achieve project goals, household-scale studies generally do not grapple with the normative ideas and a priori theories used to formulate project goals in the first place. To date, insufficient attention has been given to unpacking some of the built-in assumptions that inform cookstove projects from the outset (Chatti et al., 2017). These include questions concerning the meanings, practices and performances of ‘free time’, ‘labour time’ and ‘empowerment’ in the domestic sphere.⁵ Khandelwal et al. (2017), for example, describe how ‘defining wood collection as drudgery and cooking with fire as dirty and inefficient led many ... to push for change; however, those pushing for change often simplistically presume that new forms of labour will inevitably replace these activities and those will be more pleasant, more efficient, more remunerative, and thus enable better quality of life’ (ibid.: 22).

In order to better understand labour activities and relationships that are often difficult to assess at the domestic scale (Biehler and Simon, 2011), and to determine the scope of benefits that can be reasonably achieved through improved stove distribution, we draw on ‘mundane energy science’ research as a source of inspiration. Kammen and Dove (1997) present mundane science as a research approach that prioritizes the assessment of everyday issues that largely affect women, the poor and other marginalized groups. The authors argue that mundane science is often overlooked and note, ‘unless we overcome the bias against mundane science, we will remain wedded to short sighted, partial solutions to emerging issues in development and the environment’ (ibid.: 38).

Although these authors herald cookstove replacement projects as potentially successful examples of mundane science ‘in action’, we argue here that moves ‘towards the mundane’ have proven challenging within this development sector. Even after many decades of dedicated research, improved cookstoves still tend to only meet the use needs of a small segment of target populations; they tend to have short lifespans with inadequate infrastructure to support upkeep and repair; and stove performance — including fuel

5. In this article we differentiate between ‘free time’ and ‘leisure time’. We consider ‘free time’ as time that is open to use as one chooses; vacant moments which are available for any undetermined use, including forms of labour, or for rest, socialization, political engagement, or religious practice. Free time is just that — free from compulsion to do anything, including waged labour. ‘Leisure time’ is time specifically designated for relaxation, socialization and/or enjoyment. It is not free time, strictly speaking, as it is already allocated — for leisure. Leisure time is thus one way a woman could elect to deploy her free time, but not all free time is necessarily leisurely.

efficiency and reduced emissions levels — frequently differs from testing laboratory to field site. Put simply, improved stove project best practices continue to run up against the actual needs and priorities of many recipient households.

This is an unfortunate and persistent condition addressed by Chatti et al. (2017) who note a dearth of mundane domestic energy-based research. They argue: ‘Understanding the perspectives and values of the users of mundane bioenergy is a critical step that is often missed...’ (ibid.: 29). We agree that finer-grained examinations of mundane energy practices may challenge conventional and problematic perspectives on clean cookstoves. In this article we take issue with a particular group of postulations (such as labour time, free time and women’s empowerment) that permeates much of the clean cookstove discourse; a set of assumptions ‘which dominate neoclassical economics and thus much of the political discourse around the subject’ (ibid.: 33).

TEMPORALITY AND SOCIAL TIME IN DEVELOPMENT

In order to better assess these mundane practices we draw from research exploring the diverse and often interacting temporalities of individuals and communities, a form of ‘social time’ that challenges notions of commonly understood and experienced temporal progressions and time chronologies (Birth, 1999; Bluedorn, 2002; Lauer, 1981; Levine, 2019; Munn, 1992; Nowotny, 1992). We suggest here that multifaceted and culturally situated uses of time must be taken into consideration when assessing clean cookstove project goals, limitations and accomplishments (Brislin and Kim, 2003; Douglas, 2002; Levine and Norenzayan, 1999). Unfortunately, development discourse — frequently constructed in the developed world around value-laden notions of modernization, economic efficiency and productivity — often misrepresents and generalizes the nature of time management for rural women in the developing world. We leverage theories of ‘social time’ in order to demonstrate that development conceptions of ‘free’, ‘leisure’ and ‘labour’ time and associated levels of ‘empowerment’ (see, e.g., Alkire et al., 2013) may not neatly map onto the lives and mundane experiences of rural residents.

This study leverages three areas of social-time research. First, we recognize the important distinction between monochronic time, which presents time used for a singular, focused purpose, uninterrupted by other activities, and polychronic time connoting time experienced through plural or overlapping chronologies, and periods of clustered activity (Douglas, 2002). In the case of the latter, this may occur as a person switches from one activity to another and adapts and engages multiple undertakings simultaneously (Bluedorn, 2002; Hirway and Jose, 2011; Lentz et al., 2019; Levine and Norenzayan, 1999). Second, we affirm the distinction between

‘clock time’, reflecting standardized units of regimented time (where time management requires adhering to broadly regulated temporal units, such as minutes, hours, etc.), and ‘event time’ units, determined and valued as a perceived and relative duration defined by a group or individual rather than as an absolute length (Levine, 2019). Third, we contribute to research complicating notions of the work/leisure divide by suggesting that cultural factors (across individual and community scales) disrupt any clear distinction between work and leisure that may be implied by capitalist rationales of waged labour and economic (un)productivity (Brislin and Kim, 2003; Kelly, 1987; Walker et al., 2005). As the following sections demonstrate, an exploration of ‘mundane’ activities and complexities of ‘social time’ help us to animate domestic cooking and fuel-procurement dynamics and challenge underlying temporal and empowerment considerations that inform improved cookstove projects.

