PERCIEVED FACTORS INFLUENCING ADOPTION OF MODERN COOKING TECHNOLOGIES IN PUBLIC SECONDARY SCHOOLS IN NAIROBI COUNTY OF KENYA

ESTHER ATIENO WEREH

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DECLARATION

This Project report is my original work and has not been presented for examination or award from any known institution of higher learning.

Signature: ..... Date: .....24th September 2023 .....

Esther Atieno Wereh

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This project report has been presented for examination with my approval as the university supervisor.

Signature: ..... Date: 25/9/2023

Dr. Angeline Mulwa

University of Nairobi

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ABBREVIATIONS

CSS	Content-Scaling–Structure
GACC	Global Alliance of Clean Cookstoves
GHG	Green House Gas
HAP	Household air pollution
ICS	Improved Cookstoves
LPGs	Liquefied Petroleum Gas
MCT	Modern Cooking Technologies
MoE	Ministry of Education
NACOSTI	National Commission for Science Technology and Innovation
NDC	Nationally Determined Contribution
SMEs	Small and Medium Enterprises
TBH	Theory of Planned Behaviour
TIS	Technological Innovation System
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization

ABSTRACT

Biomass energy usage in Kenya, accounts for about 68% of country's total energy consumption, the major consumers being households, communal institutions such as secondary schools, and small and medium enterprises. Firewood has remained the fuel of choice for institutional use. However, the growing population and firewood demand in schools is reaching alarming levels. However, a myriad of alternative energy sources is available for use in institutions, these include pellets and briquettes, LPG Gas, Biogas and even electricity. This has led to innovation and technologies resulting in production and commercialization of improved cookstoves and other environmentally friendly cooking technologies including Savika Biojiko, Liquefied Petroleum Gas, Biogas, Ethanol, and Electric stoves. The intention of this research was to investigate the perceived factors which determine the acceptance and usage of green cooking technologies in government owned Secondary Schools of Kenya, with a case study of Nairobi County. The study adopted a descriptive research design in which it targeted secondary school principals, and the manufacturers. A total of 56 participants took part in the study. Semi-structured questionnaires and interview guides were used to gather information from the participants. The data collected was processed, cleaned, and analyzed through inferential and descriptive statistics using SPSS version 23. The mean student population was about 866±455 with an average annual income of KES. 2,368,422±1,624,987. Almost half (48.1%) of the schools sampled fully relied on firewood, 19.2% of them used charcoal to complement firewood, 17.3% used LPG besides firewood, 9.6% used charcoal and LPG alongside firewood, while 5.8% supplemented firewood with briquettes. The study further established that socio-economic factors, stove characteristics and environment related factors significantly influence the adoption of modern cooking technologies. Stove characteristics had the highest positive correlation of $r=0.903$, ($p< 0.001$) followed by Environment related factors which had a correlation of $r=0.638$ ($p< 0.015$) and then Socioeconomic which had a correlation of $r=0.614$ ($p< 0.001$). Additionally when adoption of MCT was regressed against socioeconomic factors, stove characteristics and environment related factors, the study established that Socioeconomic factors, Stove characteristics and Environment related factors significantly predicted Adoption of MCT, $F(3, 211) =101.506$, $p=0.001$. The coefficient of determination R^2 value was 0.669. This shows that 66.9% of the variance in adoption of MCT can be explained by Social-economic factors, Stove characteristics, Environment related factors. For every unit increase in socioeconomic factors, adoption of MCT could increase by 0.175 units (17.5%), for a unit increase in stove characteristics, adoption of MCT would increase by 0.267 units (26.7%); and for a unit increased in Environment related factors, Adoption of MCT, would increase by 0.227 units (22.7%). The findings based on data analysis revealed the trends in adoption of modern cooking technologies, consequently, uncovering the critical reasons that cause overreliance of institutions on fuel wood which is a critical area in Biomass studies. Thus, a new practice in sustainable institutional cooking may be arrived at. The study therefore recommends that stove manufacturers should consider doing market research among the secondary schools in Kenya to establish their expectation with regards to which modern cooking technologies. Additionally, Systematic and structured awareness creation about modern cooking technologies should be formulated just to target the secondary schools and implemented across the County and country and Policies should be formulated, customized, implemented for the adoption of modern cooking technologies in secondary schools such that government has a defined role and mandate of enforcing the adoption policy in all secondary schools.

CHAPTER ONE
INTRODUCTION

1.1. Background to the study

Modern cooking technologies (MCT) in the framework of this study implies cooking methods which use the least possible fuels within the shortest time to deliver the best results with the least possible health and environmental side effects. In other words, modern cooking technologies is an umbrella term for cooking methods which are efficient and effectives and pose the least possible health and environmental concerns (Urmee, & Gyamfi, 2014). In this regard therefore, modern cooking technologies focuses on both fuels/energy and heating equipment which use them in the cooking process.

1.1.1 Adoption of Modern cooking technologies

The whole world is struggling to promote and adopt cooking technologies which are affordable, readily available, and accessible and safe in terms of human health and to the environment at large. This explains why the sustainable development goals 3, 7, 11, 12, and 13 rely on adoption of sustainable cooking technologies. According to Vigolo et al (2018), about 42% of the global population have no access energy efficient cooking infrastructure and still rely on biomass such as woodfuel, crop agricultural residue and charcoal for their cooking and heating.

Since the invention of fire, cooking has been part of human life because they rely on food for their living. The biggest percentage of human population on earth has intensively relied on biomass for their cooking. In developing counties for instance, cooking technology is highly limited to wood biomass in form of charcoal, firewood, or other forms of agricultural wastes. These cooking methods have been closely linked to poverty, gender inequalities, poor health, environmental degradation, both indoor and outdoor air pollution and climate change. About 4 million global deaths are traced to traditional cooking technologies (Vigolo et al, 2018).

1.1.2 Dependent Variables

Household air pollution (HAP) for instance promotes a number of diseases including ischemic heart disease, lower acute respiratory complications in infants, chronic bronchitis or emphysema, lung cancer and stroke in grown-ups (Bielecki, & Wingenbach, 2014). Other research studies have also linked air pollution due to cooking biomass to increased blood

pressure in expectant women, lower birth weight of infants, and increased childhood pneumonia. Moreover, traditional cooking methods have been established to cause more burdens to girls and women in the countryside because they are compelled to spend quality time fetching firewood (Bielecki, & Wingenbach, 2014).

Although a lot of campaigns have been on going across the globe for adoption of clean cooking technologies to help with fight against climate change, the adoption of the same has not matched the efforts. Vigolo, Sallaku, and Testa, (2018) in their study of stimulants and obstacles to clean cooking technologies in Italy established that economic factors, socio-demographics, cooking technology availability and accessibility, attitudes towards technology, social and cultural influences, consciousness of risks of conventional cooking technologies and the advantages of environmentally friendly cooking technologies are the major issues which influence of adoption of various cooking technologies. They however noted that more than 80% of Italians have adopted modern cooking technologies.

Pachauri, Rao, and Cameron, (2018), while studying on modern cooking energy access in Central America, found out that family income is a chief determining factor of household cooking technology adoption. They projected that it would take up to 2030 for 40%-50% of rural Guatemalans and Hondurans in the rural places and about 67% of Nicaraguans to be able to adopt clean cooking technologies. They recommended 50% financial support of the citizens on cooking technologies such as LPG which can spur the adoption of that modern cooking technology.

1.1.1. Study Context

Global Alliance for Clean Cookstoves (GACC) (Cordes, 2011), notes that 80% of energy supply in Africa is biomass like fuel wood, dry animal dung, charcoal, and agriculture residue. Consequently, Africa continues to register serious environmental degradation to sustain the energy demand (Pattanayak, 2012). Many African counties are classified as developing while others are underdeveloped. Accessibility of modern cooking stoves is therefore still a significant challenge. In addition, Bonan et al (2017), observes that many people, though can afford some efficient cooking technology, are still stuck with the notion that modern cooking technologies are expensive while others hold that departing from their traditional cooking

methods is deviance from their cultures. Bonan, Pareglio, & Tavoni (2017) also notes that some rural households in African Countries are still characterized with big families which cannot be sustainable by some of the accessible and affordable modern cooking technologies

In Kenya, the shift from traditional cooking methods to modern technologies has not been impressive yet, the forest cover in Kenya is still under significant threat due to the rising demand of firewood and charcoal. The constitution of Kenya protects at least 10% forest cover target in the country. In December 2020, Kenya tendered its updated, intended Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC). In the NDC, Kenya vows to lower its carbon emissions to 32% by 2030 (Ministry of Environment and Forestry – Kenya, 2020). The Government of Kenyan has demonstrated that, to achieve on this grand target, several measures including expansion in clean energy options and efficient fuel technologies will be indispensable to minimize overdependence on wood fuel (Ministry of Environment and Forestry – Kenya, 2020).

Biomass energy supplies 68% of the national energy demands in Kenya; whereby 81% are rural population and 39% are urban population (PACJA, 2017). As the main fuel, overdependence on biomass has led to increased deforestation, subsequently, rendering the efforts to achieve the minimum tree cover requirement of 10% vain (Gitonga, 2017). Unsustainable utilization of biomass, as a primary cooking fuel has stressed the urgent need to transference to alternative energy sources as well as efficient end-use technologies. “There are technologies in Kenya that can reduce the consumption of biomass energy by almost 80% when compared to the traditional technologies” (Mugo & Gathui, 2010, pg 27). The mandate of Kenya’s energy sector is to increase accessibility of consistent, efficient and reasonably priced energy to Kenyans and promote renewable energy and new technologies (Gitonga, 2017).

Most Kenya’s formal studies on biomass energy focused household energy consumption. Limited attention has been given to institutions which happen to be some of the large-scale consumers of biomass fuel (MoE, 2002; O’keefe *et al*., 1984). Among the notable large scale consumers of biomass fuel include both primary and secondary schools- as well as colleges and universities. Some researches (Kituyi *et al*., 2001; Kituyi and Kirubi, 2003; RETAP, 2007,

2010, Ngeywo, 2008) centered on biomass energy consumption in some of these institutions. These studies were instigated by the inclusive dependence of more than 40,000 education institutions on wood fuel for cooking and heating (RETAP, 2010). Unfortunately, majority of the schools or colleges use energy inefficient (5-10%) cook stoves which consume a lot of fire wood and emit so much smoke. Their cooking technology thus leads to high demand for wood fuel hence additional pressure on the declining forest covers but also air pollutions due to incomplete combustion. What is disturbing is that there are various efficient wood fuel cookstoves in the market. Some of the cookstoves are designed specifically for large scale cooking like in the case of these institutions but the uptake rate is still low and slow. As noted by RETAP (2010), some significant changes on uptake have been witnessed from mid 1990s and the market is still huge with a must as 41% of the institutions in questions are yet to adopt modern energy efficient cookstoves.

The growth in the number of schools poses more threats to the forests cover. Between 2007 and 2011, the number of school grew by 3,300 (from 32,600 in 2007 to 35,900 in 2011) (KNBS, 2013a). It is subsequently obvious that the reliance on wood fuel and charcoal from forest will continues to expand.

It is therefore necessary to adequately understand factors that may influence such large educational institutions' adoption of modern cooking technologies. This will enable policy makers to create shift towards these technologies in order to save the dwindling forest reserves in Kenya. Modern cooking technologies in this sense is used to refer to technologies that use clean energy like electricity, LPG, biogas, biomass Pellets, Briquettes and anything else that does not harm our environment.

1.2 Research Problem

Biomass energy contributes about two thirds of the combined national energy resources in Kenya. Petroleum accounts for 22%; Electricity; 9% and others such as (Solar and wind) 1% (Ministry of Energy (MoE), 2002). Among the large scale users include hospitals, prisons, schools, etc), households, and Small and Medium Enterprises (SMEs), tea factories and hotels an food joints. Firewood has remained the fuel of choice for institutional use. More than 40,000 secondary schools, colleges, and universities, depend fully on firewood for cooking and

heating water needs (RETAP, 2010). A greater percentage of schools in Nairobi use firewood for daily cooking needs. Whereas there is high adoption of improved institutional stoves, the growing population and firewood demand in schools is reaching alarming levels. Kenya's commitments to global GHG abatement agreements require concerted efforts to reduce deforestation and woody biomass use. Kenya vision 2030 seeks for 10% reforestation by the year 2030 and the achievement of the nationally determined contribution equally heavily rely on reforestation and reduced forest degradation. The national climate change action plan 2013-2018 called for reduced reliance of biomass fuel (Ministry of Environment and Forestry – Kenya, 2020). However, the stubbornly increasing rate of firewood dependency seek redress from all sectors. Thus, the recent tightening of laws that govern logging and charcoal burning. This move has seen the cost of wood fuel going up. Firewood as sole source of cooking fuel is increasingly becoming unsustainable despite increased adoption of more efficient firewood cookstoves.

Contradictorily, a myriad of alternative energy sources is available for use in institutions, these include pellets and briquettes, LPG Gas, Biogas and even electricity. However, institutions are yet to actively adopt the use of these modern and clean fuels (WHO, 2015). The greatest problem here is the fact that a myriad of alternative energy sources and technologies is available for use by institutions, yet their uptake response is not as fast. This study thus aims at assessing the adoption of modern cooking technological solutions and the strategies that would help increase the uptake of these technologies. The study focused on government owned senior secondary schools in Nairobi County as a case. The findings of this study aims to support the ongoing attempts in Kenya to encourage a shift towards clean cooking using environmentally friendly and green cooking technologies especially in educational institutions. It will be a factor to tackling energy hurdles and inefficiencies in schools and develop apposite practices that would enable sound adoption of modern cooking technologies in secondary schools. This study therefore seeks to answer the following question, "what is the influence of socio-economic factors, stove-related factors and environmental factors on the adoption of modern cooking technologies in public secondary schools of Nairobi County?"

1.3 Research Objective

The rationale of this research was to examine the perceived factors which influence adoption of modern cooking technologies in Public Senior Secondary Schools in Kenya, with a focus on Nairobi County.

1.3.1 Specific Objectives of the Study

The research aimed to:

1. Examine the influence of socio-economic factors on adoption of modern cooking technologies in government owned senior secondary schools of Nairobi City County
2. Evaluate the influence of stove characteristics on adoption of modern cooking technologies in public Secondary schools of Nairobi County.
3. Scrutinize the degree to which environmental related factors influence the decision to adopt modern cooking technologies in public senior secondary schools of Nairobi County.

1.4 Value of the study

The conclusions of this research resound to the benefit of the society considering that biomass energy takes center stage in meeting their energy demand. The greater demand for biomass energy in institutions justifies the necessity of assessing the factors which sway the adoption of modern cooking technologies to promote and achieve a sustainable and environmentally friendly method of cooking. Thus, institutions which would apply the recommended approaches derived from the conclusions of this study would reduce overreliance on fuel wood and therefore play a part in the realization of 10 percent forest land cover in the country by the year 2030 as targeted. The outcomes of this research revealed the trends in adoption of modern cooking technologies, consequently, uncovering the critical reasons that cause overreliance of institutions on fuel wood which is a critical area in Biomass studies. Thus, a new practice in sustainable institutional cooking may be arrived at. There are many existing new modern technologies in the institutional cooking sector, technologies like Savika Biojiko, Electric cookers, LPG and Biogas cookers which are available for use by institutions, this study hopes to give them visibility thereby promoting sustainable institutional cooking. The completion of this study also leads to the Award of a *Master of Arts Degree in Project Planning and Management* of the University of Nairobi.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This section provides a critical review of the past literature which focused on the issue adoption of modern cooking technologies globally, continentally, regionally, and nationally. The chapter therefore concentrates on the socio-economic factors, stove related factors and environmental related factors which impact on the decision to adopt of modern cooking technologies. Empirical studies of the past and their findings on adoption of efficient modern technologies and switch behavior and theoretical review from are discussed in this section. The chapter concludes with a brief presentation of conceptual framework and summary of the literature review.

2.2 Theoretical Framework

There exist various interrelated concepts that guided this research on the main factors which determine the adoption of clean and green cooking technologies in government owned secondary schools of Kenya. This provides a rationale for conducting the research. These theories have been described below:

2.2.1 Energy Ladder Theory

Energy ladder theory indicates that a change from conventional to cleaner energy fuels is determined by the household income such that the switch occurs with increase in income. This implies that the increase in income enables the units to shift from the conventional biomass to environmentally friendly modern energies like LPGs, natural gas and electricity in the spirit of fuel switching. This theory is thought to be in three steps where the first step is characterised by common dependence on biomass. Step two is the stage marked with the transition to fuel like kerosene, charcoal and coal due to increased incomes. In the final step is switching to LPG, electricity or natural gas. Income and relative fuel prices is hypothesized to be the major drivers affecting the determining the shifting from traditional to modern energies (Kumar *et al*., 2017). The energy ladder model successfully captures the strong income dependence of fuel choices.

