Strategy for institutional cook stoves promotion in the context of a behavioral change-A case study of Opoku Ware School and ST. Paul's Seminary, Accra, as the control in the research in Ghana.

Michael Kweku Commeh
Technology Consultancy Centre, College of Engineering, Kwame Nkrumah University Science & Technology
Kumasi, Ghana
Tel: (+233) 0200644968
mcommeh.tcc@knust.edu.gh

Christlove Opoku-Appiah
Logistics Comeph & Associates
Accra, Ghana
Tel: (+233) 0540413065
3kwesi60@gmail.com

Joseph Okine
(Rector)
St Paul's Seminary
Accra, Ghana
Tel:(+233)0208714609
jokineq@gmail.com

James Hawkins Ephraim
Director
Comeph & Associates Gh Ltd
Accra, Ghana
Tel: (+233) 0208716156
eygamkow@gmail.com

ABSTRACT

76% of households mainly cook using polluting fuels and inefficient cooking technologies or devices (Ghana Statistical Service [GSS] , 2017) [1]. As a result 13,000-16,000 people die from the aforementioned factors. Clean cook stoves borders on SDG 7 on clean energy and SDG 3 on health (Kumar et al., 2021) [2], SDG 2 on food security and sustainable agriculture, SDG 5 on gender, SDG 11 on cities, and SDG 13 on climate change, (Fenny et al., 2017) [3]. However, improved efficient cooking devices that eliminate the death associated with inefficient cooking stoves are not easily accepted, even when subsidized, (Ackah et al., 2021)[4] .What might be the underlying narratives to this resistance? This article tends to find out using OWASS as the first case study and using St. Paul's Seminary as a control. The research looked at the design of the institutional stove for both firewood and gas. The pot size is 210 litres stainless steel for 6 gas stoves and 6 firewood stoves.

The experiment from start to finish took exactly one year, from studying cooking dynamics including mental modelling mapping and some social philosophies. It also involved changing over from highly inefficient smoky stoves to efficient little or no indoor air pollution stoves.

Results indicated a relatively quick adoption of ICs within two months whilst St. Paul's Seminary took extra funds and a threatening approach to get cooks to adopt the technology over two months, even though incentives in the form of cash were given.
Three major narratives emerged as to the reason for the success toward the adoption or acceptance of the technology, namely; safety of the stove, efficiency or huge energy/cost saving, human centered design, power or control of the fire/flame and discipline in the supervision of management protocol by actors in the improved clean cooking devices value chain. Despite the huge success, work still needs to be done on the safety of the gas stove and continuous training on the management of the cooking devices, especially the gas stove.

Conclusively, acceptability was generally successful with OWASS while St. Paul was with difficulty despite the similarity in problems and solutions.

Keywords: Institutional cooking devices, actors, power play, safety & security and management protocol.

1. INTRODUCTION

76% of households mainly cook using polluting fuels and inefficient cooking technologies or devices (Ghana Statistical Service [GSS], 2017) [1]. As a result 13,000-16,000 people die from the aforementioned factors. Clean cook stoves borders on SDG 7 on clean energy and SDG 3 on health (Kumar et al., 2021) [2], SDG 2 on food security and sustainable agriculture, SDG 5 on gender, SDG 11 on cities, and SDG 13 on climate change, (Fenny et al., 2017). Ghana, like India, has 65% of its citizens cooking on inefficient biomass cooking devices. These biomass stoves produce smoke and greenhouse emissions (GHG) either in an enclosed area or an open area, (Nina , 2022) [3] ; Cooking in an enclosed area with inefficient biomass cooking devices leads to Indoor air pollution (IAP) and while cooking outside leads to localised pollution especially when attending to the smoldering firewood. It has been observed over the years that inefficient institutional cooking devices pollute more than household cookstoves using a cooking pot of fewer than 20 litres, (Venkataraman et al., 2010) [6]. A cooking device is termed as institutional when it is more than 20litres cooking pot. An efficient clean cooking device is a device that uses less fuel, 96%

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fewer emissions, uses more than 60% less fuel and no or 95% smoke. Normally institutional cooking devices which are found in big restaurants, hospitals, schools, street vendors etc. face a lot of resistance. Unfortunately, these institutional devices do massive damage to the environment, the climate as well as minimise income. Despite the negative results inefficient biomass institutional stoves give us, acceptability is at its rock bottom in Ghana. Funding by the United Nation Development programme under the Global Environmental Facility for large-scale intervention efforts to pilot 23 schools amounts to 46 stoves. In trying to address multiple methodological and sociocultural issues, each school had one flat bottom stainless steel pot and one stove fitting traditional round-bottom cooking pot, normally made of aluminum, in 2015. Despite its efficiency, speed and comfort during cooking, all the schools abandoned the new stoves and the question is WHY was the cook stoves abandoned?
This article tends to find out using OWASS as the first case study and St. Paul's Seminary as a control. The research looked at the design of the institutional stove for both firewood and gas. The pot size is 210l stainless steel for 6 gas stoves and 6 firewood stoves.

2. METHODOLOGY

This exploratory study provides preliminary data cook stove acceptability study between Opoku Ware Senior high School (OWASS) and St. Paul Catholic Seminary. The project at Opoku Ware was funded by alumni of the school, while St, Paul's Seminary was funded by School authorities. And the reason was to save money and have a clean hygienic kitchen.
Traditional cooking devices and practices were assessed through observations. Twenty vehicular metal tire rims were formerly used for 150-180 litres round bottom pots. The interventional stove is a sunken-in-stove, where the cylindrical stainless steel cooking pot is 210 litres figure 1.