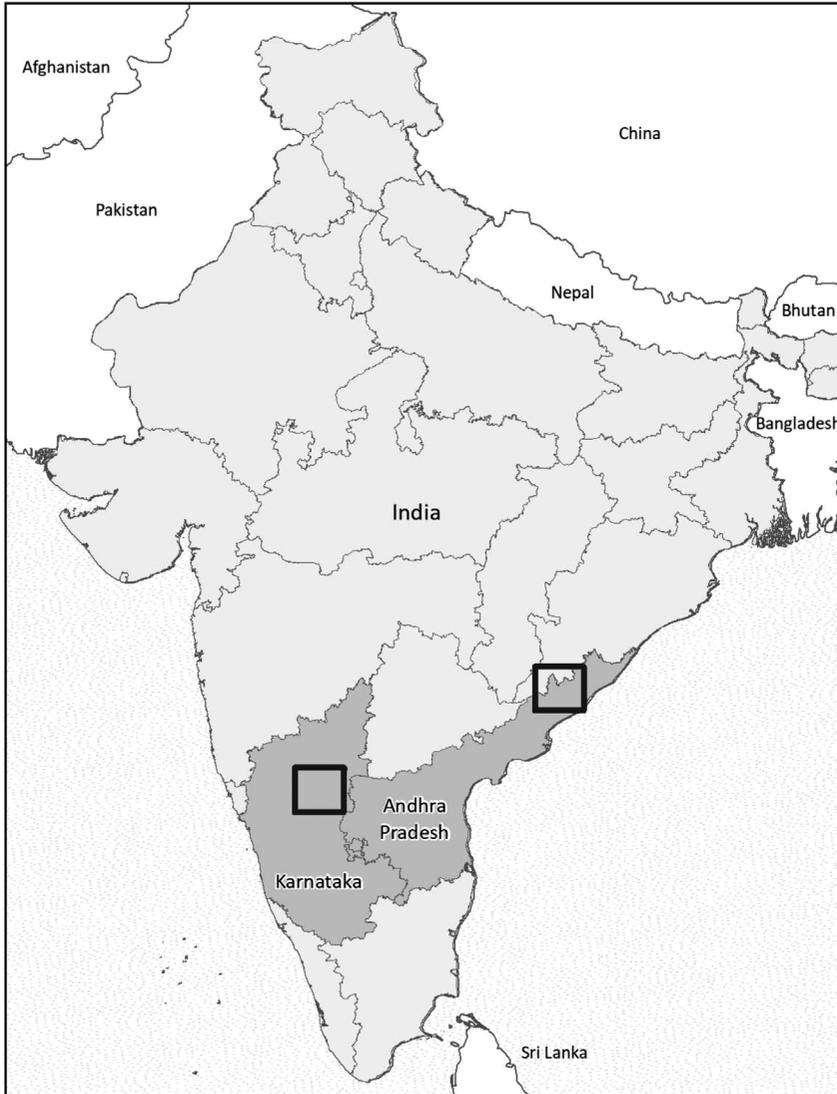
Methodology and Fieldwork Areas

Fieldwork for this study was conducted in rural south India at the sites of two distinct clean cookstove projects — one in the Gangavathi Taluk of Koppal District in Karnataka and the other in the Paderu Taluk of Visakhapatnam District in Andhra Pradesh (see Figure 1). The research team consisted of female and male researchers from the United States and India. Surveys and focus group discussions were conducted throughout the second half of 2017. Research findings are based on surveys of 877 households who received improved cookstoves, field and in-home observations, and 10 extended (one- to two-hour) focus group discussions with women who had acquired new stoves within the three years prior to 2017. Respondents were all women understood to be either in charge or actively involved in cooking activities inside the home. All surveys and interviews explored how improved stoves may have changed women’s cooking and fuel-collection practices, impacted daily routines and/or generated new business opportunities.⁶

New cookstoves were issued by a local NGO in each project site during the period 2014–17. These locally operating partner organizations facilitated the design, production, delivery and installation of new cookstoves in participating villages. Stoves were installed only in the homes of families who chose to take part in the project. Nearly all homes surveyed contained an improved cookstove. Survey participants were selected randomly from each

6. Although time-use data have been shown to capture details about unpaid labour and informal employment (Budlender, 2007), particularly in developing nations such as India (Hirway and Jose, 2011), we did not employ such methods here. This decision was influenced by well-documented limitations associated with this technique that tend to underreport ‘invisible’ care and unpaid work (Lentz et al., 2019).

Figure 1. Case Study Areas in Karnataka and Andhra Pradesh



Note: Map of South India. The two study sites are indicated with boxes: Gangavathi Taluk in Karnataka (left) and Paderu Taluk in Andhra Pradesh (right)

Source: Authors' own compilation.

village and approximately half to two-thirds of those selected participated in our study. The 170-question surveys were completed manually with the help of NGO field staff, and completed surveys were eventually uploaded using Qualtrics survey software. Focus group discussions were announced

prior to meetings so that those women who were interested had time to complete other activities beforehand. Participation was open to all who wished to participate, with groups ranging in size from 10 to 15 women. Discussions were recorded manually and with the use of digital recordings. All translations between Telugu (Andhra Pradesh)/Kannada (Karnataka) and English were handled by the Indian research team members, and specific members of partner NGOs in each state. Our mixed-methods approach utilized surveys to generate quantitative data (using closed-ended, rating, multiple choice and demographic questions) and focus group discussions (which were based on open-ended questions) which generated qualitative data including detailed quotes and personalized insights from participating women. In a similar fashion, individual and focus group interviews were conducted with NGO employees in each site to better understand the stove distribution and upkeep process.