This theory argues that wood fuels are an inferior economic good meant for the less fortunate or economically marginalized people. Van der Kroon *et al*. (2013), argues that the energy ladder theory portrays a positive strong correlation between income and the choice of fuel. This indicates that a country's economic growth can significantly influence her adoption of modern energies thereby decreasing the significance of solid fuels. The energy ladder theory posits that a nation can progress through the process of industrialization which relies on electricity and petroleum. Accessibility of green cooking technologies such as LPGs, natural gas and electricity increases with increase in income among households in Ghana (Adam *et al*., 2013). Nasir *et al*. (2015) confirms the same results in Pakistan by stating that poverty is an essential factor in the choice of fuels among households. This theory has been criticized for its inadequacy to expound on the slow rate of adoption of ICS and the fact that most households do not do a complete energy switch but always stack the energy fuels. Besides, the studies on energy ladder theory do not give an account of low-income households that have adopted ICS. The energy ladder theory in this research therefore factors in the issues which influence the adoption of modern cooking methods in government owned secondary schools of Kenya, exploited the social and economic factors and the environmental factors. The way institutions have shifted their cooking technologies overtime was looked at and the influence of the income capability for the school.

2.2.2 Diffusion of Innovation Theory

Diffusion of innovation theory was first proposed in 1962 by Rogers with the aim of explaining the acceptance and usage of a new idea, behavior, product or an innovation. This theory posits that adoption of an innovation is a process in which individuals get more quick in the adoption of a new innovation than others (Kaminski, 2011). This characterizes people into five groups namely; "innovators, early adopters, early majority, late majority and laggards" (Dearing, 2009, pg 51). "Innovators" are normally the pioneer consumers of an innovation, explorer, take risk and consume in new ideas. "Early adopters" on the other hand refer to experts who take up leadership functions and appreciate opportunities to change. It is easier to appeal to this group of people through user manuals and information sheets on implementation. The "late majority" are individuals who are highly cynical to change and will only accept and use a new idea after the majority have tried and approved it. This group needs evidence on the number of people who have tested, tried, or tasted the new idea and have accepted and used it appreciably.

"Laggards" are loyalists to their traditional way of doing things and are resistant to shift to a new culture (Dearing, 2009). This theory therefore opines that it is imperative to fathom the social-cultural profile of the market niche when advocating for adoption of a modern technology.

The theory lays emphasis on the circumstances that are advantageous or disadvantageous in the adoption of a new innovation. According to Rodgers the pioneer groups in adoption of a new innovation can directly and indirectly influence adoption or non adoption of the same by the rest. For example early adopters of ICS in rural Kenya acted as drivers of this innovation to the neighbors relative to producers and distributors (Person *et al*., 2012). This theory relies on factors including social landscape, economic profile, cultural and environmental factors. For innovation diffusion to occur, it has to be preceded by research and development leading to market segmentation and development of customized promotions.

While Godwin et al. (2015) suggests that user behavior explains innovation adoption, Bielecki, and Wingenbach (2014) states that the diffusion of innovation theory sums up as a "combination of local production of high quality products, inclusive distribution mechanisms, innovative financing systems, and a favorable policy environment is pre-requisite for enhancing access to clean cooking solutions" (Bielecki, & Wingenbach 2014 pg 357). According to Tigabu (2017), most researchers have focused on technology diffusion of renewable energy in Africa and have identified technological, economic and social factors as either the drivers or obstacles of adoption. However, Tigabu argues that it is imperative to analytically understand the utilitarian framework of renewable energy technologies and further states that the Technological Innovation System (TIS) is a beneficial waylay. He suggests that policies that strengthen the purposeful growth of TISs are vital to boost the larger scale adoption of environmentally friendly energy.

The diffusion of innovation theory plays a critical role. In this study, it was used to examine the stove related factors and draw conclusions from the field. Additionally, there was need to compare the rate at which schools take up the different available technologies in the market.

2.2.3 Theory of Planned Behavior (TPB)

Icek Ajzen put forward this theory in 1985. It links one's belief and behavior. The theory entails three conceptual causes on the adoption of a newfound technology; they are the mindset concerning the technology, social issues that are referred to as "subjective norms", which are basically the apparent social compulsion on institutions to take up or not to take up modern cooking technology and aiding circumstances which show perceived behavioral control such as the availability of policies, plans and regulations that ensure adoption of new cooking technologies in institutions (Ajzen, 2011). TPB plays a critical role in this research, as it was used to investigate environmental related factors and draw conclusions from the field.

2.3 Empirical Studies

2.3.1 Adoption of Modern Cooking Technologies

Biomass reportedly supplies about 10% of the global energy demand supply but about 65% of developing countries' energy consumption. According to Guta (2012), more than 3 billion people across the globe cannot access modern energy options. This explains the global efforts on energy switch to improved cookstoves which are generally healthy, clean, and safe. The biggest obstacle to the energy switch is the slow adoption rate. The world energy strategy through institutions such as Global Alliance for Clean Cook Stoves (GACC) aimed at creating a shift from the high cost solid fuels to cost-effective renewable fuels that combat both health and environmental risks (Cordes, 2011). The major challenge however is not providing alternative fuel sources but enhancing the adoption of environmentally friendly cooking technologies.

In Africa, approximately 82% of the people rely on biomass such as firewood, coal, charcoal, animal dung and agricultural waste from crops. These amounts to environmental pollution and public health disaster that results from solid fuel cooking emissions which have been found to kill up to 600 thousand Africans yearly (Vigolo *et al*., 2018). Due to the contribution of 1% carbon dioxide, and nitrous oxide emissions and six percent global black carbon, solid cooking fuels have an impact on the climate change. Biomass fuels generally impose noteworthy costs on households relying on them in form of expenditure on solid fuels, time lost on collection of firewood, environmental and climate costs associated with deforestation and emission of

carbon (IV) oxide and socio-economic costs of increased mortality and morbidity. Only a handful of Africans use environmentally friendly cooking energies such as LPG (5%) and electricity (6%) as their main sources of fuel but they still use traditional fuel energies as their alternative source of fuel. Ideally, about 3.5% of African households use ICS while 10% use both basic ICS and legacy cook stoves (Owen *et al*., 2013). This moderately improves fuel efficiency and lowers emissions in comparison to conventional cooking methods. Africa has the least access to environmentally friendly cooking technologies globally. Among the biggest challenges to the usage of the modern and green cooking solutions is accessibility.

In Kenya, 89% of rural households and 7% in the urban and peri-urban areas depend on solid fuels as their major cooking and heating energies. Biomass fuels supplies about 68% of Kenya's national energy demands annually. Due to biomass fuel consumption Kenya's forest cover is reducing at the rate of 0.09% yearly (Mugo & Gathui, 2010). Wood fuel and charcoal production have highly contributed to woodland degradation and deforestation which is largely attributed to the growth in population in both rural and urban places, land tenure and unemployment. The unsustainable biomass extraction ultimately leads to over-exploitation of natural resource including forests, land leading to increased soil erosion, endangering some species of flora and fauna, reduction in the ecological services of forests, and increased burden on girls and women who have to take their time to fetch firewood. In some cases the overexploitation of land resource has led to worsening food insecurity because of limited soil productivity and household income redirection into the purchase of for cooking and heating (Mugo & Gathui, 2010).

However, Kenya has since formulated energy policies, forest legislations and charcoal production regulation to administrate on development of biomass energy (Momanyi & Bernards, 2016). Unfortunately, wood fuel still dominates the energy sector as it is the main source of cooking energy more so in the rural places. Most urban households have adopted the improved clean fuels but most institutions still use fuel stacking models based on the types of food to be cooked and the population served.

Most researchers have found out that the choice of adoption of modern cooking technologies is determined by several factors such financial strength, demographic factors, attitudes towards technology, fuel availability, availability and access to technology, risk awareness on traditional cooking methods and advantages of ICS, location and socio-cultural influences among others (Eshetu, 2014; Vigolo *et al*., 2018; Massawe & Bengesi, 2017; Momanyi & Benards, 2016; Kumar *et al*., 2017; Kapfudzaruwa *et al*., 2017). Although all agree that there is slow adoption of modern cooking technologies as opposed to the use of traditional fuels, they have varied views on the extent of the implication of the various factors on the acceptance and use of ICS. Additionally, researchers tend to concentrate on households either in rural or urban centres rather than institutions like schools, hotels, and hospitals among others.

2.3.2 Socio-economic Factors and Adoption of Modern Cooking Technologies

Although improved access to efficient cooking fuel is a development goal as spelt out in Kenyan vision 2030, many households and institutions remain dependent on biomass fuels technologies. This is basically attributed to various issues including level of education, income, size of family, age, cultural believes and social influence (Uhunamure, Nethengwe, & Tinarwo, 2019).

Energy consumption forms a substantial part of budgets in schools, homes, hospitals and hotels among others. While clean cooking energies are indispensable in battling high levels of health and environmental risks caused by traditional solid fuels, its affordability in terms of cost is the most limiting factor (Massawe & Bengesi, 2017). Clean fuels aid in the prevention of forest degradation and are helpful in the improvement of productivity. Therefore most energy policies target to reduce deforestation more than indoor pollution while health policies target fuel choices that are healthier, cleaner and safer.

According to research finding on "*Large-Scale Uptake by Households of Cleaner and More Efficient Household Energy Technologies*" in London, by Puzzola et al., (2013), affordability of various clean cooking technologies is among the most critical issues which influence adoption of modern cooking technologies. While there is possible argument advanced that the affordability question may not hold in the bigger picture, Puzzola and colleagues noted that affordability within the scope of intended fuel, and size of families/household is critical. Some of the modern technologies are very affordable but not suitable for some sizes of households.

In other words, some households are large but the most affordable cooking stoves are limited to cooking food for smaller families of five or less people. In large families, mostly common in traditional set ups and in in rural areas, bigger cookstoves are preferred. Unfortunately, the economic status of such families does not match the costs and therefore they resort to traditional biomass cooking technologies. In the long run, they are perceived to be hesitant on adoption of modern cooking technologies. The researcher however did not consider institutions like schools in their studies.

In Latin America, the case is not significantly different. WHO (2015), notes that biomass consumption for heat generation and for cooking remains significant in urban places like Honduras, Guatemala, Peru, Nicaragua, Haiti and Paraguay. Troncoso, and da Silva (2017), singled out urbanization, accessibility of green, development, and household income as major determinants of adoption of modern cooking technologies. Although changes have been witnessed in the number of people adopting some modern cooking technologies, the changes are not attributed to a shift from traditional cooking technologies but rather to increasing urbanization (Troncoso, & da Silva, 2017).

A study carried out in Mexico by Troncoso, & da Silva, (2017) in a few communities in rural Chiapas revealed that 59 percent of households surveyed already spend an equivalent of US$ 20 every month to purchase wood fuel. The price of an LPG cylinder is $16 and people who entirely depend on LPG have to refill the cylinder in two or three weeks' time. 96% of the respondent argued that they do not have the money to sustain the use of LPG in all their cooking. 82% of the participants in theresearch pointed out their willingness to exclusively use LPG if the cost dropped to about US$ 3 per month (Puzzola et al., 2013). At the same time, 14% of the participants indicated their willingness may shift to using LPG if the cost came down to about US$3 while 4% held that they still would not use LPG even if the cost dropped to about US$3. Bedsides the cost, the responses indicated that rural Mexicans look into other issues. Such factors include complicatedness to prepare tortillas using LPG cooker (Troncoso, & da Silva, 2017). Notably, the differences in costs among various energy sources encourage the continuous use of traditional biomass fuels among the low-income populations in urban and rural areas.

Regarding schools, the income of the school could also determine the choice of fuels. Owuso et al. (2015) established that the utilization or frequency of use of MCT in Ghana was mainly influenced by factors such as household income, number of income-earners in a family and education status of the head of a household. However, Vigolo *et al*. (2018) state that accessibility and affordability of energy use technology are exclusively the factors which determine adoption of MCT. Instead, they argue that people responsible for policy making, and MCT business managers should get in touch with consumers with a simpler and a more customized strategy which takes into account the local market landscape and the associated socio-cultural variables. To achieve sustainable adoption of MCT due recognition of a wide scope of issues from household to national echelons should be made (Debbi et al., 2014). It is therefore highly expected that apart from income, there are other major factors that affect the ICS scale up.

Several researchers also believe that the entity size tend to determine the ICS uptake (Jan *et al*., 2017; Owuso *et al*., 2015). The size of a household negatively influences the adoption of some modern cooking technologies. This is attributed to the amounts of foods to be cooked which may require bigger cooking stoves or consume a lot of fuel. Bigger household size is an indication of demand for more energy and certain types of cookstoves. Large families therefore prefer cheaper cooking technologies like biomass fuel to modern cooking technologies. However, such families are likely to adopt improved cookstoves which are less consuming and highly effective. Schools, as opposed to families are homes of many people and the food needed to sustain them is cooked in far larger volumes compared to families and households. It is unquestionable that they need much bigger cookstoves to be able to sustain the efficiency, effectiveness and the large volume of meals which have to be cooked (Troncoso, & da Silva, 2017). The number of students in any school is thus expected to influence the choice of cooking technology. However, no research has been customized to focus on institutions choice of cooking technologies.

The likelihood of modern cooking technology adoption also increases with increase in level education since education creates awareness about benefits of modern technology (Jan *et al*., 2017; Owusu *et al*., 2015). The level of education matters significantly in this adoption

whereby the highly educated are expected to be more aware of the benefits of modern cooking technology scale up. According to Kojima (2013), the technology uptake is faster where the head of a family has higher education. This can be explained by the fact that, education makes it easy for one to understand the advantages of modern cooking technologies for their families, and to the society at large.

Through education, one can appreciate the bigger picture. In other words, education enables one to evaluate and compare the overall costs of brown and black cooking technologies and the environmentally friendly green cooking technologies (Gebreegziabher *et al*., 2012). A good example is the ability to incorporate the costs of time, the costs of emissions, the cost of convenience, the cost of efficiency into the bigger picture of comparing costs of traditional cooking methods and modern cooking technologies. As to whether educational institutions have met the expectations of modern cooking technology uptake is yet to be established. It is only through education that the degree of global understanding of the far-reaching health and environmental risks can be enhanced by the policy, donor, and development communities in order to encourage the adoption of clean cooking methods (Cordes, 2011).

Cultural and social believes equally play very significant roles in the adoption of ICS and modern cooking technologies. This is because there are some cultural preferences within varied communities (Uhunamure et al, 2019). For instance, some households in Mexico consider cooking some foods on traditional stoves in order to realize certain aromatic aldehyde taste (Troncoso, & da Silva, 2017). Some traditional cuisines in the Central American countries with exception of Panama share common cuisines. Among the most common cuisines is tortilla. The process of making tortilla is energy intensive because it takes long and thus traditional cooking method (use of open firewood ovens) is preferred most. The bigger sizes of families, characteristic of these countries demand that a lot of food be cooked. Puzzola *et al*., (2013) notes that an average family (3-5people) need about 3kg of tortilla. Bigger families with more people would thus need more than 3kg. That implies more time, and more firewood for cooking.

Similarly related findings were established among the subsistence fishing in Canada. More specifically, many communities around Thunder Bay, Meldrum Bay, and Batchawana rely significantly on smoking preservation Among the most prevalent methods of fish preservation includes smoking (Dipanjan et al., 2021). The process of smoking requires burning of biomass and depending on the number of fish, a lot of wood fuel can be used. Consequently, they cannot adopt modern cooking technologies because they do not produce smoke. The essence of smoking preservation is blend of drying, salting and addition some of aldehydes produced through in wood smoke and salting. Smoking is also used as an intermediary step in the preservation of canned fish. Smoking works because it contains bacteriocidal, and antioxidant properties and chemical such as aliphatic chemicals (280^0C), alcohol, ketone, aldehydes and acids (McGee, 2004). Most fish smoking is done by burning the shells of coconut and husk, paddy husk, sage wood dust, firewood from mango trees, sage wood chips, among others. These biomass materials cannot work with the available modern technologies and therefore, those involved in the business.

Therefore the improvement of thriving global clean cooking solutions that is persistently revolutionizing to improve design and performance is one of the most sustainable strategies of bringing modern cooking technologies to the vast populations under the threat of traditional biomass fuels in developing countries. While the cost of clean cooking solutions is a critical component of adoption, designing solutions that appeal to the people and address their cultural and social inclinations will successfully lead to saving of life and life-changing developments in the lives of many people from all over the world.

Whereas it is important to remain conscious of the peoples' social and cultural believes, a shift from local cooking practices to cleaner products and fuels can be enhanced through creation of educative awareness, marketing, subsidy policy and outreach to aid in creating demand. Marketing can be well targeted in order to enhance adoption of new cookstoves and clean fuels. Therefore with new products, preliminary stream of culturally suitable advertising and social-marketing would be appropriate to create awareness. The face-to-face interaction, more so among female consumers, could be more strategic in broadcasting awareness about clean cooking technologies. Women form an essential segment of the ICS value chain because they are the most responsible for household cooking. Consequently, the presence of women, their

tastes and preferences of cookstove design, duration of cooking, fuel accessibility, and other cultural elements must be considered in the designation of clean cooking equipment.

2.3.3 Stove Related Factors and Adoption of Modern Cooking Technologies

Stoves are the vessels which convert a certain type of energy into heat for cooking, or heating. Design of the cookstoves play an imperative role in determining demand for adoption (Rehfuess et al., 2014). It is highly significant to study what consumers need and how to change behavior and create demand which is important for development of market for modern cookstoves. The stove designs should not only achieve the objectives of better efficiency and minimal emissions but should equally be attractive to the consumers relative to cultural suitability, aesthetics, utility, and apparent upgrading relative to the traditional stove (Shrimali et al., 2011). This explains why GACC, (2013) recommends a detailed training of the manufactures and the supply chain entrepreneurs of modern cookstoves on how the quality of their products to meet the expectation of the targeted market.

