

WHEN ACCESS ISN'T ADOPTION: SOCIAL AND MATERIAL DETERMINANTS OF CLEAN-COOKING PRACTICE IN KIGALI

QUANDO O ACESSO NÃO É ADOÇÃO: DETERMINANTES SOCIAIS E MATERIAIS DAS PRÁTICAS DE COZINHA LIMPA EM KIGALI

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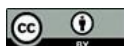
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Abstract

This study examines clean-cooking transitions in Kigali, Rwanda, showing how policy, market dynamics, social obligations, climatic events, and kitchen materialities jointly shape everyday fuel choice. Using a qualitative narrative-ethnographic design, we combined 20 semi-structured interviews, 100 in-home observations, 15 transect walks, and 10 focus-group discussions with 50 households, supplemented by document and grey-literature review. Narrative inquiry reveals an enduring access–adoption gap: despite nominal availability of LPG and electricity, patterned frictions keep households fuel-stacking. Temporal pressures (school and work rhythms, rain events) and sensory conventions (flavour and texture as quality criteria) sustain charcoal “finishing,” while material authority (prepayment meters, mobile-money balances, cylinder custody, and last-mile access), mediates when clean fuels are practicable in real time. Adoption trajectories are thus driven less by device ownership than by situated interactions among people, artefacts, places, and rules. We show that cylinders, meters, and phones distribute decision-making power across household members and vendors, and that rain-induced transitions and “anticipated flavour” shape sequence choices even in connected homes. These findings explain why “access” alone rarely yields exclusive clean-fuel use. We argue for practice-aware interventions that pair technical provision with measures that smooth refill and credit frictions, redesign metering and custody arrangements to align authority with primary cooks, and leverage peer forums for safety, taste, and skill retraining. Because these determinants are gendered and time-sensitive, programmes that reduce the temporal and cognitive load on primary cooks are

Resumo

Este estudo examina as transições para o cozimento limpo em Kigali, Ruanda, mostrando como políticas, dinâmicas de mercado, obrigações sociais, eventos climáticos e a materialidade da cozinha moldam conjuntamente a escolha diária de combustíveis. Utilizando uma abordagem qualitativa narrativa-etnográfica, combinamos 20 entrevistas semiestruturadas, 100 observações domiciliares, 15 caminhadas de reconhecimento e 10 discussões em grupo focal com 50 famílias, complementadas por revisão de documentos e literatura cinzenta. A investigação narrativa revela uma lacuna persistente entre acesso e adoção: apesar da disponibilidade nominal de GLP e eletricidade, padrões de fricção mantêm as famílias utilizando combustíveis diferentes. Pressões temporais (ritmos escolares e de trabalho, eventos de chuva) e convenções sensoriais (sabor e textura como critérios de qualidade) sustentam o uso de carvão vegetal, enquanto a autoridade material (medidores pré-pagos, saldos de dinheiro móvel, custódia de cilindros e acesso ao último quilômetro) influencia quando os combustíveis limpos se tornam viáveis em tempo real. Assim, as trajetórias de adoção são impulsionadas menos pela posse de dispositivos do que pelas interações situadas entre pessoas, artefatos, lugares e regras. Demonstramos que botijões de gás, medidores e telefones distribuem o poder de decisão entre os membros da família e os fornecedores, e que as transições induzidas pela chuva e o “sabor antecipado” moldam as escolhas de sequência, mesmo em casas conectadas. Essas descobertas explicam por que o “acesso”, por si só, raramente resulta no uso exclusivo de combustíveis limpos. Defendemos intervenções práticas que combinem o



likely to deliver larger and more durable gains in emissions reduction, health, and everyday reliability than access-only strategies.

Keyword: Clean Cooking. Household Energy Practices. Access–Adoption Gap. Fuel Stacking. Material Authority.

fornecimento técnico com medidas que suavizem as dificuldades de reabastecimento e crédito, redesenhe os sistemas de medição e custódia para alinhar a autoridade com os cozinheiros principais e aproveitem fóruns entre pares para segurança, sabor e reciclagem de habilidades. Como esses determinantes são influenciados pelo gênero e pelo tempo, programas que reduzem a carga temporal e cognitiva dos cozinheiros principais provavelmente proporcionarão ganhos maiores e mais duradouros na redução de emissões, na saúde e na confiabilidade diária do que estratégias focadas apenas no acesso.