The Gangavathi Taluk field site, located in Karnataka, is a semi-arid environment and is predominantly comprised of dry land agricultural land uses — though increases in irrigation and commodity crop production are quickly changing both the region's economy and landscape. The population from which all survey and focus group participants were drawn ($n = 394$) is almost entirely Hindu (95 per cent). Nearly half (47 per cent) identify as other backward class, with 20 per cent identifying as a member of a scheduled tribe. The average age of women in the study was 37 years old. Nearly 60 per cent of the female research participants were non-literate, with another 36 per cent receiving standard (i.e., primary) education.

The Paderu Taluk field site, located in Andhra Pradesh, is a hilly environment of the Eastern Ghats containing a number of irrigated paddy areas and community forest plots. Vegetation cover in the area is noticeably patchy and comprised of shrubs, grasses and small trees. From the population of research participants in the Paderu area ($n = 483$) nearly all hold tribal status (96 per cent). The population includes over 15 caste affiliations with Konda Dhora (264) and Bagata (116) the most commonly referenced. The average age of women involved in the study was 39 years old. A full 88 per cent of women participating in the study identified as being non-literate.

MULTIPLE TEMPORALITIES OF COOKING AND FUEL COLLECTION

A primary objective of clean cookstove projects, and the basis for increased female empowerment, is to reduce the amount of time women spend cooking and collecting fuel. As the GACC states, sector 'efforts have helped lower household spending on fuel, minimize women's "drudgery" or the many hours spent on unpaid work like fuel collection and long cooking times, and reduce their exposure to deadly fumes' (GACC, 2018). Our first task was therefore to determine how improved cookstoves alter cooking times

and how stove users accommodate these changes in the context of other household-related activities.⁷

Women in both the Karnataka and Andhra Pradesh field sites described reductions in cooking and fuel-collection time as well as changes in their daily labour routines as a result of their improved cookstoves. Survey respondents almost unanimously (92 per cent) reported a decrease in time spent cooking since receiving the stove. However, when asked to qualitatively and quantitatively measure the amount of time saved, most women described relatively small blocks of time, with most reporting a reduction in cooking time of 15–60 minutes per day and very few reporting larger units of time.⁸ Most women described ‘somewhat less’ time spent cooking (58 per cent), or only ‘a little less’ time (33 per cent), suggesting that most women do not perceive the time savings as dramatic or life altering, but rather a minor convenience. (For example, only 6 per cent described ‘a lot less’ time spent cooking.)

Clean cookstove projects are also designed to save women time through reduced fuel needs. Because the stove has a higher heat efficiency, it takes less fuel to boil water, in turn limiting the amount of time and labour women spend procuring fuel. The survey results regarding fuel collection are comparable to cooking time savings: although a considerable majority of women (83 per cent) reported that the time they spend collecting fuelwood has decreased since receiving the stove, most describe only ‘a little less’ time spent: 60 per cent of women surveyed described savings of 1 hour or less per day and another 36 per cent reported saving 1–2 hours on fuel collection.

With total time savings between 1 and 2 hours per day for most women, the potential for life-transforming pursuits and ‘empowering’ activities such as schooling, entrepreneurship, or even wage employment appears limited. This is not to say the stoves have no meaningful temporal implications (in fact, they have many), nor is it to say the stoves cannot positively impact an individual’s livelihood. In focus group responses nearly all women reported being quite happy with their stove and the convenience it provides, indicating that new stoves may subtly enhance the quality of life of these women even if they do not systematically ‘empower’ them in formal social and economic spheres.

Our findings also suggest that while women do in fact generally spend less time cooking and collecting fuel, their notions of ‘free time’, time savings, and even time itself are more complex than the cookstove discourse allows. As the following sections illustrate, there are many cultural and practical

7. While not explicitly highlighted here, the composition, size and distribution of labour roles in each household will vary significantly. Our findings represent the experiences of diverse family arrangements such as nuclear households with a mother-in-law present and households with a single woman and spouse who migrates for work.

8. Here, quantified durations are only approximate, as many village women do not necessarily conceptualize their day or their labour in terms of standardized temporal units. In surveys, they often did not describe an exact time amount in minutes/hours.

nuances influencing how individual women manage their time, and these dynamics must be appreciated to fully conceptualize the implications of improved stoves on household labour routines. Moreover, the values applied to cooking and fuelwood foraging activities by development agencies (labelling this work as one-dimensional ‘drudgery’) is often inconsistent — even incompatible — with stove users’ actual experiences. In subsequent sections we outline and examine these complex temporal effects, including how women choose to employ their extra time, and consider these findings in relation to the popularized ‘empowerment’ discourse.