It is critical to appreciate the principal user inclinations and latent costs outside health in the structure and distribution of ICS. Notably, in South Asia and some parts of Sub-Sahara Africa, Improved Cookstove (ICS) are developed with the focus on technology and cosmestic designs but without consideration of end user expectation based on their cultural practices of cooking and using fire, and possible size of entity (Puzzola *et al*., 2013). Consequently some of the modern cookstoves are either too small to carry the large cooking pots, or the fuel feeding passage is too small for the fuel type used. Most households in those regions have therefore been reluctant on adopting the modern cookstoves. ICS adoption requires that the cooking expectation of the potential customers can be achieved mores easily, more affordably, more effectively and more efficiently as compared to the conventional/traditional stoves they use. Retailers should therefore engage with end-users directly in order to build on the user learning curve. They should train the users at the point of sale using prescribed and casual efforts as well as perform customer consistent sequel visitations until the consumer's masters the technology.

Among the serious elements that households consider is whether a cooking technology will serve their interests such as cooking enough food for them within the expected time, whether

a cooking/fuel technology can serve their cultural need of fuel energy like food preservation, whether a cooking/heating technology can provide warmth in cold regions like some parts of Europe, Canada and United States or whether a cooking technology can provide heat for drying their clothes, and domestic fabrics (WHO, 2016)

According to USAID (2017) there are two identified major types of cookstoves in the market namely household and institutional/Commercial stoves for large scale cooking. More efficient institutional cookstoves, can potentially realize very substantial benefits, with regards to fuel consumption efficiency. Shifting from biomass to cleaner fuels like LPG may not necessarily deliver cost savings, but can potentially deliver health or time-related paybacks. In essence, both the household and institutional stoves should guarantee safety, convenience, and ability to supply warmth during the cold season.

It has been found that in as much as there is a global surge to introduce clean cooking solutions to curb the health and environmental risks, the demand is very low and the rate of adoption wanting. Low demand is attributed to the consumer perceived value of the stove, safety, efficiency, technicality of handling, environmental gains, and cultural believes among others. Price (2017), indicates that the adoption of cleaner cooking technologies like LPGs are limited by relatively high costs, smaller sized of the stoves, low demand and unreliable supply.

Following the alarming rates of wood fuel demand, degradation of forests and harvesting of shrubs is inevitable. The vast populations are additionally exerting much pressure on land clearance for agriculture and human settlements (WHO, 2016). This therefore makes solid fuels readily available for consumption. There is need to create demand for clean cooking fuels by encouraging adoption and sustainable use. This can only be achieved through the consideration of the demand-supply chain ranging from production, infrastructure, marketing, distribution, and consumption by the end-user (WHO, 2016). For LPGs for example, adoption should consider sustainable use of first stove acquisition and refill affordability and regular and consistent availability of fuel and accessibility as this will enhance equitable scale-up of clean fuels.

With the intention of creating demand for cleaner cooking solutions, marketing is paramount. The modes of creating demand include raising detailed awareness on the new technologies

benefits and by word of mouth through women associations. Demonstration on how to operate a cookstove, coupled with in face to face persuasion are effective in influencing adoption of ICS (WHO, 2016).

Low demand has been attributed to external household influences and traditional negative attitudes (Miller & Mobarak, 2011). They found that women, stronger prefer modern cooking technologies but lack the authority influence the purchase of the same. Additionally, they established that information sharing about choices of cooking technology by esteemed members of the community induces adoption decisions better. They finally suggested public policy making should take care of the role of women with regards to household cooking technology preferences is promotion and adoption of modern cooking technology is to be sustained. The consumers of the modern cooking technologies therefore ought to derive demand from the apparent meaning of the cooking technologies, efficiency, environmental gains, productivity and cultural believes.

It is highly significant to understand what consumers need and their consumption behavior can shift in favor of demand as an essential element for development of market (Shrimali *et al*, 2011). For example ICS adoption requires that retailers engage with end-users directly in order to build on the user learning curve. They should train the users at the point of sale through conventional and colloquial approaches as well regularly following up with customers.

2.3.4 Environmental Related Factors and Adoption of Modern Cooking Technologies

Various aspects of the environment influence the adoption of fuel-efficient cooking methods. Those aspects include fuel diversity, availability and accessibility, their impacts on health and the ecology and research and economic growth and development can easily enhance the adoption of modern cooking technologies (Cordes, 2011).

Consumers are often certain to adopt certified stoves and cooking fuels since they meet standard agencies' specifications based on design, fuel consumption efficiency and emission. Stove and stove parts distribution from well-known suppliers, strict supplier of stoves from recognized manufactures and penalizations of non-compliance on the guidelines, lean government regulation on prices of fuel and raw material and enforcement mechanisms for

effective clean cooking technology adoption. Besides, government policies that restrict the consumption of solid fuels can automatically enhance the adoption of clean cooking solutions. Involving every single on of the stakeholders at each stage of project planning and implementation also enhances adoption of new cooking technologies, lack of which negatively impacts on adoption. Good programs go in tandem with government policies otherwise the adoption rate would be slow.

The end-users should be educated on the benefits of the new technologies. This can be achieved through awareness raising activities, good infrastructure, and good distribution channels. Continuous research and development ensures monitoring and evaluation of the success of ICS adoption (Cordes, 2011). Involving women all through the procedure of designing the technology and its distribution would create a sense of proprietorship thereby leading to positive correlation to adoption. Government subsidies on stoves and modern fuels and financial incentives for stove construction and maintenance positively affect stove adoption. Additionally, marketing and information dissemination plays a crucial function in the acquisition of more efficient and economical cooking technologies.

Institutions form key players in the purchase and use cooking stoves and modern energies thereby creating shift to more clean, healthy, and safe cooking solutions. This implies that institutional input can never be overlooked. To avoid confusion among the various players, several task forces are created to streamline the policies, legal frameworks, and rules in aid of clean energy adoption and reduction of health and environmental threats from the traditional solid fuels

2.4 Knowledge gap

Table 2.1 below presents the gaps that were identified from the reviewed literature.

Table 2.1: Matrix Table Showing Identified Gaps in Knowledge

MATRIX TABLE SHOWING IDENTIFIED GAPS IN KNOWLEDGE

Variable	Author (year)	Title of research publication	Methodological approach	Results of the research	Knowledge gaps	Interest of this Current Study
Adoption of modern cooking technologies	Troncoso, & da Silva, (2017)	"LPG fuel subsidies in Latin America and the use of solid fuels to cook"	The research adopted descriptive research design.	The study found that Subsidies have significantly induced the shifting from USF to green cooking energies in LAC	The study did not focus on Effects of adoption of LPG fuels by institutions like schools	This study focused on the adoption of modern cooking fuels.
	Tembo, Mulenga, & Sitko, (2015)	Cooking fuel choice in urban Zambia: implications on forest cover	Urban household Survey in Zambia	This study found that Living in Urban residences increases chances of adopting ICS due to higher income, education, and accessibility	The scope of the study was demised on household's adoption of ICS	This study identified the need to study institutional adoption of ICS
	Nyambane A, (2016)	"Demand and supply dynamics of wood energy in schools in Trans-Nzoia county, Kenya"		This study comprehensively delved on wood fuel use analysis by certain secondary schools in Trans-Nzoia County.	The study was limited to wood resource	This study focused on other modern cooking technologies too.
Socioeconomic factors	Hooper LG, Dieye Y, Ndiaye A, Diallo A, Sack CS, Fan VS, et al. (2018)	"Traditional cooking practices and preferences for stove features among women in rural Senegal"	The study adopted a Cross-sectional descriptive research strategy.	The research found that below 1 percent of families which had stoves burning liquid propane used them as the main cooker. Although 92% used the traditional open fire, the women preferred alternatives stoves.	The study delimited the scope on the available cookstoves, such as liquid propane cookers, which do not exhaustively address the preferences of the consumers.	This study focused on the cooking habits and practices that influence use of modern cooking technologies.
Stove related Factors	Bielecki, & Wingenbach, (2014)	Rethinking improved cookstove diffusion programs	This study employed a descriptive research method	The research found that People choose cooking fuel technologies	The study only focused on individual and	The study examined the influence of availability of

				depending on accessibility of the fuel technology	household choices on cooking technology as influenced by the availability of the technology of choice	cookstoves on adoption
	Puzzola *et al*., (2013).	"Factors Influencing the Large-Scale Uptake by Households of Cleaner and More Efficient Household Energy Technologies"	The study adopted cross-sectional survey research method	The study found that Meeting users' needs, giving valuable fuel savings, offering quality products which satisfies user prospects and ensures hardiness are key influences of adoption of MCT	The study relied on a broad range of studies which researched on a broad scope of subjects of adoption of MCT. None of them had a specific focus on adoption of MCT by institution such as schools.	This study focused on schools
	Uhunamure, Nethengwe, & Tinarwo, (2019)	"Correlating the factors influencing household decisions on adoption and utilization of biogas technology in South Africa"	This study employed a descriptive research design. Purposive and simple random sampling were used.	The study found that the Size of household, availability of technical support and distance to the source of woodfuel therefore positively determine the adoption of biogas energy.	The survey was limited to household survey on adoption of biogas. It did not focus on institutional adoption of biogas	This study focused on institutional factors
Environmental Factors	Dipanjan, Sonmoina Rajita et al (2021)	Smoking Preservation of Fish. Aquafind.	The research employed a descriptive cross-sectional study method	The study found that Fish smoking for the purpose it is done compels those practicing the smoking to use fuel wood	The study was limited to household adoption of fuel technology	This study looked at institutional use of fuel
	Nyakone B.O (2015)	"Factors Influencing Adoption of Improved Cookstoves among Households of Thuti Location, Othaya, Nyeri County, Kenya"	The study adopted a descriptive cross-sectional study method	Extreme cold weather encourages the adoption of solid fuel technologies and thus a resistance to modern technologies like electricity and LPG	The study was also limited to household and sought to answer the question of why households adopt the cooking technologies they use as opposed to why they do no adopt ICS	The study focused on institutions like schools

2.5 Conceptual Framework

Independent variables **Dependent variable**

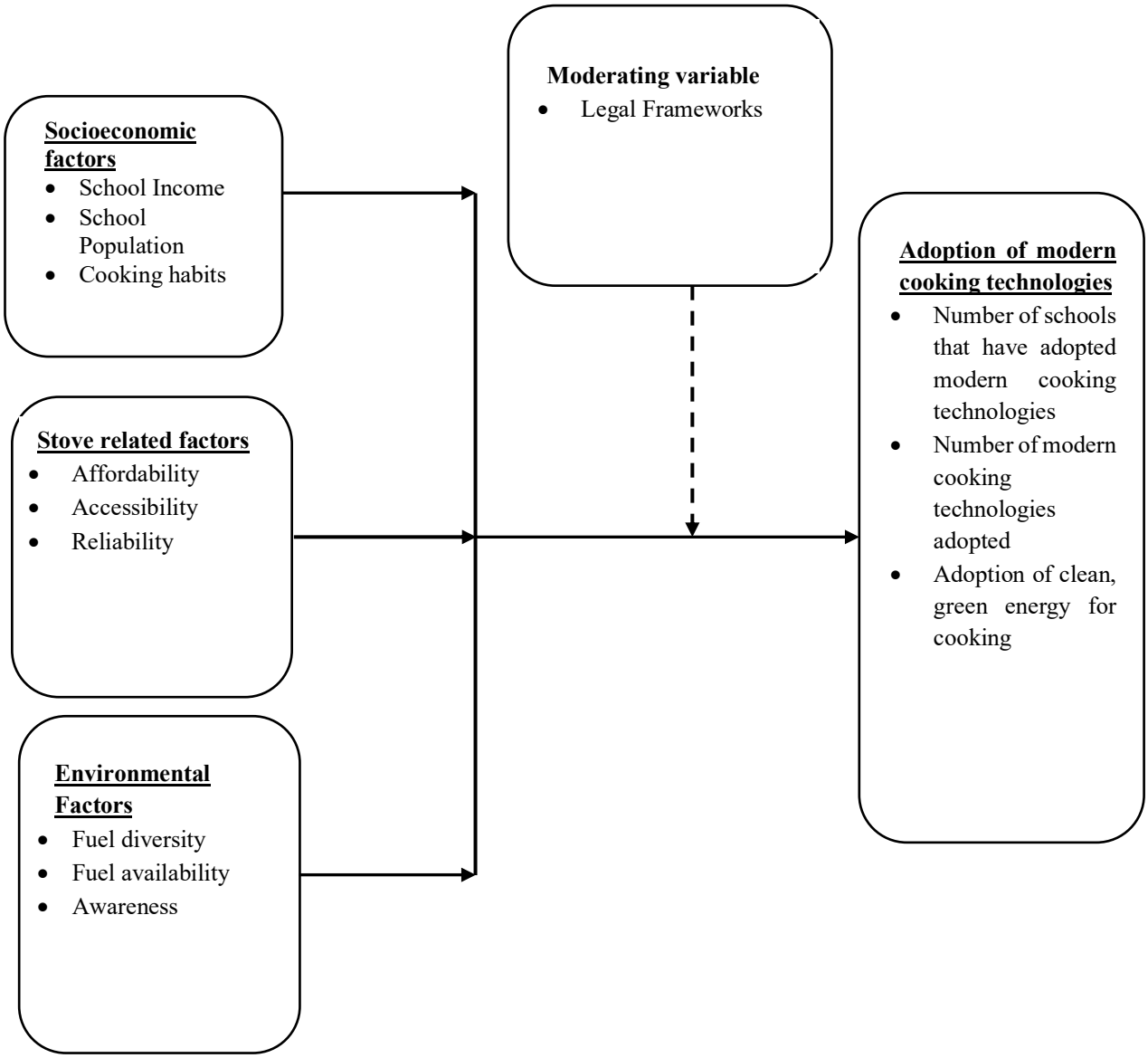

Figure 1: Conceptual Framework of the Variables of the Study

2.6 Research Hypotheses

This project seeks to test the research hypotheses outlined below

3. **H_0** Socio-economic factors have no significant implication on the choice to adopt modern cooking technologies in government owned secondary schools in Nairobi County
4. **H_0** Stove related factors have no significant influence on the adoption of modern cooking technologies in government owned senior secondary schools in Nairobi County
5. **H_0** Environmental factors have no significant influence on the adoption of modern cooking technologies in government owned senior secondary schools in Nairobi County.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This section describes the framework which the study employed to achieve the objectives. It thus covers the subject of research method or strategy, the population of study, the size of the study population sampled, and the sampling procedure used to select the study participants, the procedure used to collect data and data analysis methods and the ethical issues involved.

3.2 Research Design

This research employed descriptive research method in which data qualitative and quantitative research strategies were explored and the corresponding analysis techniques to examine the variables of the study. The descriptive approach adopted case study to describe the characteristics of government owned secondary schools in Nairobi County, with regards to factors influencing the kind of cooking technologies they adopt.

This research applied descriptive survey to execute the research. Descriptive study designs applied in maiden and investigative researches to enable the researcher to collect data, process it, analyze it, interpret, and present the findings so that conclusion and recommendation can be made from the study (Orodho *et al*., 2002). Mungenda and Mugenda (1999) opine that the suitability of descriptive research design is applicability is determining and reporting issues without any manipulation. Consequently, data was collected, analyzed and presented as they were without any manipulations.

3.3 Target Population

The study targeted government owned secondary schools with some element of cooking to the students in Nairobi County, Kenya. The number of government owned secondary school in Nairobi County is 97 (7 National, 26 Extra-county, 17 County and 47 Sub-county schools) (Data retrieved from Ministry of Education Source on 1st September 2022), (See appendix VIII). The study targeted all the school principals, as well as stakeholders such as County Education Officers, Institutional stove manufacturers and distributors. Public Secondary

Schools and the stakeholders have been chosen because they are best placed to study cooking habits and adoptability of the modern cooking solutions, they also have a common base that allows comparison and study.

3.4 Sample Size and Sampling Procedure

Kumekpor (2002), states that the unit of analysis in any social science is the actual empirical unit, object, occurrence, etc. which must be measured or observed to study a particular phenomenon. In this study, the units of enquiry were public secondary schools providing cooking services to students in Nairobi County.

3.4.1 Sample Size Determination

The sample size in this study was established with the Krejcie and Morgan Table (1970). The table is an inventive guideline for deducing and determining the size of a study population which ought to be sampled for reliable representation. From the table, when the study population is below 10, all of them are sampled. Therefore, all the education officers and all the institutional stove manufactures were sampled.

The sample size of the study was 167 respondents who were extracted from a population of 209 based on Krejcie and Morgan Table (1970). Table 2 below shows how the sample frame was deduced.

Table 3.1: Sampling Frame

Category	Target Population	Sample size
Heads of Schools	97	76
Head Cooks	97	76
Education Officers	5	5
Institutional stove manufactures and distributors	10	10
Total	**209**	**167**

3.4.2 Sampling Procedure

Three sampling procedures were adopted in the study. First the targeted respondents were profiled to identify the stratum they fall in. Secondly, the study population was heterogeneous, the researcher therefore employed stratified sampling which involved classification of the target respondents into strata. The size of target population in each strata was then divided by the total number of targeted respondents, multiplied by the inferred sample size from the Krejcie and Morgan Table (1970). Lastly, simple random sampling was used within each stratum. Kumekpor (2002) proclaim that stratified sampling statistically preferred because it gives more accurate representation than random sampling.