Palavras-chave: Culinária Limpa. Práticas de Energia Doméstica. Lacuna Acesso-Adoção. Combinação de Combustíveis. Autoridade Material.

1 INTRODUCTION

Household energy use is environmentally consequential, and clean-cooking initiatives aim to reduce exposure to harmful smoke and accelerate low-emissions transitions (Murshed, 2022; Shankar *et al.*, 2020; Ravindra *et al.*, 2021; Carter *et al.*, 2019). Yet adoption alone rarely predicts practice; switching fuels in principle does not guarantee switching routines in practice (Yang *et al.*, 2024; Sovacool, 2016; King, 2005). Across African cities, policy incentives, subsidies, and infrastructure expansion have increased the availability of LPG and electricity, but day-to-day cooking remains shaped by social meanings (taste, hospitality, status), temporal pressures (school and work rhythms), and material constraints (cylinder access, prepayment balances, rain) (Belaid & Hejazi, 2025; Agoundedemba *et al.*, 2023; Das *et al.*, 2024). A practice-theoretic lens conceptualises cooking as patterned action, embodied, materially mediated, and socially organised, stabilised (or disrupted) by policies, markets, places, and norms (Halkier, 2009; Hoolohan *et al.*, 2022; Seidl *et al.*, 2021). From this perspective, interventions succeed when they align with the teleo-affective order of kitchens (the ends pursued, emotions engaged, and norms enacted) and falter when new devices or tariffs collide with established routines (Molander & Hartmann, 2018; Welch, 2017; Ngusa, 2025; Vigolo *et al.*, 2018).

Qualitative research, especially open-ended, in-situ designs, is well-suited to reveal how interventions articulate with lived routines because it attends to sequences, settings, and the mundane skills that make practice possible (igniting, heat management, timing by smell or sound) (Sutton & Austin, 2015). In Kigali, clean-cooking options coexist with persistent fuel stacking, suggesting that “access” is necessary but insufficient for “adoption” in practice (Nshimiyimana *et al.*, 2024; Shankar *et al.*, 2020; Vigolo *et al.*, 2018; Ibe & Kollur, 2024). Our narrative-ethnographic approach, combining semi-structured interviews, in-home observations, transect walks, and focus-group discussions, was designed to elicit unanticipated dynamics (Chand, 2025; Marion Suiseeya & Zanotti, 2023; Gobbo, 2022), including rain-triggered fuel switching, “flavour” expectations, and the distribution of authority around cylinders, meters, and mobile money.

This article addresses the access–adoption gap by asking: Which social and material determinants sustain or disrupt clean-cooking practice once access exists? We demonstrate how social meanings (taste, hospitality, elder authority) and material arrangements (prepayment balances, cylinder custody, last-mile logistics) jointly configure everyday cooking routines in Kigali. In doing so, we move beyond device ownership or price-elastic responses to examine how infrastructure, artefacts, and social relationships allocate decision rights in time-critical cooking moments. The analysis contributes three points. First, it reframes clean cooking as the alignment (or misalignment) of programmes with existing practice architectures, not simply as a substitution of fuels. Second, it identifies material authority (who controls keys, meters, phones) as a pivotal, under-recognised determinant of practicability. Third, it specifies how temporal pressures and sensory conventions sustain fuel stacking even where electricity and LPG are available.

The rest of the paper proceeds as follows. We outline the Kigali case and our narrative-ethnographic methods, present five determinant clusters organising routine fuel use, and discuss its implications for programme or solution design to close the access–adoption gap.

2 CASE SELECTION AND RESEARCH METHODS

This study involved extended immersion in Kigali to examine how women’s clean-cooking practices are domesticated, contested, and sustained over time. Fieldwork

was conducted over six months across Kigali's three districts, Gasabo, Kicukiro, and Nyarugenge, and, in total, engaged 50 households through 20 semi-structured life-history interviews, 100 in-home cooking-session observations, 15 transect walks, and 10 focus-group discussions that were done over meals and used for horizontal validation of emergent themes. The study therefore spans a full six-month period, capturing routine variation across weekdays/weekends and wet/dry conditions.