Polychronic Time

Polychronicity is typically understood within the behavioural and occupational sciences as an individual’s preference for working between different tasks (Poposki and Oswald, 2010). This stands in contrast to multitasking, which is the behavioural outcome or practice of shifting between tasks that may result from those individual preferences (as well as relevant work conditions, community demands, personality traits and other cultural contexts) (Kirchberg et al., 2015; König et al., 2010). In other words, multitasking is moving between various tasks, while polychronicity is an individual’s preference for, and propensity to engage in, multitasking. Here, we evoke the condition of ‘polychronic time’ in this critical development context to highlight how women’s use of time (as free time, labour time, hybrid time, etc.) contains some level of polychronicity. As development agencies contemplate empowering outcomes, they should remain keenly aware that women, with varying degrees of polychronicity, hold some inclination for multitasking behaviour. As the section below suggests, the condition of ‘polychronic time’ — a temporality comprised of complex and overlapping activities — makes linear calculations of time savings (and resulting forms of empowering activity) extremely difficult to calculate.

Indeed, the notion of ‘saved time’ is considerably more complicated than it first appears. Our inquiries reveal that improved stoves save time not only by speeding up the entire cooking process, but even more so by allowing women to complete other chores while cooking. This is because the improved heat efficiency of clean stoves means the fire stays lit without being tended to, freeing up small amounts of time for other tasks while food is cooking, such as bathing, laundry, childcare, or socializing. As one woman reported, ‘once you light it you can keep doing other things and it will still keep burning, you don’t have to sit with the stove’.⁹ More explicitly, another woman elaborated: ‘I can do two jobs at a time because I can keep sticks in the stove while cutting vegetables or even go for a wash, because once you light it this stove does not stop, with the traditional stove you

9. Interview, married female, Gangavathi, Karnataka, 6 January 2017.

have to be next to it to keep blowing and putting sticks in'.¹⁰ Here we see how the new stove appears to enhance the possibility of polychronic labour routines.

Hence, reported time saving often takes the form of increased multitasking abilities, not only by speeding up cooking itself but because the stove simply requires less attention. Rather than opening up extended periods of time for entrepreneurship or wage labour, the efficient stove creates smaller, fragmented units of time interspersed within the cooking process. In this sense, the temporal effect of the stove is not just time saved but increased labour efficiency through polychronicity; as an NGO field officer summarized: 'they all say that cooking has become more efficient, there is more time to be able to do cleaning or fetching water or washing clothes while they cook'.¹¹ While this may not dramatically change individual livelihoods or lead to income-generating activities outside the home, it can substantially enhance the ease of their household labour routine and save time required for other chores.

A close analysis of cooking routines illuminates further complexities and contingencies. In Karnataka, for example, when preparing bread staples like *roti* the improved stove was found to require more attention. Women noted that because the new stove has a more concentrated and intense flame, the *roti* cooks much faster. As one woman described, 'with *roti* making we have to be very alert because the centre of the pan becomes very hot very quickly, so we have to be careful to turn the *roti* or it will burn If you keep turning and moving the *roti* it shouldn't be a problem'.¹² While with the traditional stove one could do other things while the *roti* cooked, it now must be closely watched. Of course, this concentrated flame and need for constant attention does substantially reduce the total time required for making *roti*. As another women indicated, 'I used to cook up until 10.30, but now I am finished cooking at 8.30. Mainly the time saved is coming from *roti* making only. Before it took over an hour to make 30 *roti*, now I can finish in 20 minutes'.¹³ Hence, the new stove can both create and foreclose opportunities for multitasking depending on the item being prepared.

Another intriguing but different example of polychronicity involves the process of collecting fuelwood for cooking. Despite their reduced fuel needs, many households tend to collect the same amount as before and simply stockpile the surplus for heating and cooking purposes during future (and perhaps energy insecure) periods. Over 80 per cent of surveyed households said they maintain a large stockpile of wood, especially for use during the monsoon when weather and damp wood make collection more

10. Interview, married female, Gangavathi, Karnataka, 6 January 2017.

11. Interview, male NGO field staff, Paderu office, Andhra Pradesh, 9 January 2017.

12. Interview, married female, Gangavathi, Karnataka, 5 January 2017.

13. Interview, married female, Gangavathi, Karnataka, 5 January 2017.

difficult. In this sense, households usually strategize fuelwood collection and storage along extended and overlapping temporal horizons — here women do not necessarily conceptualize fuel needs only on a daily or weekly basis (as the cookstove sector tends to suggest), but as a sort of permanent future need which must be prepared for each day. In this way, future moments and securities are often superimposed upon present decision making, as the spectre of future scarcity influences the allocation of labour time in the present. Distinct from the multitasking effect, nuances of fuel collection involve the co-existence of present and future moments (i.e., reflecting the simultaneous influence of multiple temporalities). The intrinsically polychronic nature of decision making means that fuel savings do not automatically generate drastic changes in fuel-collection behaviour as there is always a broader undercurrent of energy security at play. Thus, women tend to continue to spend labour time collecting fuel for future use and energy security, even if they have plenty for the present week, confounding any assumed simple relationship between fuel savings and time/labour savings.

Such dynamics illustrate how the characteristics of an improved stove sometimes require women to adapt to the new technology and carefully integrate it into their labour routine. This builds on Mary Douglas's concept of 'periodicity', which suggests that 'work frequencies tend to cluster into complementary role categories' (Douglas, 2002: 86) and that individuals will hold different capacities to be flexible in their use of time and accommodate new labour opportunities and forms of task-linking. Our research also demonstrates how different tasks or foods have unique needs and are thus affected differently by the new stove. But perhaps most fundamentally, examining this 'multitasking effect' illuminates how cooking is both *intrinsically* polychronic (women always completed other tasks while cooking, for example) and, in this case, *increasingly* polychronic (as efficient stoves create more time for multiple, simultaneous activities). This polychronicity renders seemingly straightforward time savings calculations difficult to quantify, as time saved/spent cooking is usually dynamic and overlapping with other domestic activities.