3.5 Methods of Data Collection

Semi-structured questionnaires were used to collect primary data because they are more affordable and easier to distribute. Walliman (2005), argues that "using questionnaires enables a researcher to organize the questions and receive replies without actually having to talk to every respondent". This research was therefore, made use of semi-structured questionnaires because questionnaire could easily be dropped and picked. The structure of questionnaires was guided by the research objectives and contained both open and closed questions to ensure effective analysis. The open-ended questions alongside the interview schedule were used for collection of both qualitative and quantitative data which can be relied on to determine the relationship of the variables of the study.

Before administering the research instruments, the researcher/assistant requested for consent to carry out the study in the schools identified. A physical introductory letter and a research permit from the Ministry of Education and NACOSTI (See Appendix II) was used to request for free-will of the respondents. Where necessary, preceding appointments with the participants was made to sufficiently prepare them for the research. Drop and pick method was used administer the research instrument. Where drop and pick method could not be used, the researcher conducted live interviews using the questionnaire as a guide. The research instrument was split into two parts. Part A concentrated on collecting data related to demographics. Part B on the other hand concentrated on data directly linked to the study objectives.

3.5.1 Pilot Testing of the Research Instruments

The research instrument first pre-tested to make any necessary revisions before they could be adopted in the actual study. The piloting was run in nearby Machakos County (Tala Girls Secondary School). The researcher familiarized with the social characteristics of targeted participants during the main study while undertaking the pilot study. Due diligence was paid to the structure and length of the queries in the questionnaires so that they were not lengthy or heavily phrased so that the respondents could easily understand and respond to them accurately.

3.5.2 Validity

Mugenda and Mugenda, (2009) postulates that validity is the accuracy with which the data collections instrument can measure the parameter that it is intended to measure. To ensure validity, the study reviewed related literature to establish whether the objectives would be achievable using the items in the questionnaire or the interview guide for the study. Expert opinion was equally sought from senior researchers and academicians and suggestions on the research instruments obtained from them and necessary adjustments made.

Content validity was attained through formulating the questionnaire in line with questionnaire based on the research objectives. To achieve this, *Content-Scaling–Structure* (CSS) method was followed. CSS technique is apposite and recommended for examining and enhancing the content validity of a questionnaire or interview schedule scale (Koller *et al*., 2017). According to Koller *et al*. (2017), the method is appropriate for several research questions revolving around content validity. Content validity of the research instrument questionnaires and interview guides was achieved through seeking opinions of the experts' opinion. Construct validity was realized by certifying that the operative variables mirror the theoretical hypotheses from the literature reviewed.

3.5.3 Reliability

Reliability is a measure of the coherence of research instrument if it was used repeatedly at difference time but with same study population. Cronbach Alpha coefficient will be calculated after the findings from piloting. According to Creswell *et al*., (2003), a reliability coefficient of 0.5 or higher signifies that the data collected through the research instruments is highly reliable thus suitable for the study. To achieve reliability, the researcher used the Cronbach

Alpha test. The Cronbach Alpha tests intramural evenness of a scale of test parameters. It indicates the precision of the multifaceted Likert scale in appraising the parameter in question. According to Cronbach (1951), alpha value ≥ 0.7 indicates reliability of the research questionnaire.

3.6 Operationalization of Variables

The table below gives a summary of how the concepts were measured.

Table 3.2: Operationalization of Variables

Objectives	Variables	Indicators	Measurement Scale	Type of Analysis	Tools of Analysis
To "examine how socio-economic factors influence adoption of modern cooking technologies in public secondary schools of Nairobi County"	Independent Variable Socioeconomic factors	- School Income -School Population -Cooking habits	Interval	Descriptive Inferential	Frequencies, Means and Percentages -Correlation -Regression
To "evaluate the influence of stove characteristics on adoption of modern cooking technologies in public Secondary schools of Nairobi County".	Independent Variable Stove related factors	-Affordability -Accessibility -Reliability	Interval	Descriptive	Frequencies, Means and Percentages
To scrutinize the degree to which environmental related factors influence the decision to adopt modern cooking technologies in public secondary schools	Independent Variable Environmental Factors	-Fuel diversity -Fuel availability -Weather and climate	Interval	Descriptive Inferential	Means and Percentages Frequencies, Means and Percentages correlation, Means and Percentages -Correlation -Regression

The overall goal of the research was to research on perceived factors which influence adoption of greener cooking alternatives in Public Secondary Schools of Kenya	Dependent Variable Adoption of modern cooking technologies .	-Number of schools that have adopted modern cooking technologies -Number of modern cooking technologies adopted -Adoption of clean, green energy for cooking	Interval	Descriptive Inferential	Means, standard deviation and Percentages -Correlation -Regression

3.7 Methods of Data Analysis

The data collected was processed to ascertain integrity, consistency, accuracy, and completeness. The processing involved cleaning of data to get rid of inconsistencies and thereafter, categorizing it according to relatedness followed by tabulation. The tabulation relied on coding from Likert Scale data. Content descriptive techniques was used to investigate qualitative data. The analysis involved objective examination of data with similar characteristics, and same categories. Clean data was keyed into SPSS version 23 for quantitative statistical analysis. Descriptive and inferential analysis were done followed by the corresponding discussion in line with the research questions. Qualitative data was exported into Nvivo version 26 for interpretative phenomenological analysis (IPA)

3.7.1 Regression Model

The regression equation below was used to examine the weight of each independent variable on the adoption of modern cooking technology in government owned secondary schools in Nairobi County;

$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \varepsilon$…….

Where:

Y = Adoption of modern cooking technology

X1 = Socio-economic factors

X2 = Stove Characteristics factors

X3 = Environment related factors

$\beta 0$ = Constant;

$\beta 1 - \beta 3$ = Coefficients of independent variables and

ε = Error term

Regression model estimates the direction and total effects of both the intervening variable on the predictive variables effect on the dependent variable.

Pearson correlation test was used to run multicollinearity test to analyze the relationship and between the independent variables and the dependent variable of the study. The test pinpoints the course of the relationship between more than two variables and how strong the relationship is. Where there is a seamless linear relationship between all the predictor variables and the response variable, the estimates from the regression model cannot be fully constructed. The term collinearity is used to describe linear relationship between two variables. Multicollinearity is used in reference to a linear relationship between more than one predictor variable and response variable. The chief fear is that any increase in the level of multicollinearity cause instability of the regression model guesstimates of the coefficients and thus standard errors of the coefficients becomes outrageously overstated (Midi, Sarkar, & Rana, 2010).

The "tolerance" is a measurement of the percent of variance in one independent variable which cannot be accounted for by another predictor variable, thus miniature values demonstrate that a variable is not significant, and values that are <0.1 imply that multicollinearity among the predictors is not a problem (Raykov, & Marcoulides, 2012). The Variance Inflation Factor (VIF) is calculated as 1/Tolerance and going by modus operandi, a variable whose VIF value is >10 may raise an alarm for further investigation. An integral value signifies a direct association between variables while a negative result signifies that the variables are contrariwise related (Raykov, & Marcoulides, 2012).

3.7.2 Diagnostic Tests

The study assumed that the study population was normally distributed and therefore before any statistical analysis was ran, diagnostic tests was conducted to verify the normality. Normality is the supposition that the diagnostic error is uniformly dispersed with a mean of zero and an invariable discrepancy (Koller *et al*., 2017). Data is considered normally dispersed when the

Skewness and Kurtosis Z-values are within ±1.96. Alternatively, data is considered normally or approximately normally distributed if the p-values (*Sig*.) from Shapiro Wilk tests are > 0.05 (Razali, & Wah, 2011). Normality for this study was done through Shapiro-Wilk test which spots divergence of data from normality due to biasness. A threshold of *p*-value of 0.05 was used to measure normality of the data. *P*-values above 0.05 are indicative of approximately normally distributed data.

CHAPTER FOUR
RESULTS, ANALYSIS AND DISCUSSIONS

4.1 Introduction

This section stages the results of the study, the analysis of the data and corresponding discussion. The section is therefore organized into four main parts namely diagnostic tests (reliability and normality), responses rate, demographic analysis, descriptive statistics and inferential statistics.

4.2 Diagnostics Tests

Diagnostics tests are analysis of which qualify the data collected dependent on the variables the data was meant to measure. Two main tests were done as described below.

4.2.1 Reliability Tests

The reliability of the data collection tools was analyzed by running Cronbach's alpha tests on the data collected. The study constructs which returned alpha coefficients ≥ 0.7 were considered to be reliable. The output of the test are presented in Table 4.1 below .

Table 4.1: Reliability Test

Study Variable	Number of Items	Cronbach's Alpha Coefficient
Socio-economic factors	6	0.779
Stove characteristics	5	0.827
Environment related factors	4	0.835

Source: Research data (2022)

As shown in Table 4.1, all the tested study constructs returned Cronbach's alpha coefficients >0.7. According to Cronbach (1951), Cronbach's alpha Coefficient >0.7 is satisfactory for testing reliability of research questionnaire. Therefore, the research questionnaire was deemed reliable because all the Acronbach's Alpha Coefficient were >0.7

4.2.2 Normality Test

In this study normal spread of data was tested through Shapiro Wilk Test as captured in Table 4.2.

Table 4.1 Normality Test (Shapiro Wilk)

Variable	**Statistic**	**Sig.**
Socioeconomic Factors	.907	.139
Stove Characteristic	.916	.234
Environment Related Factors	.902	.302

Source: Survey Data, (2022)

As indicated in in the analysis captured in Table 4.2, the responses for the three variables were normally distributed. Data is normally spread out if the Skewness and Kurtosis *z*-values are within ±1.96. Alternatively, data is considered normally or approximately normally distributed if the *p*-values (*sig*.) from Shapiro Wilk tests are above 0.05 (Jurečková, & Picek, 2007). This study relied on the *sig*. values to determine the normality. The analysis indicates that the responses on socio-economic factors (Shapiro Wilk test = 0.907, *p*-value=0.139), Stove characteristics (Shapiro Wilk normality test = 0.916, *p*-value =0.234), and Environment related factors (Shapiro Wilk test = 0.902, *p*-value=0.302), and were normally distributed. In other words, the scores on all the three independent variables were normally distributed among the respondents. It therefore minimizes possibilities of skewness of the responses and thus creating more credibility.

4.3 Response Rate

The stratified and simple random sampling yielded 52 public secondary school principals/deputy principles from Nairobi County translating to 60.47% response rate. A response rate of 60% and or higher is considered satisfactory for survey studies, according to Fincham, (2008). Although the study targeted 76 heads of the schools and 76 head cooks, data was collected form only the school principals for convenience and avoidance of duplication reasons.

4.4 General Characteristics of the Respondents

The primary focus of the study was to examine factors influencing the adoption of modern cooking technologies among government owned secondary school in Nairobi City County. To patently analyze the data to answer the corresponding research questions developed from the research objectives, the participants were asked a few questions on their background. Their responses were captured as presented subsequent sections below.

4.4.1 Gender Distribution of Respondents

The gender information of the participants was collected and recorded as captured in Table 4.3 below

Table 4.2: Respondents' Gender

Group	Frequency	Percentage
Male	30	57.7%
Female	22	42.3%
Total	**52**	**100.0**

The results show that 57.7% of public-school heads in Nairobi County are males compared to 42.3% school headed by female teachers. Consequently, it can be interpreted that most public schools in Nairobi County meet the two-thirds gender rule in terms of gender in school headship. Although this observation is within the provision of the 2/3 gender rule, it further elaborates the gender disparity in managements and leadership positions in public service in Kenya

4.4.2 Respondents' Age Characteristic

The age characteristic evaluation of the participants is captured in Table 4.4 below.

Table 4.3: Age Characteristics of Respondents

Age Group	Frequency	Percentage
18-30 Years	2	3.8%
31-45 Years	13	25.0%
46-55 Years	21	40.4%
56-65 Years	16	30.8%
Total	**52**	**100.0%**

The data as presented in Table 4.2 shows that most of the participants (40.4%) are aged between 46 and 55 years, followed by those aged between 56 and 65 years (30.8%), while those aged between 31 and 45 years composed of 25.0% of all the participants. A few, (3.8%) were aged between 18 and 30 years old. The results resonate with the demographic characteristics of public secondary school principals reported by (Ndiritu, 2012). Notably, majority of teachers are promoted to principals towards their retirement ages.

4.4.3 Achieved Level of Education

The information on highest education achievement of the participant was collected as reported in Table 4.5 below.

Table 4.4 Education Level

Group	Frequency	Percentage
Diploma	3	5.8%
Degree	28	53.8%
Master's Degree	17	32.7%
PhD	4	7.7%
Total	**52**	**100.0**

The results as reported in the table above shows that 7.7% of the respondents had doctorate degrees, 32,7% had Master's Degree while the majority were Bachelor Degree holders. Notably, a few (5.8%) were Diploma holders. This result implies that the public secondary school principals had reliable educational achievement, a condition that Carmen-Pilar et al. (2011), opined as being imperative and necessary for effective decision making for any management position.

4.3.4 School Duration of Service

A response on the duration of service of the respondents in their current workstations was captured, Table 4.6 displays the results.

Table 4.5:Duration Of Service

Group	Frequency	Percentage
< 1 years	1	1.9%
2-5 years	11	21.2%
6-9 years	22	42.3%
Above 10 years	18	34.6%
Total	**52**	**100.0%**

The result highlights that majority of the participants (42.3%) have served in their workstations for between 6-9 years, 34.6% have headed their schools for more than 10 years while 21.2% and 1.9% have served for between 2 and 5 years and less than 1 years respectively. With this kind of results, evidently, majority of the participants in the schools sampled have been in their workstations long enough to understand the management and decision-making dynamics of the schools. They have understood all the stakeholders, the potentials of the schools and what is most preferable for the school in terms of energy needs.

4.4.5 School Students Population

The study inquired about the average students' populations in the schools sampled. The results show that most schools (40.4%) had between 500 and 1,000 students. A significant other (26.9%) had between 1000 and 1500 students. The other schools (23.1%) had 500 and below while only five school (9.6%) had more than 1,500 students. The mean student population was

about 866±455. With all the schools indicating that they provide meals for all the students, the mean students' population was an indicator that the cooking needs of the school in terms of energy would be a technology that would effectively and efficiently deliver the cooking demands of relatively high populations. Table 4.7 below summarizes the school's students' population.

Table 4.6: School Population

School Population Groups	Frequency	Percentage
1-500	12	23.1%
501-1000	21	40.4%
1001-1500	14	26.9%
1501- 2000	5	9.6%
Total	**52**	**100.0%**

4.4.6 School Income

The principals were further asked about school income. While an appreciable number of the principals (26.9%) declined to answer, the responses of those who answered were captured as outlined in Table 4.8 below

Table 4.7: Average School Income

Income Category	Frequency	Percentage
1-1000,000	7	18.4%
1,000,001-2,000,000	15	39.5%
2,000,000-4,000,000	9	23.7%
4,000,000- 6,000,000	5	13.2%
6,000,001 +	2	5.3%
Total	**38**	**100.0%**

Evidently, the schools sampled had an average annual income of KES. 2,368,422±1,624,987. While some schools (5.3%) had an income of above KES, 6,000,000, a significant number (18.4%) had less than KES 1,000,000. Majority of the school (39.6%) had an average annual income of between KES 1 million and 2 million, 23.7% of the school had between KES 2

million and 4 million, while remaining 13.2% had between KES 4 and 6 million. The study could however not validate the accuracy of the information given by the respondents but going by the population of most schools, it was evident that the respondents understander their annual monthly income. The minimum annual secondary school fees per student in Kenya is about KES 22,244 (For Day School) (Media Team, 2023). Going by the average student population per school of 866 among the school sampled, the average annual income would be about KES 19.3 million.

4.4.7 Source of energy for Cooking in Schools

The dominant energy the school uses for cooking was needed. The data on the cooking energy used was summarized as presented in Table 4.9 below

Table 4.8: Major Source of Fuel

Energy Category	Frequency	Percentage
Firewood	25	48.1%
Firewood & Charcoal	10	19.2%
Firewood & LPG	9	17.3%
Firewood, Charcoal & LPG	5	9.6%
Firewood and Briquets	3	5.8%
Total	**52**	**100.0%**

As evidenced in Table 4.9, all the schools rely on firewood as their predominant energy for cooking. Almost half (48.1%) of the schools sampled fully relied on firewood only. The rest of the schools used other fuels to complement on firewood, but their usage was limited to small scale cooking for instance cooking for teachers. For example, 19.2% of them used charcoal to complement firewood, 17.3% used LPG besides firewood, 9.6% used charcoal and LPG alongside firewood, while 5.8% supplemented firewood with briquets. The overreliance on firewood poses the threat to the forest cover target as postulated by the government (Ministry of Environment and Forestry – Kenya, 2020)

4.5 Descriptive Statistics

This was done to examine the frequency, means, and standard deviation on the data collected on perceived factors which influence the adoption of MCTs in the schools surveyed.