Sampling was purposive and saturation-driven to maximise variation in dwelling type (Palinkas *et al.*, 2013), tenure status, household size, income proxies, and cooking histories. Eligibility criteria were women (≥ 18 years), residence in Kigali, and access to at least one grid-based energy supply. The design foregrounded temporality (life-history trajectories), sociality (peer exchange and collective meaning-making), and place (the embodied materiality of Kigali's kitchens).

Kigali was selected for analytical depth and policy relevance; comparatively high urban electrification coexists with persistent reliance on biomass for cooking (Nsabimana *et al.*, 2022), creating a context where clean-cooking offerings meet entrenched tastes, routines, and infrastructures. Socio-spatial diversity across the three districts provided contrasting settings, from tiled indoor kitchens to shared courtyard hearths, within which to study practice. The six-month window avoided peak rainfall periods where feasible while still capturing weather-induced switching.

Interviews over a meal elicited food and cooking biographies (past routines, present rhythms, future aspirations) and mapped vertical diffusion influences (policies, supply chains, artisan collaborations) (Mills *et al.*, 2016). Participant observation attended to ignition, heat management, task sequencing, cleaning, and embodied skills (airflow control, flame-pitch listening, aroma-based timing, safe cylinder handling) (Harvey, 2018). Transect walks documented kitchen layouts and last-mile access (Okoko & Prempeh, 2023); focus groups surfaced collective norms, peer authority, and skill transfer (Gailing & Naumann, 2018). A document/grey-literature review situated household narratives within market and NGO frameworks (Paez, 2017). Ethics clearance was secured from the Human Research Ethics Committee of Thammasat University and the National Council for Science and Technology (NCST) in Rwanda. All participants provided informed consent; anonymisation, member checks, reflexive journaling, and peer debriefings strengthened credibility, dependability, and confirmation.

3 RESEARCH FINDINGS

The analysis shows that access to adoption and everyday cooking coheres around determinants distributed across people, objects, places, and policies, with fuel stacking emerging as the workable compromise. What households do at the stove reflects interacting determinants, not isolated “barriers”, and adoption in practice hinges on conditions unfolding in time, space, and social relations. We therefore present results by determinant cluster: temporal–material, social–cultural, material authority, policy–market, and peer diffusion, combining mechanism-focused explanation with illustrative vignettes.

4 TEMPORAL–MATERIAL DETERMINANTS: WEATHER, TIME PRESSURE, AND STAGED FUEL USE

Across districts, time pressure repeatedly intersected with weather and appliance warm-up profiles to produce staged fuel use within single meals. During sudden downpours, cooks shifted to LPG or electric hotplates to ignite quickly indoors, reduce smoke accumulation in enclosed verandas, and keep pace with schooling and work departures. Fieldnotes describe breakfasts where water for tea or porridge moved first to LPG (“fast flame”), while beans or cassava simmer returned to charcoal once rain eased and courtyard airflow improved. The constraint is not simply meteorological; it is temporal: late buses and crowded morning routines compress acceptable cooking windows. LPG’s rapid response allows cooks to “buy time,” but charcoal’s perceived superiority for slow dishes reasserts itself once the rush abates (Dias Júnior *et al.*, 2021).

Even on dry days, temporal sequencing mattered. Weekday mornings privileged speed and predictability, boiling and reheating on LPG, whereas weekend gatherings tolerated charcoal’s longer ignition for perceived “flavour” and conviviality around the stove. These rhythms were further shaped by electricity reliability and prepayment balances; when evening balances ran low, cooks anticipated meter trips and preemptively reallocated long-simmer tasks to charcoal to avoid mid-meal power loss. Children’s homework schedules, prayer times, and market closing hours also set temporal boundaries that made certain fuels practicable in the moment.