Collectivized Time

Research findings also raise questions about the assumed atomistic nature of household labour time. Interviews and focus groups reveal that women frequently use excess time to assist friends and family with their chores, distributing any time savings to neighbouring households by helping them in their fields or with other tasks. When discussing how they use newly freed-up time, it was common for individuals to describe sharing their labour: 'we go to work in our own fields, but sometimes we need more help ... so neighbours will come help, and if they need help we will go help in their

fields too'.¹⁴ A full two-thirds (67.1 per cent) of respondents said they often spent additional time saved by helping others with agricultural labour. Sentiments like these lead us to understand that freed-up time is often collectivized (see, e.g., Leder et al., 2019). Individuals do not readily perceive of time as an individual resource, which they can manage, consume and benefit from as they see fit. Rather, time is often treated as a collective village resource, which is traded and shared through practices of reciprocated assistance.

Under this system of collective time, multiple obligations often unfold in concert. Women's time is layered by social relationships, as it overlaps with other individuals' time and needs. In this sense individual time cannot be neatly saved or managed, because it is already embedded in a web of other social commitments. If villagers often treat time as a shared resource, and any free time accrued due to the clean cookstove is given to or exchanged with others, we must reconsider the assumed implications of 'time savings'. Faster cookstoves will not necessarily open space for entrepreneurship or employment if that time is already rooted within a network of collective labour needs and obligations.

Hybrid Labour and Leisure Time

Periods of time allocated for 'productive' work (labour time) and time allotted for pleasure (leisure time) are typically understood as occurring within separate temporal containers (e.g. using the Women's Empowerment in Agriculture Index) — time allocations that, while related, are experienced (and measured) as empirically distinct (Alkire et al., 2013). Our research, however, suggests that what many outsiders have described as work (and even drudgery) may in fact double as a meaningful opportunity for socializing or 'leisure time'. For example, when women collect fuelwood they often do so in small groups for company and safety, taking the time to socialize and gossip with their friends, and also to gain a valuable respite away from their home and family where they can rest or defecate away from the family compound (O'Reilly et al., 2017). As one woman related: 'If we are going far away, then we always go together, for security, if there is a problem we are there to help out'.¹⁵ Women also help each other tie loads, place loads on one another's heads, and climb trees to reach difficult items — collection is usually a cooperative activity. Aside from these outings, women might not readily find opportunities to spend time with their friends and to be away from their husbands. When asked if they enjoy anything about collecting wood, one woman stated that she enjoys 'going in a group and spending time together, doing this one activity together as an outing. We also enjoy going

14. Interview, married female, Paderu, Andhra Pradesh, 10 January 2017.

15. Interview, married female, Gangavathi, Karnataka, 5 January 2017.

to get the best wood possible and get pleasure in finding good wood'.¹⁶ In this sense, some women appear to perceive fuel collection as an opportunity for social interaction, personal pleasure and home care as much as a chore.

Leisurely household activities such as gossiping, socializing and watching television together are a major part of how women employ any excess time afforded by a new stove. However, as with fuel collection, women usually perform simple household tasks while engaging in leisure, and they don't necessarily see any of these activities as distinct temporal categories of their social lives. Most activities are interspersed with elements of both tedium and enjoyment, and women tend to socialize and rest within a continuous work process and not apart from it. (This conforms to the polychronic nature of women's routines, as constant and dynamic multi-tasking complicates simple delineations of time.) When it comes to cooking and fuel collection, work is rarely only work, and leisure rarely only leisure. Our discussions with women suggest these two temporal modalities are frequently collapsed within a single activity — indeed, some women did not readily comprehend the meaning of free or leisure time when asked.

Our findings thus expose a false dichotomy between leisure time and labour time often promulgated within development discourse such as that of the GACC. This binary enables a converse and zero-sum relationship, where a reduction in labour time necessarily results in an increase in leisure time. But because these temporal categories are often ambiguous and overlapping, it becomes difficult to systematically assess the implications of newly found 'free time' in women's routines. The familiar work/leisure dichotomy is largely created through the definitions of waged employment — where labour becomes formalized and temporally delineated as an hourly wage, and its inverse (leisure) becomes a distinct social practice and temporal category (Veal, 2004). And yet labour and leisure time are not necessarily differentiated in women's household labour routines. This signals a single hybridized stream of activity that defies easy characterization or imposed 'solutions' by development agencies utilizing traditional delineations of leisure and labour time (e.g. Alkire et al., 2013).

EMPLOYING FREE TIME: WAGED LABOUR AND 'EMPOWERMENT'

Despite the complexities outlined above, it is nonetheless important to explore how women actually use any 'saved' time afforded by the improved stove. Does this time indeed go to entrepreneurial activities and

16. Interview, married female, Paderu, Andhra Pradesh, 11 January 2017.

social engagement, as has been suggested within the clean stove sector? Although considerable emphasis gets placed on the value of time savings, and on the potential of this time to economically empower women, women participating in our study did not describe anything so dramatic.