4.5.1 Influence of Socioeconomic on Choice of Cooking Technology

The participants were interrogated on the factors they perceived informed the choice of cooking technology adopted in their respective schools. Likert Scale was used to pull together their views of the respondent in which "1 = Strongly disagree, 2= Disagree, 3 = Not sure, 4 = Agree, 5 = Strongly Agree". The scores of the respondents for each statement in the scale were tallied and their means calculated.

Their opinions were recorded as summarized in Table 4.10.

Table 4.9: Descriptive Statistics of Influence of Economic Factors on Adoption of MCTS

Scale	N	Mean ($\bar{x}$)	SD (σ)
The size of the school (population) has a direct influence on the preference of cookstoves	52	4.67	0.3017
The cost of a cookstove influences the choice	52	3.92	0.1183
The availability and accessibility of a cookstove influences the choice	52	3.31	0.0109
The school management's decision has an influence of the cookstove used at the school	52	4.66	0.2629
The efficiency and Effectiveness of a cookstove has an influence on its adoption	52	4.72	0.2005
The type of fuel used for cooking has an influence on the choice of cookstove	52	3.57	0.3148

Table 4.10 shows the descriptive statistics for six items which were used to measure factors which influence the choice of cooking technology adopted in the schools. From the results, all the items means are above 3.5 (equivalent of "Agree" when rounded off to the nearest whole number) and compared with the standard deviations, it is evident that all the items in the construct had significant effect on the choice of the cooking technology use by the schools. are significant.

These results corroborate with those of other studies which have established that the choices of cooking technologies adopted depends on various factors including cost of energy (income) (Adam, et al., 2013; Sesan, 2012), accessibility of ICS, (Bonan et al., 2017), institutional bureaucracies and decision-making role (Sesan, 2012; Debbi et al., 2014; Jan, 2012), failure of ICS to meet their cooking needs (Debbi et al., 2014), efficiency and effectiveness for the intended purposes (Jan et al., , 2017), and availability, accessibility and affordability of the type of fuel used in any particular ICS (Debbi et al., 2014). In all these studies, these factors were established to significantly influence adoption of clean energy cooking technologies such as those involving ICSs. However, Adam and colleagues noted that increased household income encourages the adoption of charcoal and LPG as cooking energy instead of wood fuel. This was not the same observation with the secondary school as even the biggest secondary schools by student population, still depended on wood fuel for most of their cooking. According to Adams and colleagues, the use of wood fuel should be dominant among household/users with low and decreasing income (Adam, et al., 2013). It is consequently imperative to consider the factor which can be influenced by producers of the ICS for instance size of the cook stoves, the efficiency and effectiveness for large scale cooking and the energy needed.

4.5.2 Influence of Stove Characteristics on Adoption of Modern Cooking Technologies

The respondents were asked what they thought about MCT characteristics which could influence their adoption by the schools. The participants' opinion for each of the items used to measure the influence of stove characteristics on adoption of modern cooking energies among the schools sampled was collected using a Likert scale. Table 4.12 summarizes the opinions of the respondents about the items in the scale.

Table 4.10: Descriptive Statistics

Reason	N	Mean ($\bar{x}$)	SD (σ)
They are very expensive	52	3.93	0.1003
They are technical to operate	52	3.42	0.2601
They breakdown easily and No servicing is easily available and accessible	52	4.27	0.2507
The applicable fuel is not affordable	52	3.08	0.1773
The applicable fuel is inaccessible	52	3.36	0.2104
They come in small sizes which cannot sustain the cooking demand	52	4.71	0.3065

The means indicate that only 3 stove characteristics influenced the adoption of modern cook technologies based on rounding of the means to the nearest whole numbers as depicted by the Likert scale. The three characteristics included the stove being very expensive ($\bar{x}$=3.93±0.1003), easy breakdown and non-availability of repair services ($\bar{x}$=4.27±0.2507), and that the stoves come in small sizes which cannot sustain cooking demands of the schools ($\bar{x}$=4.71±0.3065). The respondents generally agreed that cost of the MCT, and strongly agreed that the ease of breakdown and non-availability of repaired services of the MCTs influenced their adoption. These results resonate with the conclusion of other studies which have highlighted that cost of purchasing the ICSs is a barrier to their adoption (Adam, et al., 2013; Sesan, 2012). Due to high cost, some of the research works have recommended that the government and other stakeholder can work on policies can review payment modalities and possibilities of giving the ICSs for free (Eshetu, 2014; Jan, 2012). The respondents were however not sure if technicality in operation of the MCT, non-affordability of the applicable fuel in the MCT and inaccessibility of the applicable fuel do influence the adoption of the MCTs in schools. It is therefore not possible to rule out or justify the impact of technicality of operating MCT, non-affordability and inaccessibility of applicable on adoption of MCT by the schools sampled.

4.5.3 Influence of Environment Related Factors on Adoption of MCTs

The environmental factors of interest in the study were, availability and accessibility of MCTs, awareness about MCTs and availability and accessibility of the energy applicable with the MCT. The respondents when asked whether they agreed that these factors influenced their adoption of the MCTs notes varied opinions as depicted in the summaries of their responses captured in Table 4.12.

Table 4.11: Descriptive of Statistics of Influence of Environment Related Factors on Adoption of Mcts

Statement	N	Mean ($\bar{x}$)	SD (σ)
The MCTs are not readily available and accessible within reach	52	4.47	0.1803
Accessibility of information about the MCTs (knowledge/Awareness)	52	4.29	0.2719
The energy applicable with the MCTs is not readily available and accessible	52	4.33	0.3442
Predominant culture of using firewood	52	4.15	0.1057

Considering the means, all of which round off to the nearest 4, (Agree), the respondents generally agreed that the environment related factors such as awareness about MCTs, availability and accessibility of MCTs, availability and accessibility of the applicable fuels and common culture of firewood use significantly influence adoption of MCT. Availability and accessibility of the MCTs to a school or any other consumer for instance would significantly influence whether such a school could influence the adoption of the MCT in question. If a certain MCT is not available and accessible to a potential user, then chances are rare that the potential user will adopt it. The same findings were established by Bonan, et al., (2017), who noted that fuel efficient stoves had not been significantly adopted among households in countryside populations in Borena Woreda: North Central Ethiopia because it was not available in the local markets and neither accessible to them. Debbie et al., (2014) also noted that knowledge is an important factor informing adoption because a consumer only adopts what they know about. The knowledge in this case include knowledge of how a product can meet the needs and all other benefits associated with the product (Okur, & Saricam, 2019),

knowledge of health and socioenvironmental hazard associated with dependance on wood fuel (Edelstein, Pitchforth, Asres, Silverman, & Kulkarni, 2008) and user knowledge and perception (Adane, Alene, Mereta, & Wanyonyi, 2020). Moreover, the availability and accessibility of the fuel to be used in any given cookstove plays a role in influencing its adoption. Debbie et al., (2014), also established that where the fuel used in certain ICS is not readily available and accessible, the potential adopters of the ICS pull back because they might not be able to use the cookstove without the applicable fuel.

4.5.4 Awareness About of Modern Cooking Technologies Able to Sustain Cooking Demands of the Schools

The study participants were also asked if they knew of availability of MCTs which could sustain the cooking needs of the school in terms of volume of food they cook, efficiency and effectiveness. Surprisingly, only 11 schools (21.2%) indicated that they are aware MCT which could be adopted in their schools for the cooking in the schools. Evidently, majority of the participants are not aware if there are MCTs in the market which could deliver the same cooking demands, effectiveness, and efficiency the schools. This could imply that either such MCT do not exist in the current market, or they exist but the target customers are not appraised about the same. All the participants however affirmed that they would be willing to adopt MCT, on condition that their cooking demands in terms of quantity of output, effectiveness and efficiency can be guaranteed. The preferences of the participants on the MCT was recorded and presented in Table 4.13

Table 4.12: Awareness of Modern Cooking Technologies able to Sustain Cooking Demands of the School

MCT Known	Frequency	Percentage	Rationale of Preference
Improved Cookstove	7	13.5	Easy to operate
LPG Gas Cookers	18	34.6	Help preserve environment
Biogas	11	21.2	Help recycle biodegradable waste
Ethanol Cookers	4	7.7	Clean
Saviko Biojiko	6	11.5	Seems dynamic in fuel
Electric Cookers	12	23.1	Clean and efficient
Totals	**52**	**100**	

A further inquiry into the types of MCT known to the participants, majority (86.5%) indicated awareness of improved cookestoves, LPG Gas cookers, Biogas cookers, ethanol cookers and Electric cookers. Table 4.15 presents other responses.

Table 4.13: Types of MCT Known to Participants

MCT Known	Frequency	Percentage
Improved Cookstove	52	100
LPG Gas Cookers	52	100
Biogas	47	90.4
Ethanol Cookers	45	86.5
Saviko Biojiko	5	9.6
Electric Cookers	52	100

Notably majority of the respondents (53.8%) first got to know about the MCT through formal education, social interactions (21.6%), mainstream media (15.4%), and Workshop Training (9.2%). None of the participants received awareness about any MCT through policy communication. Table 4.15 summarizes the data on means of awareness about ICS among the participants.

Table 4.14: Means of Awareness

MCT Known	Frequency	Percentage
Workshop training	5	9.2
Mainstream Media	8	15.4
Formal Education	28	53.8
Social interactions	11	21.6
Policy Communication	0	0
Total	**52**	**100**

4.5.5 Awareness about Global Campaigns for Adoption of Green Cooking Technologies

The study also inquired whether the participants were aware that there are global campaigns towards adoption of MCT to enhance global efforts to fight global warming. The participants

were divided almost into half with 51.9% indicating that they are aware of global campaigns to adopt clean cooking technologies while 49.1% indicated that they are not aware of such campaigns. Among those who were aware of the campaigns, the media stood out as the main source of knowledge at 62.9%. The rest of the participants got the information through formal communication agencies (22.2%), publications (11.1%) and Ministry of education (3.8%). These results show a gap in the information system about ICS and their adoption among the public secondary schools in Kenya. In other words, there is a weak information system about the ICSs as evidence by a lack of structured communication targeting the public secondary schools particularly on ICSs and the need for cultural change on their cooking technology.

4.6 Inferential Analysis

The research used Pearson's correlations and Regression statistics analyze the data and test the hypotheses. The sections below present the results of the two analyses.

4.6.1 Correlation Analysis

To establish the existence of relationship, the direction, and strength of the relationship between the variables of the study, Pearson correlation analysis was used to establish three main constructs, namely, existence of a bivariate relationship between one viable and the other, the strength of the relationship and whether the relationship is statistically significant or not. Results of the correlation analysis are therefore primary basis of testing hypotheses of a study. This study carried out correlation analysis to establish the correlation of socioeconomic factors, Stove characteristics and Environment related factors and adoption of MCT in government owned secondary schools in Nairobi County. Table 4.16 below, presents the results of the analysis.

Table 4.15: Correlation Analysis of the Variable

		Adoption of MCT in Public Secondary Schools	Socio-economic factors	Stove characteristics	Environment related factors
Adoption of MCT in Public Secondary Schools	Pearson Correlation	1			
	Sig. (2-tailed)				
Social-Economic factors	Pearson Correlation	.614**	1		
	Sig. (2-tailed)	.001			
Stove characteristics	Pearson Correlation	.903**	683**	1	
	Sig. (2-tailed)	.001	.001		
Environment related factors	Pearson Correlation	.638**	.595**	.711**	1
	Sig. (2-tailed)	.015	.000	.018	

From the results of the analysis, all the independent variable of the study independent variables positively correlated with the adoption of MCTs. Stove characteristics had the strongest positive and statistically significant correlation of r=0.903, (p< 0.001) followed by Environment related factors which had a correlation of r=0.638 (p< 0.015) and then Socioeconomic which had a correlation of r=0.614 (p< 0.001). These results indicate that all the predictor variables statistically and significant correlate with adoption of green cooking technologies at 95% confidence interval (2-tailed). In other words, Stove characteristics, environment related factors and socio-economic factors at the schools influence the adoption of MCTs for cooking purposes. The environmental factors which were explored included environment related awareness and knowledge of the existence and relative advantage to the potential adopters of the MCT. Additionally, the study explored availability and accessibility of the MCT questions within the immediate environment of the schools, availability and accessibility of the applicable fuels and the predominant culture among the secondary schools,

by the potential adopters. Although the findings per school were not identical, the average findings points to potential impacts on adoption.

The findings resonate with the finding of various studies. Which have established that socio-economic factors such as financial abilities (Treiber, Grimsby, & Aune, 2015), population (Troncoso, 2011), decision making bureaucracies ("Ruiz-Mercado, Masera, Zamora, & Smith, 2011"), efficiency and effectiveness of cookstoves and have fairly significant determining influence on the adoption of ICS among the secondary schools. Financial issues of concern in the cost effectiveness of the MCT, while the population is a question of how many people the cookstove should serve. Evidently, not all the schools surveyed fall in the same financial strength category (Table 4.6), and therefore, not all of them would be expected to hold onto financial constraints as the reason they have not adopted non-wood fuel cookstoves. That notwithstanding, financial characteristics significantly influenced the acceptance and use of green cooking energies and technologies in the schools surveyed just as was similarly established by various studies in sub-Saharan Africa (Treiber, Grimsby, & Aune, 2015; "Van der Kroon, Brouwer, & Van Beukering, 2013; Ruiz-Mercado, et al., 2011"). The non-adoption or reluctance to do the same could be understood for schools which could be financially constrained due to the small number of student population. The effect of income denote that an economic motivation targeting enhancing the ease of purchase of MCT could imply a critical and significant effect on adoption of MCT by financially constrained customers/consumers who have not yet made the decision to shift from traditional cooking technologies to MCT. Bureaucracies involved in decision making on the other hand is a question of who holds the final say on whether an innovation is accepted, embraced and adopted. Notably, not every stakeholder has a direct mandate of either influencing or making change decision (Karanja, & Gasparatos, 2020).

Stove characteristics scored the highest in correlation with adoption of ICS (r=903, p=001). The design and the size of the stove define how much it can deliver within a certain time. The volume of the food to be cooked at any given time must thus be a question height. Other studies established that the design and size of the stove therefore influences adoption (Pandey, 2010). In most cases the ICSs are designed without consideration of the needs of the targeted market (Troncoso, 2011). This explains why Puzzolo et al., (2013) suggested that it is imperative to

customized the size and design to meet the specific expectation of the potential consumers. The quantity of food which can be cooked on a cook stove at any given time is a question the cook stove has to answer before it is adopted. Besides size and design, the stove durability is a question of interest to potential adopters. The common perceptions that the ICSs in the market are exotic and generally less durable is a factor which can potentially keep people away from adopting as would be expected (Troncoso, 2011; Chowdhury et al., 2011). Arguably most of the MCT in the market which burn clean fuels come in small versions which may not be suitable for large scale cooking as would obviously demanded by school.

Availability, accessibility of both the MCT and the applicable fuel and awareness equally stood out as some of the environment related factors which directly, positively and significantly influence adoption. Various studies have equally established the same relationship. Githiomi, Kung'u, & Mugendi, (2012); Kituyi et al. (2019) and Correa et al., (2019) all noted that availability and accessibility of both the targeted ICS and the applicable fuel determines whether potential consumers adopt them or not. People will more readily adopt what is readily available and cost effectively accessible to them. The environment related factors such as location of market, location of producers, distances covered to access the MCT or the applicable fuel and awareness of modern MCT products all in combination determines whether a modern cooking technology is adopted or not (Hollada et al., 2017; Shen et al., 2015). The location of market, access to both the MCT and the applicable fuel all determines the overall cost of adoption. Karimu (2015) added that awareness is a functioned not just education level, but also information on the specific relative advantage of the MCT. Notably the level of awareness would a factor which determines why a potential adopter will go for a certain MCT and not the other. Such information could come from public campaigns in mainstream or social media, adverts, workshops or policy communication (Karanja, & Gasparatos, 2020). This study confirmed that a larger part of the respondents were at least informed about some modern cooking technologies and their relative advantage. Subsequently, ignorance could not significantly have influenced the minimal or non-adoption.

4.6.2 Regression Analysis

To check for the variance on adoption of MCT, regression statistics was done to evaluate the predictive potential of socioeconomic factors, stove characteristics and environment related

factors. The results are as presented in Tables 4.17, 4.18, 4.19 and 4.20. The regression statistics was used the hypotheses of the study, that is:

This project seeks to test the research hypotheses outlined below

1. **H_0** Socio-economic factors have no significant implication on the choice to adopt modern cooking technologies in government owned secondary schools in Nairobi County
2. **H_0** Stove related factors have no significant influence on the adoption of modern cooking technologies in government owned secondary schools in Nairobi County
3. **H_0** Environmental factors have no significant influence on adoption of modern cooking technologies in government owned secondary schools in Nairobi County

Table 4.16: Model Summary

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate	Durbin-Watson
1	.754[a]	.679	.818	.192	2.407

a. Predictors: (Constant), Socio economic factors, Stove characteristics, Environment related factors

b. Dependent Variable: Adoption of MCT by public secondary schools

From Table 4.18 it is evident that, there is a positive direction of the variance of the adoption of MCT (dependent variable) relative to the predictive influence of the Social-economic factors, Stove characteristics, Environment related factors (independent variables). The coefficient of determination, R^2 value was 0.679. This implies that 67.9% of the variance in dependent variable (Adoption of MCT) was explained and predicted by the independent variables (Social-economic factors, Stove characteristics, Environment related factors).

