

BINDURA UNIVERSITY OF SCIENCE EDUCATION

DEPARTMENT OF NATURAL RESOURCES MANAGEMENT

**AN ASSESSMENT INTO KNOWLEDGE, ATTITUDES AND PRACTICES IN THE
USE OF FUEL EFFICIENT STOVES (TSOTSO STOVES) IN MANHENGA
COMMUNAL AREA**



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RELEASE FORM

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DECLARATION

I, Ardelaide Violet Masarakufa declared that this piece of work is my own work and has not copied or lifted from any source without the acknowledgement of the source.

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Date:

DEDICATION

This project is dedicated to my lovely parents, Mr Witness Masarakufa and Mrs Netsai Masarakufa who offered unwavering support and sacrifices during my 4 year study towards my undergraduate degree.

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ABSTRACT

Background: Climate change has been an interest topic for many researchers during the past years and it has been discovered that it is being caused by natural factors and anthropogenic factors which include expansion of agricultural land due to increased population, urbanisation, deforestation to mention but just a few. Deforestation as one key drivers of climate change is primarily a concern in developing countries and in trying to curb it the use of fuel efficient cook stoves is being implemented. However in order for this fuel efficient cook stoves to be fully adopted it is important to look into knowledge, attitudes and practices on the use of them

Materials and methods: The study made use of questionnaires to collect data from 85 participants regarding their demographic characteristics, knowledge, attitudes and practices. Interviews were also used where clarification was needed. SPSS version 23 and Microsoft Excel were utilised for data analysis.

Data analysis: SPSS version 23 was employed for data analysis. Responses were categorised as very good for the average score above 70%, fairly good for the average of above 50% and poor for the scores below 50%.

Results: 23.3% of the respondents were male and 75.6% were female. The average scores for knowledge, attitudes and practices were 71.4%, 58.8% and 26. % respectively this indicated that people have knowledge on fuel efficient cook stoves and their attitudes towards the use of fuel efficient cook is fair. On practices the score was very poor and it indicated that most of the participants are not using stoves. This was mainly because tsotso stoves are not durable and they destroy pots. There were significant relations between knowledge, attitudes practices and socio-economic variables. There was a ($P=0.02$, $\chi^2 = 17.910$, $df = 8$) significant association between age and the perception that women benefit more from using FES. There was a ($p=0.00$, $\chi^2 = 96.114$, $df = 9$) significant association between education and the fact that climate change can act as a climate change mitigation measure.

Conclusion: Based on the results of the KAP survey it was discovered that there is a high level of knowledge about tsotso stoves among the respondents but there is low level of practicing the use of fuel these fuel efficient stoves. This suggests that there's a gap between awareness and behaviour when it comes to the adoption of tsotso stoves. The use of fuel efficient stoves (Tsotso Stoves) has a great potential to fight against deforestation, but in order to have a greater impact, wider dissemination must take place

Recommendations: There's need for further education and awareness-raising through training and awareness campaigns. The construction of tsotso stoves need to be improved by replacing materials which are being used with some durable materials so as increase their life span since it will encourage the adoption of tsotso stoves. The fuel efficient stove program should continue, and efforts should be made to spread the stove's use, to make this happen the responsible departments must be equipped with resources to initiate more programs of fuel efficient stoves. Further research is needed to better understand the reasons why people are not using tsotso stoves.

Key terms: Climate change, deforestation, fuel efficient cook stoves.

LIST OF ACRONYMS

W.H.O	World Health Organisation
U.N.F.C.C.C.	United Nations Framework Convention on Climate Change
R.E.D.D+	Reducing Emissions from Deforestation and forest Degradation
F.C	Forestry Commission
UN	United Nations
G.H.G	Green House Gases
F.E.S.	Fuel Efficient Stoves
K.A.P	Knowledge, Attitudes and Practices.

CHAPTER 1

1.0 BACKGROUND OF THE STUDY.

Climate change which is the long term shifts in temperatures and weather patterns (Helmuth, Russell et al. 2014), has become a widespread topic for the past years(Schuur, McGuire et al. 2015). The changing climate is manifested in rising temperatures, floods, droughts and other extreme events affecting natural and human ecosystems (Zou, Peng et al. 2023). The drivers of climate change include clearing of land for agricultural lands, emissions from industries, deforestation to mention but just a few (Alem 2021). Regardless those efforts deforestation is still evident in most parts of the world.