While most women reported spending less time cooking each day, they also noted that their routines overall have not significantly changed: 'Yes, it is different, not so much a change in daily routine but there is a little saving in terms of cooking time'.¹⁷ Or, as another woman noted, 'The routine didn't change much, but we have some extra time with the new stove because cooking is much faster'.¹⁸ Few of the respondents reported pursuing entirely new economic activities since receiving the stove, contradicting the idea that time savings afford women novel opportunities. When asked if there is anything new they can do which was not possible before, one focus group participant in Koppal District noted 'there are no completely new activities that we do since getting the stove. We don't even sleep more often, in the village we do not sleep much', though she did add that 'with more time we get more gossiping with our friends, and more time to watch our TV shows'.¹⁹ Women often cited watching their favourite television shows together, or perhaps staying up a bit later to socialize. Women shared that they now spend more time chatting with their neighbours, saying they visit one another's houses more often. 'After we come back from the field and finish cooking, then there is time for [social] interaction, probably around the stove because it is cold'.²⁰ The majority of respondents (72 per cent) said that time spent socializing with friends has increased since they acquired the new stove. Similarly, some discussed spending more quality time with their children while they cook (in part because reduced smoke makes the kitchen more habitable); 61 per cent of women reported that the time spent caring for children or other family members has increased. While all of this would be difficult to characterize as political or economic 'empowerment' in the conventional sense, it does signal simple but meaningful changes in these women's daily comfort and quality of life.

There are notable exceptions, however, including cases where waged labour emerged from newly freed-up time. Many individuals reported getting more involved in various community programmes, especially other projects run by local NGOs. Here, 71 per cent said that their time spent on community activities has increased since receiving the new stove, with many people becoming more involved in microcredit programmes, religious groups, agricultural training and other activities. These cases

17. Interview, married female, Paderu, Andhra Pradesh, 10 January 2017.

18. Interview, married female, Gangavathi, Karnataka, 6 January 2017.

19. Interview, married female, Gangavathi, Karnataka, 5 January 2017.

20. Interview, married female, Paderu, Andhra Pradesh, 10 January 2017.

demonstrate how clean stove projects can provide access and exposure to other development projects involving health, education, environment and social development.

However, many remarked that the reduction in time spent on one chore (e.g. cooking) usually just meant they had more time to engage in other chores. When asked, one woman responded that she spends her new free time ‘cleaning the house, washing the clothes or dishes, going to fetch water, and so on’.²¹ The overwhelming majority of respondents reported that their time spent on unpaid labour like household chores had not decreased since receiving the improved stove — in fact, 71 per cent of women said the time spent on chores other than cooking had actually increased. These sentiments suggest it is inaccurate to assume that time savings automatically translate into new types of (paid) labour. Instead our findings suggest that time saved by the new stoves is most often simply redirected into other chores.²² As one woman noted, extra time is used to ‘just do household chores like cleaning and washing’, adding that ‘when we finish this earlier we go for agricultural work’.²³ In this context, engaging with waged work alongside the normal demands of household labour may place increasingly burdensome labour expectations on individual women.

This reference to working in the fields is informative: in these villages additional work outside the home is predominantly agricultural and only occasionally completed for a cash wage. Village economies in the Karnataka and Andhra Pradesh study areas are overwhelmingly agricultural, and there are very few other employment opportunities. As one woman put it ‘here, everyone owns their own fields, so often people are just going to work in their own fields [after cooking]’.²⁴ Another woman explained ‘because we are primarily agricultural workers, we have more time to go to the fields, especially in the morning’.²⁵ Nearly 80 per cent of women described working in their families’ fields when they have finished housework. While this would be difficult to characterize as empowering, the additional time in the field is often viewed favourably — as one woman said ‘we are farmers and we work in the fields, so if we cook quickly we can improve our lives by being more productive in the field’.²⁶ In short, a considerable amount of free time is simply distributed to other types of unpaid domestic and agricultural labour — not the kind of waged work or market participation envisaged by the GACC.

21. Interview, married female, Paderu, Andhra Pradesh, 11 January 2017.

22. These findings support a long-held understanding described by Cowan (1983) and elsewhere that technological advancement has not lessened expected female household labour output (compared to non-domestic economic sectors).

23. Interview, married female, Paderu, Andhra Pradesh, 10 January 2017.

24. Interview, married female, Gangavathi, Karnataka, 5 January 2017.

25. Interview, married female, Paderu, Andhra Pradesh, 11 January 2017.

26. Interview, married female, Paderu, Andhra Pradesh, 11 January 2017.

Instances of Employment and Entrepreneurship

Nonetheless, there were examples where respondents described additional economic activities associated with more efficient stoves, even examples of paid entrepreneurial pursuits. In Paderu, women can collect more non-fuel forest items for household use or sale at the market, potentially providing supplementary income. When they finish collecting fuel, they spend time gathering other items such as tubers or thick leaves used for making plates, brooms and other household items: 'When we go out we get many forest products like *adda* leaves and fruit and tubers for food, as well as seeds for snacks. Many of these things we can sell in the local market. We now have more time to collect these products. Because of this we have more money and our income has increased'.²⁷ Another group of women near Gangavathi recently expanded a small business making decorative flower necklaces which are used for prayer and shrine decorations. One individual explained 'Now I have more time, an extra half hour or so each time I cook, to bring flowers and tie them, so now I do extra work on these flowers and can sell them in the market or to neighbours'.²⁸

Most research participants said that entrepreneurial opportunities are far less available than wage agricultural labour, the predominant form of local employment. Many people in the Paderu site are involved with the government labour programme, National Rural Employment Guarantee Act (NREGA), in which local people help manage Forest Department timber and coffee plantations in exchange for a cash subsidy, as well as training and coffee saplings. As one NGO stove technician described 'often people now have more time to work with NREGA, before only maybe two or three people from each family could go work for the NREGA programme, but now with time saved the women and children over 18 all together can go work'.²⁹ Each family gets 100 days of labour; families may now get closer to this quota limit, thus bringing more cash into remote rural households. In fact, 87 per cent of respondents in Paderu say they have increased time available for wage labour, all referring to the NREGA. Conversely, only 2.5 per cent at the Karnataka site say wage labour and income have increased due to their time savings. This suggests that increased income and economic activity is strongly dependent on local labour opportunities.