Table 4.18: ANOVAb

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	212.703	3	48.096	104.301	.001[a]
	Residual	10.878	208	.694		
	Total	223.581	211			

a. Predictors: (Constant), Socio-Economic Factors, Stove Characteristics, Environment related Factors

b. Dependent Variable: Adoption of MCT by public secondary schools

The "generated F-statistics" (F = 104.301) indicates a significance at 95 per cent level of significance (Sig. F< 0.05), this shows that the model was suitable and, that Socio-economic Factors, Stove characteristics, and Environment related factors statistically and significantly relate with adoption of MCT by public secondary schools

Table 4.17: Coefficients of Regression

	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
(Constant)	2.667	.371	.277	7.698	.001
Socio-economic factors	.375	.068	.353	5.908	.000
Stove characteristics	.267	.064	.184	2.513	.004
Environment related factors	.376	.064	.334	4.393	.000

a. Dependent Variable: Adoption of MCT by Public Secondary Schools

The achieved t-value coefficient (t = 7.698) signifies a statistical significance at .000 per cent level (*Sig. F*< 0.05). Consequently, Socio-economic factors, Stove characteristics, Environment related factors statistically and significantly relate with adoption of MCT by public secondary school. The results show that the influence of Socio-economic factors, Stove characteristics, Environment related factors on adoption of modern cooking technologies, were statistically significant because they produced a *p* value less than 0.05. Based on the beta results, the researcher therefore interpreted the model as:

$$Y_0 = 2.667 + 0.218 (X_1) + 0.396 (X_2) + 0.307(X_3) + e$$

The model therefore infers that for a unit increase in Socio-economic factors, probability of adoption of MCT increases with 0.375 units, for any a unit improvement in Stove characteristic, chances of adoption MCT would increase by 0.396 units; and for any improvement in environment related factors, possibility of adoption of MCT would increase by 0.307 units

The results of regression analysis emphasize the findings in the correlation analysis which resonated with findings of previous studies. Various studies have established significant and positive dependence of adoption of MCT and clean energies on various factors. Among the factors which these studies have determined to influence adoption of MCT include socioeconomic factors such as, household income (Debbi et al., 2014), size of households (Sesan, 2012), cost of ICS (Adam, et al., 2013; Sesan, 2012) limited decision making roles (Sesan, 2012; Debbi et al., 2014; Jan, 2012). Household income determines whether a household has the money to purchase the ICS as well as the applicable fuel at the price offered in the market. The size of the households provokes the questioned of whether a certain ICS can deliver the cooking demands of the household in terms of among of food to be cooked which directly influence the size of the cooking pots. A bigger household would want to use bigger cooking pots and therefore an ICS should be accommodating the size of the cooking pot used by the consumer. In line with the income question, is the question of cost of ICS. Where the cost of ICS is within what a household can afford, chances are higher that the household will adopt. However, where the cost of the ICS is higher, far above what the Household can afford, the possibility of the household adopting the ICS is lower. Equally important, is the role of decision making (Sesan, 2012; Debbi et al., 2014; Jan, 2012). The adoption depends on whether a household head, or head of institution will make the decision to the same. However, whether the head of the household or institution is reluctant to decide, adoption remains a dream.

This study also established that Stove characteristics significantly influence adoption of MCT and that a unit increase Stove characteristics predicts 26.7% chance of adoption of ICS. These findings equally resonate with previous studies which established the stove characteristics such as design, size, durability, effectiveness and efficiency as the factors which make the MCT

either desirable or not. The more these characteristics are desirable and suitable the higher the chances of adoption (Adam, et al., 2013; Sesan, 2012, Eshetu, 2014; Jan, 2012). Conversely, where these characteristics score the least in the preferences of the potential consumers, adoption of MCTs become grow smaller among the target customers. In other words, the stove characteristics should be appealing adequately to attract the preference of the potential customers.

Equally, this study established significant correlation between adoption of MCT, and environment related elements such as awareness, "availability and accessibility" of the MCT within a place, availability and access of the fuel, and predominant institutional cultures positively and significantly correlate with adoption of MCT. Other researches conducted across the globe found significant relationship between these environments related factors and adoption of MCT. The findings of this study therefore correspond to the conclusions of those studies although the studies primarily focused on households (Bonan et al., 2017). It implies that socioeconomic factors, stove characteristics and environment related factors influence adoption of MCT although the influence may not be equal.

Hence, for the three hypotheses:

Table 4.20: Hypothesis Testing

Hypothesis	Test	Results	Remarks
H_{01}: "Socio-economic factors have no significant effect on Adoption of MCT by public Secondary School in Nairobi County"	Regression .000	Significant	Rejected
H_{02}: "Stove characteristics have no significant effect on adoption of MCTs in public Secondary Schools in Nairobi County"	Regression .004	Significant	Rejected
H_{03}: "Environment related factors have no significant effect on adoption of MCTs by public secondary schools in Nairobi County"	Regression .000	Significant	Rejected

4.7 Qualitative Data Analysis (Manufacturers)

The study also collected data from improved cook stove manufactures. Four organizations were represented namely Technotec Energy Systems, Joag Technical Agencies, Jawab Technical and Works and Munjo Technology Agencies. The information was collected with the aid of interview guide, processed then exported to Nvivo, for coding, and thematic analysis. The organizations were represented by the founders, the CEO, the director or the sales managers who had been in the organization for at least six of more years. They thus were generally adequately informed about the subject of the study. The lines of business products of the organizations were distributed as reported in Table 4.21 below.

Table 4.21: Types of Stoves Produced by Manufacturers

Entry	Organization	Line of Products
1	Technotec Energy Systems	Improved cookstoves
2	Joag Technical Agencies	Improved Cookstoves, Electric Cookers, Ethanol Gel cookers, LPGas cookers
3	Jawab Technical and Works	Energy saving stoves, Gas (boiling pans), charcoal jikos, different types of stoves for hotels
4	Munjo Technology Agencies	Improved Cookstoves

While one organization noted that the cost of production makes about 60% of the overall cost of operations, the other noted that the costs of producing the cooking technology primarily depended on the size of the improved cookstove they produced. Two of the organizations indicated that they did not have structured quality assurance system for checking and validating the efficiency, emission durability safety and ease of use of the cookstoves they produced. The other two indicated that they had measures in place for quality assurance, with one indicating they assured quality by ensuring that they used quality raw materials. The primary market for all the producers were schools, hotels and hospitals although two indicated homes as summarized in Table 4.22 below. When asked to comment on the flow of stock, they 100% indicated slow stock flow, which imply that the demand for their products was very low.

Table 4.18: Target Markets of The Manufacturers

Entry	Organization	Line of Products
1	Technotec Energy Systems	Schools, Hotels, Hospitals and prisons
2	Joag Technical Agencies	Schools, Hotel, Homes
3	Jawab Technical and Works	Schools, Hotel, Homes
4	Munjo Technology Agencies	Schools, Hotel, Hospitals

After Sale Services

The participants were asked whether they offered after sale services. Three indicated that they offer after sale services to their customers while one organization noted they don't offer after sale services. When asked on the specific after sale services they offer, maintenance and servicing dominated the list across the three. One organization additionally offered training of customers on the use of the products while another, delivery and installation of the products for the customers. This study considered after sale services are part of stove characteristic which would make modern cookstove more or less desirable to customers such as secondary schools. In the conclusion of Shrimali *et al*, (2011), availability of after sale services significantly influenced their desirability and that would influence their adoption.

Complaints

Three of the respondents received complaints while one did not receive any complaints from the customers. Two the organization which received complaints noted that usage was the main issues. In other words, the products were not all user friendly. The other received complaints on the capacity of the product noting that the customers wished for bigger version of the product. When asked the responses to the complaints, the organizations which received complaints on usage sent their expert to analyze the issues and respond accordingly by either addressing the issues or, retraining the customers. The other organization which received complaints on the capacity of the products respondent by giving quotation for bigger size of the products as the solution. Bigger cookstoves would meet the demand of such organization. Troncoso, and da Silva, (2017), noted that although modern cookstoves are desirable, institutions who prepare great quantities of food such as secondary schools would not find most of the cookstoves feasible. They therefore considerably incline their demand of larger

cookstoves which mainly use woodfuel as the primary source of their cooking and heating energy.

Cost of Manufacturing

The respondents were asked about the cost implication of producing cookstove technology targeting institutions like secondary schools. They noted that the costs varied with the capacity of the cookstove they produced as reported in Table 4.23.

Table 4.19: Costs of Manufacturing Cookstoves Of Different Capacities

	Manufacturing Costs (KSH)			
Capacity (Liters)	Manufacturer I	Manufacturer II	Manufacturer III	Manufacturer IV
50	75,000	85,000	65,000	70,000
100	105,000	110,000	-	-
150	120,000	-	-	-
200	130,000	150,000	-	-
240	145,000	-	-	-
300	170,000	-	-	-
400	230,000	-	-	-
500	270,000	-	-	-
600	350,000	-	-	-
1,000		-	-	350,000

The table above evidently shows that the price of the cookstove would directly be informed by the cost of manufacturing. Price, (2017) notes that the price at which a manufacturer would sell their cookstove is directly informed by the cost of production and thus the reasoning behind bigger cookstoves attracting higher costs.

Factors Considered to Produced Cookstove for Secondary Schools

The manufacturers were asked the factors they would consider, if they were to produce cook stoves for secondary schools. All the manufacturers except one indicated they would consider the population size of the school. The other one noted that they would consider flexibility to instalment payment. Notably, two of the manufacturers who consider population size of the secondary schools and the other which considered flexibility to instalment payment have received request from secondary school for supply of cookstove. The other one has not

received any requests from secondary school for supply of cookstove. This finding aligns with the arguments of Puzzolo et al., (2013), who noted that consumers are sensitive to the size of the stove because they consider the quantity of food they would be cooking.

Partnership

As to whether the manufacturers partnered with any organizations in their enterprises, the organization except one indicated they did not partner with any organization. However one organization noted that it was open to such partnership. The one which indicated they partnered with other organization identified that they partnered with microfinance institution although the interest of the institution was not clear. A further inquiry on the achievement of the partnership did not yield any results.

Government Intervention

The manufactures were interrogated on the intervention of the government (Jubilee) and their development partners had done enough to promote adoption of modern cooking technologies by secondary schools. Two of the manufacturers affirmed that the government had not done enough while one indicated the government had tried. However, noted that the Jubilee government has not done enough but acknowledge that the coalition government under the presidency of the late Mwai Kibaki did so much. The verbatim quote below emphasizes the sentiments of the manufacturer.

> "*The current Government – No*
>
> *The former government of Mwai Kibaki did so much. Through the ministry of Energy, the government would tender for the supply of energy saving cookstoves in Public schools"*

These sentiments could point to a limited political good will on the adoption of modern cooking technologies particularly by government owned institutions. According to Eshetu, (2014; Jan, 2012), government support in form of subsidies, tax reliefs, or sponsorship can encourage government owned institution of learning such as secondary school to adopt modern cooking technologies which would then translate to overuse of forests as source of firewood. This

would in turn accelerate the government commitment to achieve the forest cover of 10% as envisioned in the Kenyan constitution.

Finally the manufacturers were asked on what they would recommend for adoption of modern cooking technologies by Kenyan secondary school. They had various opinions as captured in the quoted responses below.

> *"The government should consider the allocation of funds to institutions and private homes to promote the adoption of modern energy and environmentally friendly cooking solutions. This will ensure that health issues brough about by things like indoor air pollution are adequately addressed.*
> *The CDF allocation for Environment (3%), should also be monitored for adequate use and diversification. Instead of focusing on getting dustbins for schools only and planting trees, it should also be used to provide measures to reducing the cutting down of trees for firewood by providing energy saving jikos. Schools utilize so much firewood for fuel, this encourages logging and deforestation. Using these funds, let us find a way to minimize the cutting down of trees even as we plant them"* (Manufacturer I)

> *"Artisans should be helped in terms of improving skills and innovation, the cost of raw materials should be reduced; Production machines should be made locally available so as to enhance the production of cookstoves"*(Manufacturer II)

> *"The government needs to chip in 65%, so that the burden is reduced. NGO's should also be approached so that they come in and assist in the cookstove manufacturing sector. There should be workshops and induction events in the sector. Producers and suppliers in the cooking technologies sector should be brought together in order to create a support base"* (Manufacturer III).

> *"The government should add the capitation amount sent to schools so that more schools can afford to purchase the cooking technologies and therefore enhancing adoption."* (Manufacturer IV)

In summary, the manufacturers noted that school is some of their primary market niches. In other words, schools are part of their primary target market. Additionally, the manufacturers identified costs, government support, school population size and after sale services as a few of the primary factors which influenced the adoption of cleaners and greener cooking energies and technologies. The manufacturers however did not identify environmental factors as significant factors which would influence the adoption of the MCTs.

CHAPTER FIVE:
SUMMARY, CONCLUSION AND RECOMMENDATION

5.1. Introduction

This section presents the summary of the study findings and implication. It also presents the conclusion and recommendations as a function of the conclusion of the study.

5.2. Summary of the findings

5.2.1. Socio-economic factors and adoption of modern cooking technologies

The study established that that 7.7% of the participants had doctorate degrees, 32.7% had Master's Degree while the majority was Bachelor Degree holders. Notably, a few (5.8%) were Diploma holders. Additionally, the research found that majority of the participants (42.3%) have served in their workstations for between 6-9 years, 34.6% have headed their schools for more than 10 years while 21.2% and 1.9% have served for between 2 and 5 years and less than 1 year respectively. The mean student population was about 866±455 with an average annual income of KES. 2,368,422±1,624,987.

Additionally when adoption of MCT was regressed against socioeconomic factors, the study established that Socioeconomic factors, significantly predicted Adoption of MCT, F (3, 211) =101.506, p=0.001.The "coefficient of determination" R^2 value was 0.669. This insicates that 66.9% of the variance in adoption of MCT can be "accounted for by the independent variables" (Social-economic factors, Stove characteristics, Environment related factors) For every unit increase in socioeconomic factors, adoption of MCT could increase by 0.175 units (17.5%). These results thus disqualifies the hypotheses of the study which argued that socio economic factors, had no "significant influence on adoption" of MCT by government owned secondary school in Nairobi County. Qualitative data from the manufacturers further showed that socio-economic factors such as costs of the ICSs, the capacity of the ICSs significantly influenced their adoption particularly by secondary schools in Nairobi County.

5.2.2. Stove related factors and adoption of modern cooking technologies

Stove characteristics had the highest positive and statistically significant correlation of r=0.903, (p< 0.001) afterwards, Environment related factors which had a correlation of r=0.638 (p< 0.015) then Socioeconomic which had a correlation of r =0.614 (p < 0.001). Additionally when adoption of MCT was regressed against, stove related factors, the study established that Stove related factors significantly predicted Adoption of MCT, F (3, 211) =101.506, p=0.001. The "coefficient of determination" R^2 value was 0.669. This insicates that 66.9% of the variance in adoption of MCT can be "accounted for by the independent variables" (Social-economic factors, Stove characteristics, Environment related factors) For every unit increase in stove characteristics, adoption of MCT would increase by 0.267 units (26.7%). These results thus disqualifies the hypotheses of the study which argued that stove characteristics had no "significant influence on adoption" of MCT by government owned secondary school in Nairobi County. Additionally, cookstove related factors such as after sale services has an influence on their adoption by potential customers.

5.2.3. Environmental Factors and adoption of modern cooking technologies

Almost half (48.1%) of the schools sampled fully relied on firewood, 19.2% of them used charcoal to complement firewood, 17.3% used LPG besides firewood, 9.6% used charcoal and LPG alongside firewood, while 5.8% supplemented firewood with briquettes.

Additionally when adoption of MCT was regressed against environment related factors, the study established that Environment related factors significantly predicted Adoption of MCT, F (3, 211) =101.506, p=0.001.The "coefficient of determination" R^2 value was 0.669. This insicates that 66.9% of the variance in adoption of MCT can be "accounted for by the independent variables" (Social-economic factors, Stove characteristics, Environment related factors) for a unit increased in Environment related factors, Adoption of MCT, would increase by 0.227 units (22.7%). These results thus disqualifies the hypotheses of the study which argued that environment related factors had no "significant influence on adoption" of MCT by government owned secondary school in Nairobi County.

5.3. Conclusions

Going by the findings of this research, this research concludes that most of the public secondary schools in Nairobi County rely on fuelwood as their main source of energy for cooking. While slightly less than half of the schools surveyed entirely relied on the firewood cooking technologies, the others equally used fire wood in large scale with a few using other source of energy such as charcoal, LPG and briquettes. These fuels were used but on very marginal scale, as some of the respondents indicated using them for preparing meals for teachers, which account for less than 5% of the cooking needs of the schools. This implied that there was minimal adoption of MCT.

5.3.1. Socio-economic factors which Influenced Adoption of MCT

The Analysis of data revealed that socio-economic factors (school population, cost of the MCTs, school management's decision among others) significantly influenced the adoption of MCTs by the schools. The MCT manufactures also noted that they would consider the school population if they received a request from a school for a cookstove. This implies that secondary schools gave weight to the population they take care of before they adopted any cookstove. This implies that they primarily considered whether the cookstove will be able to sustain the large scale cooking characteristics of most schools.