Two mechanisms anchor these patterns. First, start-up frictions; charcoal's ignition and ash management impose a fixed time cost that is intolerable under punctuality demands but acceptable when time is elastic. Second, heat curve matching; LPG is chosen for rapid boil or sauté, charcoal for extended simmer requiring steady, enveloping heat. The temporal–material pairing stabilizes fuel stacking because each fuel's thermal profile slots into different segments of the same meal.

Programmatically, this suggests that “exclusive clean use” targets must confront time–heat mismatches. Interventions that reduce start-up frictions on clean devices (e.g., auto-ignition reliability, wind shielding, pot–stove fit) or support temporal buffering (e.g., advance credit to avoid evening meter trips; weather-resilient cooking shelters) are likely to displace staged charcoal returns. Without addressing the tempo of kitchens, increase in access to clean cooking stoves will continue to coexist with pragmatic, time-sensitive charcoal use.

5 SOCIAL–CULTURAL DETERMINANTS: TASTE CONVENTIONS AND HOSPITALITY NORMS

Taste was not merely preference; it functioned as a shared evaluative standard organising who cooks what, for whom, and when (Clark, 1998; Koczanowicz, 2023; Spence, 2015; Schmidt *et al.*, 2017; Dinges & Zakkou, 2020; Lahne, 2016; Asimwe *et al.*, 2024). Long-simmer dishes, beans, isombe (cassava leaves), and certain stews were frequently narrated as “remembering charcoal”, meaning that charcoal confers a smoky aroma and mouthfeel coded as authentic or celebratory (Ghorbani *et al.*, 2020; Viegas *et al.*, 2012). In extended families, elders' judgements during communal meals stabilised these conventions. Hospitality norms amplified the effect; when visitors arrived, cooks sought to perform care through dishes associated with patience and abundance, often charcoal-simmered. Conversely, for school-night dinners or quick breakfasts, LPG/electric was socially acceptable, even desirable, because punctuality and predictability signal responsibility and care in those contexts.

These social valuations were learnt and policed collectively. Focus-group discussions showed how young women negotiate conflicting expectations, delivering the “right taste” on charcoal for a weekend feast while demonstrating modern competence on LPG during busy weekdays. Gossip and reputational cues mattered. A failed bean texture

or the absence of the expected aroma risked gentle to strong ridicule, which reinforced the association of specific dishes with specific fuels. At the same time, situated flexibility existed; some participants reported achieving “flavour” on LPG via small design tweaks (e.g., low-flame finishing, covered simmering, or using perforated metal inserts to diffuse heat), but such adaptations required tacit knowledge and confidence not everyone possessed.

Material practice is intertwined with meaning. Pot selection (heavy-bottomed vs. thin aluminium), lid use, and sequence (sear on LPG, finish on charcoal) were enlisted to reconcile taste with time. When these embodied techniques succeeded, cooks narrated pride in “getting charcoal taste without smoke.” When they failed, the episode was folded back into the community’s taste discourse as evidence that charcoal remains the rightful medium for certain dishes.

Messaging that treats “taste barriers” as misinformed preference underestimates their social weight. Programs can instead mobilise taste-congruent transitions; codify and share successful clean-fuel techniques for canonical dishes; sponsor peer demonstrations where respected cooks produce valued textures on clean stoves; and adjust recipe guidance to local teleo-affective orders (e.g., slow-finish methods that mimic charcoal envelopes). Recognising taste as social infrastructure, not an idiosyncratic whim, makes cultural alignment a design criterion rather than an afterthought.

6 MATERIAL AUTHORITY DETERMINANTS: KEYS, METERS, AND PHONE-BASED REFILLS

Decisions about which fuel to use were often made by the person who controlled enabling artefacts, keys to the LPG cage, the mobile phone linked to refill credit, or the prepayment meter card, rather than by the person stirring the pot. Authority migrated with objects. In several households, daughters-in-law or domestic workers did most cooking, yet a spouse or elder held the LPG cage key “for safety”, effectively deferring LPG use until the keyholder was present. Similarly, when the phone tied to mobile money sat with a wage earner away from home, timely LPG refills were impossible even if cylinders and regulators sat ready. Prepayment meters added another layer; the person who “feeds the meter” decided top-ups based on wage cycles and competing expenditures. Evening shortfalls cascaded into charcoal reversion regardless of the cook’s stated preferences.