Yet, even in instances where paid agricultural labour opportunities arise, there are notable barriers to substantive empowerment. Some women in Gangavathi, for example, described engaging in paid work for large commodity-crop operations, usually farmers outside the immediate area who have contracts with transnational agribusiness firms. In these instances, and others, women described performing tasks for a meagre wage under

27. Interview, married female, Paderu, Andhra Pradesh, 10 January 2017.

28. Interview, married female, Gangavathi, Karnataka, 6 January 2017.

29. Interview, male NGO field staff, Paderu office, Andhra Pradesh, 9 January 2017.

wealthier, landowning families, rather than working for themselves. These are certainly not the kind of aspirational and ‘empowering’ waged jobs described by the cookstove development sector.

RECONSIDERING TEMPORALITIES OF HOUSEHOLD LABOUR AND EMPOWERMENT

The prioritization of women in cookstove projects has led groups such as the GACC to issue propitious reports on the beneficial impacts of new stoves and to trumpet those benefits to governments and financiers alike — benefits that include not only health improvements from cleaner indoor air, but also forms of economic empowerment derived from increased free time. And yet, despite these explicit goals, many gender and labour simplifications persist within the clean cookstove sector (Subramanian, 2014).

Early on, Crewe (1997) argued that many of the same normative development ideas and practices — leaning heavily on modernization theory, socio-economic considerations and androcentric viewpoints — remain at work. For example, according to Khandelwal et al., if traditional stoves are ‘backward, inefficient, unhealthy, and destined for obsolescence’ (2017: 14) then clean varieties must provide a modern, efficient and healthy alternative that bring with them a wide range of broader ‘modernizing’ and entrepreneurial influences, that will ‘release’ women’s time ‘from domestic chores for income-generating activities’ (ibid.: 20). However, the evidence provided here challenges any seemingly linear or causal relationship between a new stove and decreased domestic labour or increased entrepreneurialism. The persistence of these knowledge blind spots has led project goals to be formulated around conventional development ideas that have historically undermined the achievement of gender-sensitive outcomes (Ghertner, 2006; Sultana, 2018). We propose that such assumptions endure, in part, because there is a lack of detailed understanding of diverse household dynamics and complex temporal considerations that might otherwise challenge the veracity of these sweeping sector claims (Goetz and Jenkins, 2016).

Complexities of Time in Place: Polychronic, Collectivized and Hybrid Time

Our findings suggest that while improved cookstoves definitively save time and subtly alter daily labour routines, especially by creating more time for socialization and relaxation, these time savings do not appear to radically influence the livelihood opportunities of research participants. Usually these time savings are simply redirected into other forms of household related work and chores, thus potentially increasing individual household labour burdens for women. While there is also evidence that time savings may

enhance simple entrepreneurial practices and allow for some employment in agriculture, these possibilities are strongly context dependent and cannot be expected project outcomes.

We also identify the presence of three complex temporal conditions: polychronic time, collectivized time and hybrid work/leisure time, each of which complicates our understanding of temporal labour dynamics in these villages. Due to the design and use function of improved stove technologies, most time savings actually occur through a multitasking effect, in which women find brief moments to complete other tasks during the cooking process; these are short windows of time that do not readily accommodate forms of entrepreneurship and market employment. This is a condition reflecting how periodicity limitations (Douglas, 2002) influence women's ability to 'secure autonomy from the dull constraints of routine and begin to enjoy the flexible use of time' (Fardon, 1999: 137). Moreover, because people appear to share their time with others, by maintaining a series of overlapping community obligations, we cannot assume they could or will choose to spend their time in income-generating pursuits. Lastly, we find that household labour and leisure rarely operate as a zero-sum, where time savings in the former category can be automatically shifted into the latter, because these categories are often blurred and engaged simultaneously. These fragmented, hybrid moments, which serve multiple purposes, problematize attempts to neatly classify and redistribute women's time through cooking technology. Finally, an examination into the multiple temporalities of household labour suggest that the pathway to empowerment runs, in part, through increases in non-waged employment and the capacity for women to use newly freed-up time for unpaid yet meaningful activities.