5.3.2. Stove related Factors

Stove related characteristics (size, design, being delicate, being technical to operate) highly influence the adoption of the MCTs in the schools surveyed. Characteristics such as being delicate and technical operate requires prompt after sale services such as orientation and training on the use of the MCT to make them effective and reliable. It therefore implied that there is need to customize the sizes and designs of the MCTs to meet the expectation of the school. This was further underscored by the observation of the cookstove manufacturers.

5.3.3. Environment Related Factors

Additionally, the research concludes that environment related characteristics such as comprehensive awareness of the MCTs (the merits and demerits), availability and accessibility of applicable fuels and predominant institutional culture of using firewood significantly

influenced adoption of the MCTs among the schools. The study based on the outcomes of data analysis also concluded that there has not been a systematic and structured awareness creation strategies targeting large scale cooking institution such as secondary schools and therefore, there is significant knowledge gap on the potentials of MCTs among the most of the schools' managements. Majority of the participants who were aware about some modern cooking technologies being able to sustain cooking demands of the schools got the awareness through mainstream media and other social interaction and formal education. This implies that if a schools management is not exposed to such media, they may not access knowledge about MCT. Only 9.2% got the awareness through training workshops. None of them got awareness through policy communication. This study finally concluded that there is a gap in communication of global campaigns aimed at advocating for adoption of MCTs as evidenced by 49.1% of the participants noting that they were not aware about such campaigns.

5.4. Recommendations

As informed by the conclusion of this research, the researcher recommends as follows.

1. That stove manufacturers should consider doing market research among the secondary schools in Kenya to establish their expectation with regards to which modern cooking technologies should be like to them so that they can customize the design of the stoves in terms of size, fuel applicable and durability.
2. Systematic and structured awareness creation about modern cooking technologies should be formulated just to target the secondary schools and implemented across the County and country. Such awareness should focus on comprehensively appraising the consumer stakeholder on the potential of the modern cook stoves in terms of efficiency, effectiveness, environmental friendliness, cost-effectiveness, and health wise.
3. Policies should be formulated, customized, implemented for the adoption of modern cooking technologies in secondary schools such that government has a defined role and mandate of enforcing the adoption policy in all secondary schools in Nairobi County and the rest of the country
4. The modern clean and green cooking technologies and the applicable fuels should be made available and accessible and affordable to all the secondary schools covered under the policy recommendation above.

REFERENCES

Adam, F. W., Brew-Hammond, A., & Essandoh, E. O. (2013). Relationships between energy use and income levels, for households in Ghana. *European Scientific Journal, ESJ*, *9*(16).

Adane, M. M., Alene, G. D., Mereta, S. T., & Wanyonyi, K. L. (2020). Facilitators and barriers to improved cookstove adoption: a community-based cross-sectional study in Northwest Ethiopia. *Environmental Health and Preventive Medicine*, *25*(1), 1-12.

Ahlborg, H., & Hammar, L. (2014). Drivers and barriers to rural electrification in Tanzania and Mozambique–Grid-extension, off-grid, and renewable energy technologies. *Renewable Energy*, *61*, 117-124.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control: From cognition to behavior*. Berlin, Heidelber, New York: Springer-Verlag. (pp. 11-39).

Ajzen, I. (2011). The theory of planned behaviour: Reactions and reflections. *Psychology & health*, *26*(9), 1113-1127.

Bielecki, C., & Wingenbach, G. (2014). Rethinking improved cookstove diffusion programs: A case study of social perceptions and cooking choices in rural Guatemala. *Energy Policy*, *66*, 350-358.

Bonan, J., Pareglio, S., & Tavoni, M. (2017). Access to modern energy: a review of barriers, drivers and impacts. *Environment and Development Economics*, *22*(5), 491-516.

Chowdhury, M. S. H., Koike, M., Akther, S., & Miah, D. (2011). Biomass fuel use, burning technique and reasons for the denial of improved cooking stoves by Forest User Groups of Rema-Kalenga Wildlife Sanctuary, Bangladesh. *International Journal of Sustainable Development & World Ecology*, *18*(1), 88-97.

Cordes, L. (2011). Igniting change: a strategy for universal adoption of clean cookstoves and fuels. *Global Alliance for Clean Cookstoves (GACC)*.

Correa, D. F., Beyer, H. L., Fargione, J. E., Hill, J. D., Possingham, H. P., Thomas-Hall, S. R., & Schenk, P. M. (2019). Towards the implementation of sustainable biofuel production systems. *Renewable and Sustainable Energy Reviews*, *107*, 250-263.

Creswell, J. W., Plano Clark, V. L., Gutmann, M. L., & Hanson, W. E. (2003). Advanced mixed methods research designs. *Handbook of mixed methods in social and behavioral research*, *209*, 240.

Dearing, J. W. (2009). Applying diffusion of innovation theory to intervention development. *Research on social work practice*, *19*(5), 503-518.

Debbi, S., Elisa, P., Nigel, B., Dan, P., & Eva, R. (2014). Factors influencing household uptake of improved solid fuel stoves in low-and middle-income countries: A qualitative systematic review. *International journal of environmental research and public health*, *11*(8), 8228-8250.

Dipanjan K., Sonmoina B. Rajita D. and Pran J.S. (2021). Smoking Preservation of Fish. Aquafind. Available at. http://aquafind.com/articles/Smoking_Fish.php#:~:text=The%20traditional%20method%20involves%20the,over%20slowly%20smouldering%20wood%20shavings.&text=The%20flow%20of%20smoke%20in,best%20ways%20to%20preserve%20fish.

Du Toit, J. L., & Mouton, J. (2013). A typology of designs for social research in the built environment. *International Journal of Social Research Methodology*, *16*(2), 125-139.

Edelstein, M., Pitchforth, E., Asres, G., Silverman, M., & Kulkarni, N. (2008). Awareness of health effects of cooking smoke among women in the Gondar Region of Ethiopia: a pilot survey. *BMC international health and human rights*, *8*(1), 1-7.

Eshetu, A. A. (2014). Factors affecting the adoption of fuel-efficient stoves among rural households in Borena Woreda: North central Ethiopia. *International Journal of Energy Science*, *4*(5), 141.

Fincham, J. E. (2008). Response rates and responsiveness for surveys, standards, and the Journal. *American journal of pharmaceutical education*, *72*(2).

Gebreegziabher, Z., Mekonnen, A., Kassie, M., & Köhlin, G. (2012). Urban energy transition and technology adoption: The case of Tigrai, northern Ethiopia. *Energy Economics*, *34*(2), 410-418.

Gifford, M.L. (2011). *A Global Review of the Cookstove Programmes*. Master Thesis. Energy and Resources Group UC Berkeley, California. Available from http://www.eecs.berkeley.edu/

Githiomi, J. K., Kung'u, J. B., & Mugendi, D. N. (2012). Analysis of woodfuel supply and demand balance in Kiambu, Thika and Maragwa districts in central Kenya. *Journal of Horticulture and Forestry*, *4*(6), 103-110.

Gitonga James (2017), Kenya Country Profile. Ministry of Energy and Petroleum, State Department of Energy.

Goodwin, N. J., O'Farrell, S. E., Jagoe, K., Rouse, J., Roma, E., Biran, A., & Finkelstein, E. A. (2015). Use of behavior change techniques in clean cooking interventions: a review of the evidence and scorecard of effectiveness. *Journal of health communication*, *20*(sup1), 43-54.

Government of Kenya (2013) *National Climate Change Action Plan*.

Guta, D. D. (2012). Assessment of biomass fuel resource potential and utilization in Ethiopia: sourcing strategies for renewable energies. *International Journal of Renewable Energy Research (IJRER)*, *2*(1), 131-139.

Hollada, J., Williams, K. N., Miele, C. H., Danz, D., Harvey, S. A., & Checkley, W. (2017). Perceptions of improved biomass and liquefied petroleum gas stoves in Puno, Peru: implications for promoting sustained and exclusive adoption of clean cooking technologies. *International Journal of Environmental Research and Public Health*, *14*(2), 182.

Jan, I. (2012). What makes people adopt improved cookstoves? Empirical evidence from rural northwest Pakistan. *Renewable and sustainable energy reviews*, *16*(5), 3200-3205.

Jan, I., Ullah, S., Akram, W., Khan, N. P., Asim, S. M., Mahmood, Z., Ahmad, M. N., & Ahmad, S. S. (2017). Adoption of improved cookstoves in Pakistan: A logit analysis. *Biomass and Bioenergy*, *103*, 55-62.

Jurečková, J., & Picek, J. (2007). Shapiro–Wilk-type test of normality under nuisance regression and scale. *Computational Statistics & Data Analysis*, *51*(10), 5184-5191.

Kaminski, J. (2011). Diffusion of innovation theory. *Canadian Journal of Nursing Informatics*, *6*(2), 1-6.

Kapfudzaruwa, F., Fay, J., & Hart, T. (2017). Improved cookstoves in Africa: Explaining adoption patterns. *Development Southern Africa*, *34*(5), 548-563.

Karanja, A., & Gasparatos, A. (2020). Adoption of improved biomass stoves in Kenya: a transect-based approach in Kiambu and Muranga counties. *Environmental Research Letters*, *15*(2), 024020.

Karimu, A. (2015). Cooking fuel preferences among Ghanaian Households: an empirical analysis. *Energy for Sustainable Development*, *27*, 10-17.

Kenya National Bureau of Statistics (KNBS). (2013a). Statistical abstract 2012. Government printers, Nairobi, Kenya.

Kisilu, Kombo D., and Delno, L.A Tromp, (2006) Proposal and thesis writing: An introduction. *Paulines Publications*, Africa pp. 49 – 55.

Kituyi, E., Marufu, L., Huber, B., Wandiga, S. O., Jumba, I. O., Andreae, M. O., & Helas, G. (2001). Biofuel consumption rates and patterns in Kenya. *Biomass and Bioenergy*, *20*(2), 83-99.

Kituyi. E and Kirubi. C. (2003). Influence of diet patterns on fuelwood consumption in Kenyan boarding schools and implication for data and energy policies. Journal of Energy Conservation and Management, 44,1099-1109.

Kituyi. E., Marufu. L., Huber. B., Wandiga. S., Jumba. I., Andreae. M and Helas. G. (2001). Biofuel consumption rates and patterns in Kenya. *Journal of Biomass and Bioenergy* 20(2), 83-99.

Kojima M. (2013). The Role of Liquefied Petroleum Gas in Reducing Energy Poverty. World Bank.

Koller, I., Levenson, M. R., & Glück, J. (2017). What do you think you are measuring? A mixed-methods procedure for assessing the content validity of test items and theory-based scaling. *Frontiers in psychology*, *8*, 126.

Kothari, C. R. (2004) Research Methodology, Methods and Techniques,WishwaPrakshan, New Delhi

Krejcie, R.V., & Morgan, D.W., (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement.*

Kumar, P., Dhand, A., Tabak, R. G., Brownson, R. C., & Yadama, G. N. (2017). Adoption and sustained use of cleaner cooking fuels in rural India: a case control study protocol to understand household, network, and organizational drivers. *Archives of Public Health*, *75*(1), 70.

Kumekpor, J. (2002). *Business Research: A Practical Guide for Undergraduate and Postgraduate Students*. London, Macmillan.

Malla, S., & Timilsina, G. R. (2014). *Household cooking fuel choice and adoption of improved cookstoves in developing countries: a review*. The World Bank.

Massawe, F. A., & Bengesi, K. M. K. (2017). Household social economic status and adoption of improved cook Stoves: the case of Kilimanjaro region Tanzania.

McGee, H. (2004). Wood smoke and charred wood. *On food and cooking*, 448-450.

Media Team (May 18, 2023). Fees Structure Guidelines for Secondary schools 2023. News Hub. Accessed Feb. 2023 from https://educationnewshub.co.ke/fees-structure-guidelines-for-secondary-schools-2023/

Midi, H., Sarkar, S. K., & Rana, S. (2010). Collinearity diagnostics of binary logistic regression model. *Journal of Interdisciplinary Mathematics*, *13*(3), 253-267.

Miller, G., & Mobarak, A. M. (2011). Intra-household externalities and low demand for a new technology: Experimental evidence on improved cookstoves. *Unpublished manuscript*.

Ministry of Energy (MoE). (2002). Study on Kenya's Energy Demand, Supply and Policy Strategy for Households, Small scale Industries and Service Establishments. Kamfor Consultants, Nairobi, Kenya

Ministry of Environment and Forestry - Kenya (2020), Kenya's updated Nationally Determined Contribution (NDC). Available at https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Kenya%20First/Kenya%27s%20First%20%20NDC%20(updated%20version).pdf

Momanyi, R. K., & Benards, A. H. O. A. O. (2016). Social-Economic Factors Influencing Biogas Technology Adoption among Households in Kilifi County-Kenya. *environments*, *6*(6).

Mugenda AG, Mugenda OM (1999). Research Methods: Quantitative and Qualitative approaches. Publishers Acts Press, Nairobi

Mugenda, O M &Mugenda, A G (2003) Research Methods: Qualitative & Quantitative Approaches ACTS Nairobi, Kenya

Mugo, F and Gathui, T (2010) Biomass Energy Use in Kenya. A background paper prepared for the International Institute for Environment and Development (IIED) for an international ESPA workshop on biomass energy, 19-21 October 2010. Parliament House Hotel, Edinburg. Practical action, Nairobi, Kenya.

Mugo, F., & Gathui, T. (2010). *Biomass energy use in Kenya*. A background paper prepared for the International Institute for Environment and Development (IIED) for an international ESPA workshop on biomass energy, 19-21 October 2010, Parliament House Hotel, Edinburgh. Practical Action, Nairobi, Kenya.

Nasir, Z. A., Murtaza, F., & Colbeck, I. (2015). Role of poverty in fuel choice and exposure to indoor air pollution in Pakistan. *Journal of Integrative Environmental Sciences*, *12*(2), 107-117.

Ndiritu, A. W. (2012). *Effects of principals' transformational leadership characteristics on students' academic performance in secondary schools in Nairobi County, Kenya* (Doctoral dissertation, University of Nairobi, Kenya).

Ngeywo, E. C. (2009). *Investigating the impact of improved cookstoves in Kenyan schools on PM10, CO, CO2, CH4 and N2O levels* (Doctoral dissertation).

O'keefe, P., Raskin. P, and Bernow. S (Eds). (1984). Energy and development in Kenya: Opportunities and constraints. Consultants: The Beijer Institute and the Scandinavian Institute of African studies.

Okur, N., & Saricam, C. (2019). The impact of knowledge on consumer behaviour towards sustainable apparel consumption. In *Consumer behaviour and sustainable fashion consumption* (pp. 69-96). Springer, Singapore.

Orodho AJ, Kombo DK (2002). *Research Methods.* Nairobi. Kenyatta University, Institute of Open Learning.

Owen, M., van der Plas, R., & Sepp, S. (2013). Can there be energy policy in Sub-Saharan Africa without biomass?. *Energy for sustainable development*, *17*(2), 146-152.

Pachauri, S., Rao, N. D., & Cameron, C. (2018). Outlook for modern cooking energy access in Central America. *PloS one*, *13*(6), e0197974.

PACJA (2017), Public Opinion Survey on Kenya Clean Energy Access

Pandey, F., Viviano, G., Thakuri, S., Flury, B., Maskey, R.K., Khanal, S.N., & Giannino, F. (2010). Energy, forest and indoor air pollution models for Sagarmatha National Park and Buffer Zone, Nepal. Implementation of a participatory modeling framework. Mountain Research and Development, 30(2), 113-126

Price, R. (2017). "Clean" Cooking Energy in Uganda–technologies, impacts, and key barriers and enablers to market acceleration.

Puzzola E, Stanistreet D, Pope D, Bruce N, Rehfuess E (2013) Factors Influencing the Large-Scale Uptake by Households of Cleaner and More Efficient Household Energy Technologies. London, UK: University of London. pp. 294 p.

Puzzolo, E., Stanistreet, D., Pope, D., Bruce, N., & Rehfuess, E. (2013). Factors influencing the large-scale uptake by households of cleaner and more efficient household energy technologies. A Systematic Review London: Evidence for Policy and Practice Information and Coordinating Centre. University of London, 2013

Raykov, T., & Marcoulides, G. A. (2012). *A first course in structural equation modeling*. Routledge.

Razali, N. M., & Wah, Y. B. (2011). Power comparisons of shapiro-wilk, kolmogorov-smirnov, lilliefors and anderson-darling tests. *Journal of statistical modeling and analytics*, *2*(1), 21-33.

Renewable Energy Technology Assistant Programme (RETAP). (2007). Sustainable cooking energy solutions for schools in Kenya.

Renewable Energy Technology Assistant Programme (RETAP). (2010). Survey of the improved institutional cookstoves adoption by Kenyan schools. GEF Biomass Energy Project.

Ruiz-Mercado, I., Masera, O., Zamora, H., & Smith, K. R. (2011). Adoption and sustained use of improved cookstoves. *Energy policy*, *39*(12), 7557-7566.

Sesan, T. (2012). Navigating the limitations of energy poverty: Lessons from the promotion of improved cooking technologies in Kenya. *Energy Policy*, *47*, 202-210.

Shen, G., Lin, W., Chen, Y., Yue, D., Liu, Z., & Yang, C. (2015). Factors influencing the adoption and sustainable use of clean fuels and cookstoves in China-a Chinese literature review. *Renewable and Sustainable Energy Reviews*, *51*, 741-750.