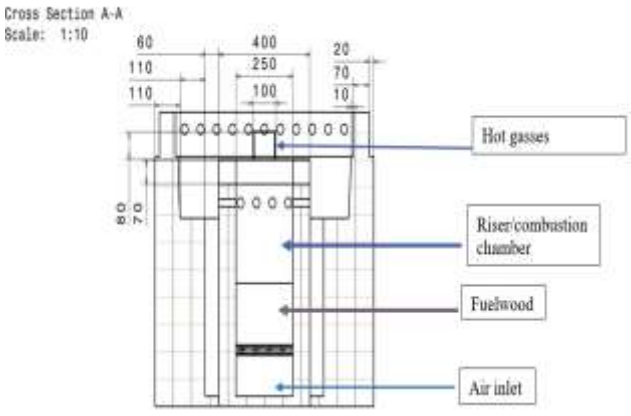

Figure 1. Sunken-in-stove

The thermal efficiency of the cooking device is above 60%, without any electrical power to add forced. In all 6 gas stoves and 6 advanced biomass stoves, one fish/meat smoker, maize and groundnut patching stove were installed as an intervention solution. The finished stove were artistically painted. GHc 20 was shared among the female cooks because they were the immediate users of the stoves after the management and maintenance training on both gas and biomass stoves at both OWASS and St. Paul Seminary. The Ghc 20 would be given every three months to the OWASS cooks for 12 months.
One also looked at the structuration theory Giddens, A., (1986) [7]; in which the concept of sociology offers perspectives on human behavior based on a synthesis of structure and agency effects known as the "duality of structure", where humans interact with meanings, standards, values, power and positing a dynamic relationship between these different facets of society. Behavioral science was used as a driver of change to identify and use in the intervention, taking seriously into consideration the "what is in it for me (WIIIFM)?" Questionnaires were administered to more than 70 actors in the value chain thus perception of Institutional cook stoves, perceptions about mission and strategy, external pressures and the environment, about stakeholders and concluding questions.

One looked at before and after of the concentrations of particulate matter (PM) with a diameter < 2.5 μm ($PM_{2.5}$), carbon monoxide (CO) and carbon dioxide (CO_2) related to traditional and advanced biomass cooking devices stove use were measured using indoor air pollution monitoring meter in real-time whilst cooking was going on in the kitchen and activities were been observed. Structured, but unconventional protocol of qualitative data on the acceptability of advanced stoves and objective measures of stove usage were also collected and observed.

3. RESULTS

90% of the stoves were indoors. All the actors in the value chain agreed 100% that the intervention was a success. Training for the cooks, both female and male was done. The males proved a little bit reluctant to use the new stove until money was shared among the female cooks. More so, the constant visit of the headmaster of the school and the Alumnus influenced the easy acceptability. Reminding the actors in the values chain of how costly the project was, also influenced the acceptance of the interventions. The assurance of safety and security of stoves played a big role in the acceptability. However, it took the rector, extra cost to train the cooks at St. Paul's Seminary and dismissal threats before the cooks reluctantly mastered the use of the new stoves.

The design (Pakravan, Mohammad H., 2021) [8] of the stove prevents smoke from being inhaled, it also prevents the heating and burning of the hands, body, etc. of the cooks. The easy control of both the firewood and gas stove influenced the quick acceptability and behavioral change rate. Initially, most women preferred firewood to the gas stove, but as peer competition intensified, humiliation from coworkers spurred everyone to improve their gas stove management skills through self-motivation. Both gas stoves and biomass stoves are now used without supervision since January 2022. The $PM_{2.5}$ concentrations averaged 2,468 g/m3 during the high peak cooking time, which is generally from 10 a.m. to 1 p.m., and 1,218 g/m3 during the low period.

The cooking devices, before the intervention, were 23 inefficient biomass stoves, hence the aforementioned results. There was no IAP recorded after the intervention due to the chimney included in all the stoves. All the smoke, if there was any, went out through the chimney. Cooks don't need to go to work in the dark where they are often met with arm robbers and rapists as the interventions allow them to cook breakfast within an hour rather than 6hours. The cooks sole problem was the non-visibility of the flame, which means they can't see it when it's on. Finally, we saw that the administration of the colorfully painted firewood stove was meticulous in order to minimize smoking on the frontage, but the single unpainted stove received less attention, resulting in black smoke staining the frontage, (Darrow, 2017).[9]. Color appears to have some impact on behavior modification in the maintenance and management of stoves, despite the lack of substantial study.

4. Conclusions

Acceptability at OWASS was quicker than that of St. Paul Seminary, even though the underlying were about the same. One reason for the quick acceptability of OWASS by the cooks was the fact that four biomass stoves were built six months before completing the rest. The high acceptance rate was largely due to the stove's design. The stove prevented heat, smoke and provided safety and security to the cooks who were mainly women. One can approach the stove and stock the firewood without inhaling smoke or emissions. The addition of a conduct through which the flame can be seen would be a further upgrade to the gas stove design. The low or no harmful gas emissions has influence over the acceptance rate in the two neighborhoods. Further understanding of how the introduction of an advanced stove influences patterns of institutions' energy use is needed. The intervention, however, with subsidies will go a long way to promote a speedy penetration rate of the project**.** Lesson(s) learnt here will help formulate policies to enhance the easy acceptability of new technology and feasibility and/or pilot studies aimed at the process of behavioral change efforts locally, nationally and maybe internationally.

Figure 2. Depicting before intervention

Figure 2. Depicting after intervention

5. ACKNOWLEDGMENTS

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