Against Stove Stacking and Other Underlying Constraints to Empowerment

While these multiple temporalities of household labour fundamentally complicate efforts to promote or evaluate women's empowerment, it is important to note that such development programmes always unfold within complex and power-laden social contexts that may stymie even the best intentioned of projects (Kabeer, 1999). The case of 'stove stacking' (using multiple stoves) restrictions presents a useful example of underlying and often fundamental barriers to empowerment. Most cookstove projects require the use of only their newly issued clean cookstoves and the removal of all other traditional stove types. This is certainly the case in carbon-financed projects (such as the two projects evaluated in this study) where emissions totals are closely scrutinized to meet carbon market offset requirements (Simon et al., 2012). In many instances, stove auditing involves monitoring women's stove use in order to ensure compliance. But most women in fact want to use multiple stove types during the course of a day, week or season as part of customizing their cooking practice. For example, a traditional three-stone fire may

be preferred for certain things, such as heating bathwater, whereas liquified petroleum gas might be used for tea during larger family gatherings. As one NGO employee remarked ‘people like having options, and like being able to use multiple stoves, so when you remove this option they don’t like that’.³⁰

In this sense, stove stacking may be considered part of a woman’s agency, expressed through her desire for choice, control and customization during household labour routines. The insistence on operating a single stove type thus presents a fine-scaled ethical paradox for development practitioners: stove projects simultaneously constrict a woman’s agency whilst attempting to enhance it. Signalling a contradiction that cuts to the very heart of these technology interventions, efforts to empower women may wind up ultimately curtailing their control over the hearth — which is itself an important space for the enactment of care, nourishment, love, femininity and moral order (Khandelwal et al., 2017).

The imposition of stove stacking restrictions is a reminder that female empowerment pursuits — just like choices women make to gain access to market employment opportunities — are situated within power-laden household, village and regional contexts. Underlying social and economic relations and constraints based on caste, class, religious and gender associations, and intrahousehold negotiation dynamics (Sen, 1990), will likely influence the ability of women to participate in market opportunities outside the home, whether entrepreneurial or otherwise, and may stymie even the most well-intentioned attempts at empowerment.

REASSESSING NEOLIBERAL EMPOWERMENT: FROM MARKET EMPLOYMENT TO FREE TIME AND ‘MUNDANE AGENCY’

Our findings suggest there is no clear link between newly generated free time and increased paid labour and/or entrepreneurial opportunities for the majority of women participating in our study. ‘Time savings’ are used in complex ways. By animating the polychronic, collective and hybrid nature of household labour, we are able to see how the pathway to empowering employment opportunities is anything but straightforward.

Our research results do, however, offer another, more fundamental, insight about the relationship between technologies, free time and empowerment: it appears flawed to argue that if employment opportunities are uncommon then women must not experience empowerment, or to argue that if jobs are available then women will be necessarily empowered. And yet these are precisely the ideological contours through which the empowerment discourse runs; a framing that routinely conflates empowerment with market employment. Within these discursive parameters we are led not only to believe that

30. Interview, female NGO field staff, Kanakagiri office, Karnataka, 6 January 2017.

if women are paid then they are necessarily empowered, but also that if new employment opportunities are not paid then those cannot be empowering.

If we adopt these neoliberal conceptions of empowerment, which emphasize income generation and market participation, then our research will lead us to conclude that improved stoves do not significantly improve the social status of women. But if we expand our conceptual purview to consider meaningful improvements in daily quality of life and the mundane activities that improved stoves can afford (e.g. more time spent with children, friends or alone) our assessment of empowerment may look quite different (Kabeer, 1999). Broadening our inquiry into the relationship between cooking technology, free time and embodied agency requires us to re-evaluate where, when and how empowerment happens (Jackson, 1998). In this sense, free time itself may be empowering precisely because it is open and unobstructed (even liberating) by giving individuals more control over their own uses of time, even if in simple and routine ways. (Of course, it is also important to emphasize that non-market and unpaid work performed during freed-up time is also not necessarily empowering: the extra chores experienced by some women were often viewed with ambivalence or even frustration.)

Extending beyond market participation, we may understand this version of empowerment as one that captures and values these forms of 'mundane agency'. Indeed, as Kabeer et al. (2013: 16) note, 'women's capacity for choice and agency' and their 'capacity to exercise personal and interpersonal agency' should be central to contemporary development conceptualizations of empowerment. Animating multiple temporalities of household labour can reveal complex, non-linear, shared, hybrid and mundane work practices and social relations that may lead to expressions of empowerment that are difficult to capture under more market-centric empowerment formulations. It is our hope that, alongside employment considerations (indeed intertwined with them), development policy will seek to encourage and protect these prosaic enactments of empowerment.

To summarize, illuminating multiple temporalities of household labour challenges conventional understandings of 'time-savings' and associated 'women's economic empowerment' and exposes their incongruence with the complex, non-linear, shared, hybrid and mundane work practices and social relations of individuals engaging with cooking technologies. More crucially, we have argued that the clean cookstove sector's sense of economic empowerment inadvertently devalues unpaid household labour by women and erases the value of more ordinary activities, meanwhile glorifying waged work that is often tedious, underpaid and mediated/controlled by wealthier, more powerful men. Further, in certain instances, waged work can impede or be burdensomely added to pre-existing unpaid domestic labour responsibilities. Directly equating waged employment with 'empowerment' simply does not reflect the reality of work for poor rural women in our research area. In these ways, the clean cookstove sector's portrayal of empowerment can be seen as facilitating the advancement of a neoliberal vision of rural

women's livelihoods in which empowerment and agency are reconfigured and incorporated into the deeply problematic wage relations of capitalist economies. Perhaps more crucially, this view of empowerment which privileges market participation (over other improvements in quality of life and 'mundane agency') overlooks many of the *actually experienced* positive effects of improved stoves; benefits which tend to be domestic, communal, routine, non-economic and difficult to quantify.

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