Shrimali, G., Slaski, X., Thurber, M. C., & Zerriffi, H. (2011). Improved stoves in India: A study of sustainable business models. *Energy Policy*, *39*(12), 7543-7556.

Simon, 2006. Adoption of Rotational Woodlot Technology in Semi-arid areas of Tanzania, Morogoro. Tanzania: Sokoina University of Agriculture.

Tigabu, A. D. (2018). Analysing the diffusion and adoption of renewable energy technologies in Africa: The functions of innovation systems perspective. *African Journal of Science, Technology, Innovation and Development*, *10*(5), 615-624.

Treiber, M. U., Grimsby, L. K., & Aune, J. B. (2015). Reducing energy poverty through increasing choice of fuels and stoves in Kenya: Complementing the multiple fuel model. *Energy for Sustainable Development*, *27*, 54-62.

Troncoso, K., & da Silva, A. S. (2017). LPG fuel subsidies in Latin America and the use of solid fuels to cook. *Energy Policy*, *107*, 188-196.

Uhunamure, S. E., Nethengwe, N. S., & Tinarwo, D. (2019). Correlating the factors influencing household decisions on adoption and utilisation of biogas technology in South Africa. *Renewable and Sustainable Energy Reviews*, *107*, 264-273.

Urmee, T., & Gyamfi, S. (2014). A review of improved Cookstove technologies and programs. *Renewable and Sustainable Energy Reviews*, *33*, 625-635.

Van der Kroon, B., Brouwer, R., & Van Beukering, P. J. (2013). The energy ladder: Theoretical myth or empirical truth? Results from a meta-analysis. *Renewable and sustainable energy reviews*, *20*, 504-513.

Van der Kroon, B., Brouwer, R., & Van Beukering, P. J. (2013). The energy ladder: Theoretical myth or empirical truth? Results from a meta-analysis. *Renewable and Sustainable Energy Reviews*, *20*, 504-513.

Vigolo, V., Sallaku, R., & Testa, F. (2018). Drivers and barriers to clean cooking: A systematic literature review from a consumer behavior perspective. *Sustainability*, *10*(11), 4322.

Vigolo, V., Sallaku, R., & Testa, F. (2018). Drivers and Barriers to Clean Cooking: A Systematic Literature Review from a Consumer Behavior Perspective. *Sustainability*, *10*(11), 4322.

WHO, (2015). WHO Household energy database. ⟨http://bit.ly/HEdatabase⟩.

WHO, (2016) Burning Opportunity: Clean Household Energy for Health, Sustainable Development and Wellbeing of Women and Children. World Health Organization, Geneva

Wong, C. C., & Hiew, P. L. (2005, August). Correlations between factors affecting the diffusion of mobile entertainment in Malaysia. In *Proceedings of the 7th international conference on Electronic commerce* (pp. 615-621).

Yamamoto, S., Sie, A., & Sauerborn, R. (2009). Cooking fuels and the push for cleaner alternatives: a case study from Burkina Faso. *Global Health Action*, *2*(1), 2088.

APPENDICES

APPENDIX I: LETTER OF TRANSMITTAL

Esther Atieno Wereh
P.O. Box 25895-00100
Nairobi.
Kenya

To
Whom it May Concern

Dear Sir/Madam

RE: PERMISSION TO CONDUCT RESEARCH IN YOUR INSTITUTION

I am a student studying for Master of Arts Degree in Project Planning and Management (MAPPM) at the University of Nairobi. As examinable component of my course requirements, I need to undertake a research project on a topic of choice and submit a report at the end of the exercise. My project is studying ***"PERCIEVED FACTORS INFLUENCING ADOPTION OF MODERN COOKING TECHNOLOGIES IN PUBLIC SECONDARY SCHOOLS IN KENYA: A CASE OF NAIROBI COUNTY."*** To be able to come up with a conclusive outcome, I will need to administer questionnaires and conduct follow up interviews to various players and I believe your organization will provide vital information to this research.

I am subsequently kindly appealing for your permission to administer the questionnaires and interview the relevant officers in your organization with an aim of accessing some data for the study.

The data collected will be used stringently for the purpose of academics only and will be handled with supreme privacy.

Thank you.

Yours truly,

Esther Atieno Were

L50/5743/2017

Cell: +254721860756

Email: essywere@gmail.com

APPENDIX II: RESEARCH PERMIT

Republic of Kenya

MINISTRY OF EDUCATION

STATE DEPARTMENT OF EARLY LEARNING AND BASIC EDUCATION

Telegrams: "SCHOOLING", Nairobi
Telephone; Nairobi 020 2453699
Email: rcenairobi@gmail.com
cdenairobi@gmail.com

When replying please quote

REGIONAL DIRECTOR OF EDUCATION
NAIROBI REGION
NYAYO HOUSE
P.O. Box 74629 – 00200
NAIROBI

Ref: RDE/NRB/RESEARCH/1/65 Vol.1 **Date: 4th August, 2022**

Ms. Esther Wereh
University of Naiorbi

RE: RESEARCH AUTHORIZATION

We are in receipt of a letter from the National Commission for Science, Technology and Innovation regarding research authorization in Nairobi County on the topic: **"Perceived Factors Influencing Adoption of Modern Cooking Technologies in Public Secondary Schools in Kenya: A Case of Nairobi County."**

This office has no objection and authority is hereby granted for a period, ending **3rd August, 2023** as indicated in the request letter.

04 AUG 2022

REGIONAL DIRECTOR OF EDUCATION
MINISTRY OF EDUCATION
P.O. Box 74629, NAIROBI

ANTHONY MBASI
FOR: REGIONAL DIRECTOR OF EDUCATION
NAIROBI.

Copy to: Director General/CEO
National Commission for Science, Technology and Innovation
NAIROBI.

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **363410**

Date of Issue: **03/August/2022**

RESEARCH LICENSE

This is to Certify that Ms.. Esther Wereh of University of Nairobi, has been licensed to conduct research in Nairobi on the topic: PERCEIVED FACTORS INFLUENCING ADOPTION OF MODERN COOKING TECHNOLOGIES IN PUBLIC SECONDARY SCHOOLS IN KENYA: A CASE OF NAIROBI COUNTY for the period ending : 03/August/2023.

License No: **NACOSTI/P/22/19463**

363410

Applicant Identification Number

4/8/2022

COUNTY COMMISSIONER
NAIROBI COUNTY
P. O. Box 30124-00100, NBI
TEL: 341666

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

APPENDIX III: QUESTIONNAIRE

1. What is your Gender?

   Male [ ] Female [ ] Other [ ]

1. How old are you?

   18 -30 Years [ ] 31-45 Years [ ] 46- 55 Years [ ] 56- 65 [ ] Years

2. What is Your Level of Education?

   Primary [ ] Secondary [ ] Diploma [ ] Bachelor Degree [ ]

   Masters' Degree [ ] PhD [ ]

3. What is your occupation role in. the school?

   Principal [ ] Head Cook [ ]

4. What is the average student Population in your school? (Give a figure)

   _____

5. What is the average income for the school per year? (either support from government or school fees)

   Below 1 Million [ ] 1-2 Million [ ] 2.1- 4 Million [ ] 4.1- 6 Million [ ]
   Above 6 million. [ ]

6. For how long have you been working in this school?

   Less than 1 year [ ] 2-5 Years [ ] 5-9 Years [ ] more than 10 Years [ ]

7. Is your School Day or Boarding?

   Boarding [ ] Day [ ]

8. Does the school provide meals for the students (Ignore if school is boarding/if you are cook)

Yes [ ] No [ ]

9. If your answer in 9 is 'Yes' above, which of the Cooking Fuels do you use

Fire wood [ ] Charcoal [ ] LPG [ ] Other [ ] _____ specify

10. How do you agree/disagree that the factors listed in the table below inform the choice of the cooking technology (cookstove) you use. Use 1 = Strongly disagree, 2= Disagree, 3 = Not sure, 4 = Agree, 5 = Strongly Agree

Scale	1	2	3	4	5
The size of the school (population) has a direct influence on the choice of cookstove					
The cost of a cookstove influences the choice					
The availability of a cookstove influences the choice					
The Accessibility of a cookstove influences the choice					
The size and amount of food being cooked has an influence on the choice of cookstove					
The school management's decision has an influence of the cookstove used at the school					
The efficiency of a cookstove has an influence on its adoption					
The effectiveness of a cookstove has an influence on its adoption					
The reliability of a cookstove has an influence on the adoption					
The type of fuel used for cooking has an influence on the choice of cookstove					

11. If your answer in 10 is ‘Firewood’ or ‘Charcoal’, Are you aware of any side effects associated with them?

    Yes [ ] No [ ]

12. If your answer in above is Yes, indicate in the table below, your level of agreements with the statements as captured (1= Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree)

Statement	**1**	**2**	**3**	**4**	**5**
Use of firewood is expensive in the long run					
Use of firewood is slow					
Use of firewood produces a lot of smoke which is unhealthy					
Use of firewood increases cost of transportation					
Use of Firewood increases risk of fire/heat injury to the cooks or fire outbreaks					
Firewood fuel pollutes the environment					
Firewood use accelerates Deforestation					

13. Are you aware about the existence of any improved and modern cooking technology that can sustain the cooking demand in your school?

    Yes [ ] No [ ]

14. Is your school ready and willing to change to (adopt) modern cooking technologies?

    Yes [ ] No [ ]

15. Which Modern Cooking Technology are you aware of? (You can tick more than one)

    Improved Cookstoves [ ] LPG Gas Cookers [ ] Biogas Cookers [ ]

    Ethanol Cookers [ ] Savika Biojiko [ ] Electric Cookers [ ]

    Other [ ] specify _____

16. How did you get the awareness in 16 above?

Through Workshop Training [ ] Through Mainstream Media [ ]

Through Formal Education [ ] Through Social Interactions [ ]

Through Policy Communications [ ]

17. If your answer in 14 above is 'Yes', What are your reasons for not adopting this modern cooking technology? (Tick in the table below as many as applicable) Also indicate your agreement with the statements on a scale of 1-5 (1= Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

Reason	**1**	**2**	**3**	**4**	**5**
They are very expensive					
They are technical to operate					
They breakdown easily					
No servicing is easily available and accessible					
The applicable fuel is not affordable					
The applicable fuel is inaccessible					
They come in small sizes which cannot sustain the cooking demand					

18. Are you aware that there are local and global campaigns for adoption of Modern Cooking Technologies?

Yes [ ] No [ ]

19. If your answer above is 'Yes', how did you get the awareness?

Through the Media [ ] Formal Communication Some Agencies [ ]

Ministry of Education [ ] Through Publication [ ]

Other [ ] Specify

……

20. Suppose any of the technologies in 16 above would meet the cooking demand of the school, which one would you go for?

Improved Cookstove [ ] LPG Gas Cookers [ ] Biogas Cookers [ ]

Ethanol Cookers [ ] Savika Biojiko [ ] Electric Cookers [ ] Other [ ]

21. What informs you preference above? Explain

……
……
……
……

22. If you had a chance to change how campaigns for adoption of modern cooking technologies is being done, what would you do to encourage adoption by secondary schools?

Introduce Subsidies [ ]

Free Installation in secondary schools [ ]

Conduct Workshops for the principals and head cooks [ ]

APPENDIX IV: INTERVIEW GUIDE

The interview schedule is meant to establish the perceived factors that influence the acceptance and absorption Modern Cooking Technologies in Public Secondary Schools in Nairobi County

The interview guide is split into two parts. First part comprises general questions while section is divided into two parts. Part A focuses on manufacturers while part B focuses on government agencies like Ministry of Education Officers and Environmental Offices within the county

Section I:

1. Which organization do you represent?
2. What are your responsibilities in the organization?
3. For how long have you worked in the organization?

Section II: Part A: For Manufactures

1. Which Modern Cooking Technology do you deal in? (Improved Cookstove, LPG Gas Cookers, Biogas Cookers, Ethanol Cookers, Savika Biojiko, Electric Cookers (Specify)
2. What is the cost implication of producing the technology you deal in?
3. Do you have a quality assurance system for checking the efficiency, emission, durability, safety, ease of use?
4. Who is your target market?
5. How would you rate your stock flow?
6. Do offer any after sale services/incentives for your customers? Explain.
7. Do you receive complains from your customers about the stoves/burners you produce? If yes, what is the scope of the complains? How do you handle the complains if any?
8. Do you have institutions as part of your target market?
9. What is it like to produce a technology for the institution like Secondary School? What are the cost implications?
10. What would be the cost a fuel burner/stove for a secondary school?
11. Have you ever served institutions like secondary schools? If yes, what was the average cooking capacity of the burner and what was the cost?
12. Which factors would you consider if you were to produce such for secondary schools?

13. Have you ever received any request by any secondary school to produce a modern cooking technology?
14. Do you partner with any other organization in the enterprise? If Yes which organization?
15. What is/are the interest/s of the organization you partner with?
16. What would you say the partnership as achieved as far as adoption of modern cooking technology is concerned?
17. Do you think the government and its development partners have done enough to promote adoption of modern cooking technologies by secondary schools?
18. What do you recommend for the adoption of modern cooking technologies by secondary schools in Kenya?

Section II: Part B: Government Agencies (Education and Environment Officers)

1. Does your organization promote adoption of Modern Cooking Technologies?
2. How do you do the promotion?
3. Who are your targeted consumers of the promotion?
4. How would you rate the effectiveness of the promotion?
5. How do you evaluate the effectiveness of the promotion?
6. What are the challenges you face in your endeavors geared towards adoption of modern cooking technologies?
7. Which Modern cooking technologies do you recommend most?
8. What is/are the reason/s for the recommendation?
9. Do you have promotion programs targeting learning institutions?
10. Would you comment on the programs (9 above) with regards to progress, drawbacks etc
11. On a scale of 1-10, how would you rate the programs?
12. What do you think should be done but has not been done to achieve the countries forest cover target of at least 10%?
13. What are your recommendations about the same?

APPENDIX V: KREJCIE AND MORGAN TABLE, 1970

Table 3.1

Table for Determining Sample Size of a Known Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Note: N is Population Size; S is Sample Size *Source: Krejcie & Morgan, 1970*

APPENDIX VI: PUBLIC SECONDARY SCHOOLS IN NAIROBI COUNTY AND THEIR CLASSIFICATION

A. National Schools

1. Starehe Girls
2. Kenya High school
3. Nairobi School
4. Moi Forces Academy
5. Pangani Girls
6. Starehe Boys Centre
7. Lenana School

B. Extra County Schools

1. Aquinas High
2. Buruburu Girls' Sec
3. Dagoretti High School
4. Dr. Ribiero Parklands
5. Highridge Girls Secondary School
6. Highway Secondary
7. Hospital Hill
8. Huruma Girls' High
9. Jamhuri High School
10. Kangemi High School
11. Karen C
12. Langata Barracks
13. Moi Girls School Nairobi
14. Muhuru Muchiri Secondary
15. Nembu Girls
16. Ngara Girls
17. Ofafa Jericho High
18. Our Lady Of Mercy South B
19. Parklands Arya
20. Precious Blood Riruta
21. Pumwani Boys Sec
22. St. Anne's Girls' Secondary
23. St. George's Girls' Nbi
24. State House Girls High School
25. Uhuru Secondary
26. Upper Hill Boys High School

C. County Schools

1. County Girls
2. Kaamukunji Secondary
3. Lavington Girls Sec
4. Maina Wanjigi
5. Mutuini High School
6. Nairobi Milimani
7. Olm Shauri Moyo
8. Olympic High School
9. Pumwani Girls Secondary
10. Raila Education Centre
11. Ruthimitu Secondary School
12. St.Teresa's Girls School
13. Kamukunji Secondary
14. Nile Road Girls' Secondary
15. Ruai Boys Secondary
16. Ruai Girls Secondary School
17. Kasarani Tree Side Special School

D. Subcounty Schools

1. Baba Dogo Secondary
2. Beth Mugo H.S
3. C.G.H.U. Mixed Secondary
4. Clay City Secondary
5. Dagoretti Mixed Secondary School
6. Dandora Girl's Secondary
7. Dandora Secondary
8. Dr. Mwenje
9. Drumvalle Secondary
10. Eastleigh High
11. Embakasi Garrison
12. Farasi Lane Sec School
13. Highway Manyatta Mixed

14. Hon. John Njoroge
15. Huruma Mixed Secondary
16. Jehova Jire Secondary
17. Kabete Vet Lab Sec. School
18. Kahawa Garrison Secondary
19. Kamiti Secondary
20. Kariobangi North Girls
21. Kayole South Secondary
22. Kibera Secondary School
23. Kiwanja Secondary
24. Langata Boys
25. Loresho Secondary
26. Makongeni Secondary
27. Mathari Mixed Secondary School
28. Mbagathi Road Secondary School
29. Mihango
30. Mwiki Secondary
31. Ndururuno Seccondary
32. Nile Road Secondary
33. North Highridge
34. Our Lady of Fatima
35. Peter Kibukosya Secondary
36. Ruaraka High
37. Ruthimitu Mixed
38. Shadrack Kimalel Mixed Sc
39. St. Dominic's Seondary
40. St. George Athi
41. St. Patrick Secondary
42. St. Teresas Boys Sec.
43. Star Of Hope Secondary
44. The Komarock School
45. Ushirika Secondary
46. Utawala Secondary
47. Zawadi Mixed