This distribution of material authority shaped practice in subtle ways (Pascucci *et al.*, 2021). Anticipating key unavailability, cooks pre-plan meals around charcoal to avoid last-minute impasses. Some households developed informal protocols (e.g., leaving a spare key with the primary cook or keeping a small cash set aside for emergency top-ups), but these arrangements were fragile and could be revoked after minor incidents (a scorched pot, a perceived waste of gas). Safety narratives amplified control; household members justified key retention by referencing cylinder risks, even when cooks had demonstrated competence.

Observation suggested that where key/phone/meter control was aligned with the primary cook, clean-fuel use was more frequent and temporally flexible. Where it was misaligned, clean fuels became “event-based” (used when the controller was home), and charcoal filled daily gaps. The artefact-mediated gatekeeping thus transformed an access problem into an availability problem at the moment of need.

Design levers include secure but accessible storage options, such as lockable cages with dual-key or coded latch systems, shared refill wallets, or delegated meter allowances that grant the primary cook bounded autonomy. Second, safety-competence pathways are brief, credential-like demonstrations that legitimise granting key access to trained cooks. Third, interface tweaks and low-balance alerts routed to multiple phones; micro-top-up products that can be purchased by any adult in the household. Relocating material authority to the point of practice is essential if clean fuels are to become everyday rather than occasion-bound.

7 POLICY–MARKET DETERMINANTS: SUBSIDIES, REFILL CREDIT, AND LAST-MILE AVAILABILITY

Households navigated an uneven terrain of subsidies, tariff structures, refill credit, and local supply reliability. Even when nominal prices favoured LPG per unit of useful heat, transaction design and cash-flow timing often determined practicability. For example, lump-sum cylinder swaps competed with small but frequent expenditures for food and transport. Where vendors allowed partial credit or mobile-money micro-payments, LPG use increased (Perros *et al.*, 2024; Hsu *et al.*, 2021); where only full swaps were possible, cooks postponed refills and reverted to charcoal purchased in small daily quantities. Electricity’s prepayment meters similarly bound usage to wage cycles; low

evening balances triggered tactical switching to charcoal for long simmers to avoid meter trips at mealtime.

Last-mile dynamics mattered. In neighbourhoods with multiple LPG depots and reliable delivery, cooks narrated confidence in planning LPG-heavy menus. In areas with fewer depots or inconsistent delivery schedules, households maintained charcoal as a risk hedge. Weather interacted with markets; heavy rains degraded road access for deliveries and made charcoal transport messy, but rain also increased indoor smoke concerns, creating contradictory pressures resolved through short-term improvisation (J. Kulindwa, 2025).

Subsidy communication shaped expectations and disappointment. Where households anticipated stable support (e.g., promotional starter kits), the withdrawal or administrative delays of subsidies bred scepticism and reinforced charcoal's reputation as "always there". Conversely, predictable benefits (e.g., consistent loyalty discounts, cylinder-swap credits) normalised LPG use. Importantly, households "read" policy through their own cash-flow lenses; a theoretically favourable tariff mattered less than whether small top-ups were possible today.

These findings suggest policy design should move beyond headline price to liquidity-compatible instruments. Options include smoothing refill costs via subscription models, enabling verified micro-credit tied to safe-use training, aligning vendor incentives with on-time delivery, and securing redundancy in last-mile networks. On electricity, targeted evening balance buffers or automatic micro-loans for cooking windows could reduce mid-meal meter trips. Crucially, programme monitoring ought to track practicability metrics (time to refill, number of vendors within walking distance, delivery reliability) alongside access metrics. When policy meets household liquidity and locality, clean fuels graduate from aspirational to default.