Forests cover almost a third of the earth's surface, and they provide a lot of environmental benefits including the hydrological cycle which is a major role, conservation of soil, reduce the negative effects of climate change and conservation of biodiversity. Forests resources can provide long term national economic benefits. For instance, at least 145 countries of the world are involved in wood production as of current (Petruccelli and Anon 1994). Sufficient evidence is available that the whole world is facing an environmental crisis on account of deforestation (Chakravarty, Ghosh et al. 2012). For years, destruction of forests has been going on without being controlled, however there has not been much comprehension on the dimension until recently.

Deforestation is the conversion of forest to an alternative permanent non-forested land use such as agriculture, grazing or infrastructure development (Bulte and Van Kooten 2000). One of the forms in which a forest can become permanently non-forested is due to fetching of fire wood. Deforestation is primarily a concern for the developing countries of the tropics as it is shrinking areas of the tropical forests (Chakravarty, Ghosh et al. 2012) causing loss of biodiversity and enhancing the greenhouse effect (Angelsen and Kaimowitz 1999). Forest degradation occurs when the ecosystem functions of the forest are degraded but where the area remains forested rather cleared.

Implementation of the Reducing Emissions from Deforestation (REDD) and the REDD+ projects in many parts of the world has been regarded as one of the positive developments to occur in the 21st century (Masson-Delmotte, Zhai et al. 2018). However despite this effort, deforestation is still a challenge in many parts of the world particularly in developing regions

like Zimbabwe (Pendrill, Persson et al. 2019). Deforestation is regarded as the second largest source of anthropogenic greenhouse gas GHG emissions ((Smith, Bustamante et al. 2014)) as well as major driver of biodiversity loss (Tilman, Clark et al. 2017). Hence deforestation needs a close check.

Previous research indicates that Zimbabwe is experiencing an increased deforestation rate (Worrell 1996); (Kwaramba 2011). This is leading to accelerated soil erosion, frequent droughts due to absence of localized evapotranspiration, migration of animals as their habitats are destructed, drying up of wells and rivers due to decreased infiltration and sinking of water table to mention but just a few.

In addition to deforestation in Zimbabwe, deforestation is rampant in most rural areas as firewood is the major source of energy (NYIRENDA Austin 2020). This applies in Manhenga area since it is losing its forests annually because deforestation which is being caused by the rising demand for fuel wood. The demand of fuel wood in Manhenga is very high since they do not have other alternative sources of energy like rural electrification and access to LP Gas which can be used as source of energy for cooking. This is due to poverty hence forests become the cheaper alternative source of fuel wood.

Almost 80% of the population in the sub- Saharan Africa relies on traditional biomass for cooking, which is typically associated with negative environmental, health, economic and social impacts ((Matavel, Hoffmann et al. 2022). Thus, many stakeholders, including development agencies and national agencies in the global south are promoting the use of improved cook stoves. Fuel efficient stoves save cooking time, save financial assets, maximise fuel efficiency and reduce air pollution. Cook stoves are a sustainable means for saving cooking time and fuel (Maitre, Key et al. 2017).

Household energy programmes mainly in the form of fuel efficient cook stoves projects have been implemented for several decades and woodland degradation are issues of great concern in Zimbabwe. However the adoption of fuel efficient cook stoves can be affected by cultural reasons, lack of full knowledge as well as negative attitudes towards the use of fuel efficient cook stoves. Therefore this study seeks to provide that information concerning Manhenga communal area.

1.2 JUSTIFICATION.

The study will extend the knowledge on the extent to which people know about fuel efficient stoves their attitudes towards the use of fuel efficient cook stoves as well as their practices. The information that will be generated can be used to identify challenges faced by people in using fuel efficient cook stoves which can help in redesigning fuel efficient cookstoves. The study is also going to generate information that can be used to target the appropriate groups in the community and it will also influence people's attitudes towards adopting fuel efficient cook stoves

1.3 PROBLEM STATEMENT.

Deforestation as one of the major drivers of climate change(Gatti, Basso et al. 2021) and it has become a problem in which different stakeholders are trying to fight by the use of fuel efficient cook stoves. Regardless those efforts deforestation is still evident in most parts of the world. Whereas it is recommended for people to adopt fuel efficient stoves this may be constrained by lack of knowledge and negative attitudes. Therefore in order to improve adoption of fuel efficient stoves there's need for KAP survey and those studies have not been carried away.