8 PEER DIFFUSION DETERMINANTS: STORY CIRCLES, DEMONSTRATIONS, AND CO-DESIGN

Peer space markets, courtyard gatherings, savings groups, and the study's focus-group discussions functioned as laboratories where practices were taught, tested, and legitimised. In these forums, respected cooks demonstrated techniques for achieving valued textures on LPG (e.g., low-flame finishing, staged seasoning, lid management),

fielding questions about safety, pot choice, and gas consumption. Observation indicated that such horizontal pedagogy reduced apprehension, especially among newer LPG users, and created a repertoire of “tricks” that participants subsequently reported using at home. Positive experiences spread through narrative contagion; a successful feast prepared “all on gas” was narrated with pride, challenging the inevitability of charcoal for taste-critical dishes.

Peer spaces also surfaced collective critique (Bauwens *et al.*, 2024). Participants compared regulator quality, cylinder seal reliability, and vendor punctuality, sometimes coordinating to pressure specific suppliers. Small co-design moves emerged: improvised “flavour rings” to diffuse heat, wind shields for verandas, or pot stands that stabilised thin aluminium pans on gas burners. These adaptations were shared, refined, and re-evaluated in subsequent meetings, turning diffuse anxieties into tinkering challenges with social rewards for innovation.

Reputation and authority modulated diffusion. Techniques endorsed by elder women or by cooks known for hosting successful events carried more weight than vendor or NGO messaging. Conversely, highly publicised but flawed demonstrations (e.g., undercooked beans at a community event) set back confidence and reinforced charcoal defaults. Sustained support mattered; one-off demonstrations impressed but did not stick without follow-up opportunities to practice and receive feedback.

Programmatically, peer arenas are not mere “awareness” channels; they are practice infrastructures. Embedding iterative, hands-on sessions (try-cook-reflect), recognising peer champions, and resourcing micro-innovations (stipends for local gadget tweaks; shared toolkits) can accelerate the domestication of clean practices. Where feasible, linking peer groups with responsive vendors (who can bring trial regulators, pot supports, or micro-refill options to meetings) bridges social momentum with market supply. Diffusion thrives when competence, confidence, and community validation rise together, turning clean cooking from an individual’s choice into a collectively maintained practice.

9 CONCLUSION: CLOSING THE ACCESS–ADOPTION GAP IN CLEAN-COOKING TRANSITIONS

Practice-theory scholarship views energy behaviours as constellations of shared routines stabilised by infrastructures, policies, and norms. The Kigali study affirms this: programme designs and market arrangements act as systems of provision, while sociocultural expectations, taste, hospitality, elder authority, and order determine when and how fuels are invoked. The result is a persistent access–adoption gap: clean options exist, yet fuel stacking remains a pragmatic equilibrium.

Our findings specify where interventions can move the needle. First, temporal–material determinants matter; start-up frictions, heat-curve mismatches, and rainy-day contingencies make clean devices impracticable at critical times. Designs that lower ignition hassle, stabilise simmering, and buffer evening electricity balances can displace “staged” returns to charcoal. Second, social and cultural determinants, particularly taste and hospitality, are not merely soft barriers; they are essential specifications. Programs that codify and diffuse clean-fuel techniques for canonical dishes and that mobilise respected cooks as demonstrators align technology with the kitchen’s teleo-affective order. Third, material authority determines availability at the moment of need. Redistributing custody (dual-key cages, shared refill wallets, delegated meter allowances) and legitimising trained cooks as keyholders turns access into usable access. Fourth, policy–market design must be liquidity-compatible: micro-refills, predictable delivery, and subscription models fit household cash flows better than lump-sum exchanges, while reliable last-mile networks build confidence. Fifth, peer diffusion is a practice infrastructure; iterative, hands-on forums that reward tinkering and problem-solving accelerate domestication and de-risk skill acquisition.

Because these determinants are gendered and time-sensitive, interventions that reduce temporal and cognitive load on primary cooks are likely to yield larger, more durable gains in emissions reduction and household health than access-only strategies. Two cautions follow; results are city-specific and based on qualitative inference; replication across seasons and cities, coupled with mixed-method evaluation (usage logs, indoor air quality, health endpoints), can test generalisability. Finally, monitoring should track practicability metrics, time to refill, evening balance trips, custody alignment, and delivery reliability, alongside device counts. Clean-cooking transitions succeed when

programmes pair technical access with practice-aware redesign of time, taste, authority, markets, and peer learning.

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Authors' Contribution

Both authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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