1.4 AIM.

To carry out an assessment into knowledge, attitudes and practices in the use of fuel efficient stoves in Manhenga Communal area.

1.5 OBJECTIVES.

1. To determine people's knowledge about fuel efficient cook stoves (Tsotso stoves).
2. To determine people's attitudes towards the use of fuel efficient cook stoves.
3. To determine people's practices on the use of fuel efficient cook stoves.
4. To relate knowledge, attitudes and practices to socio-economic variables.

1.6 RESEARCH QUESTIONS

1. To what extent do people have knowledge regarding the use of fuel efficient cook stoves?
2. What are people's attitudes towards the use of fuel efficient cook stoves?
3. To what extent are people using fuel efficient cook stoves when cooking?

4. Is there a relationship between knowledge, attitudes, practices and socio-economic variables?

1.7 KEY ASSUMPTIONS OF THE STUDY.

Some cases of deforestation are committed due to lack of knowledge of Fuel efficient cook stoves.

People have positive and negative attitudes towards the use of Fuel efficient cook stoves which can affect their adoption.

People are practising cooking with FES.

CHAPTER 2: LITERATURE REVIEW

2.1 BACKGROUND OF FUEL EFFICIENT STOVES (FES).

The origins of the Tsotso Stove lie in Zimbabwe, where it was developed by the Development Technology Centre (Karekezi and Ranja 1997). Tsotso Stove is a fuel efficient wood burning stove made from sheet metals. It was developed by David Hancock in Zimbabwe in the 80s (Makonese, Chikowore et al. 2011). about 30 000 were sold and it is so far the only commercially successful wood burning stove made in the region. Tsotso means twigs or small sticks. It is these sticks that will be used to cook a meal that feeds the family. These fuel-efficient cook stoves have replaced the open wood fires, traditionally used to cook in rural Zimbabwe. The Tsotso stove a specially designed clay pot used as cook stove has become a game changer for communities.

Tsotso stoves were also defined as type of biomass stove that is commonly used in developing countries particularly in sub Saharan Africa for cooking and heating purposes. They are designed to burn wood, charcoal, or other biomass fuels more efficiently than traditional open fire, which can help to reduce fuel consumption, improve indoor quality, and lower greenhouse gas emissions (Wei, Patadia et al. 2010).

Fuel efficient stoves can help households to save time particularly women. The stove saves time because it cooks faster than the traditional stoves (Kuhnhenh 2003), the stove saves time because its use results in a reduced amount of wood that needs to be collected and a number of households use the stove in the field. Before they had the stove, these families used to go home to cook, the time for going home and back to the field is thus saved. In some cases the Tsotso Stove led to an increase in the overall times per day that a meal is cooked.

2.2 DEFORESTATION

Tropical forests are being cleared, burned, logged, fragmented, and overhunted on scales that lack historical precedent (Laurance, Laurance et al. 1997). Implementation of Reducing Emissions from Deforestation and Forest Degradation (REDD) and the REDD+ projects in many parts of the world has been regarded as one of the positive developments to occur in the

21st century towards keeping the global warming below 1.5 and 2 degrees above pre industrial level (Masson-Delmotte, Zhai et al. 2018). However, despite this effort, deforestation is still a challenge in many parts of the world particularly in developing countries like Zimbabwe where fragmented smallholder agriculture production is increasing (Angelsen and Kaimowitz 1999) and also due to poverty people rely on forests for firewood especially in communal areas. Deforestation is regarded as the second largest anthropogenic (GHG) emissions (Smith, Bustamante et al. 2014), as well as the major driver of biodiversity loss (Tilman, Clark et al. 2017). Therefore, deforestation has become a concern and threat in many developing countries of the tropics. As such it is important to find alternatives to conventional fuel wood use by adopting fuel efficient cook stoves.

2.3 PEOPLES KNOWLEDGE ON THE USE OF FUEL EFFICIENT STOVES

STUDY PARTICIPANTS	KEY FINDINGS	REFERENCES
A review of improved cookstoves technologies and programs	Many of fuel efficient cook stove programs have been a failure due to lack of proper knowledge of the people who were targeted to use those stoves. People in Bangladesh prefer using open fires because they don't have knowledge about fuel efficient stoves indoor pollution causing health problems.	(Urmee and Gyamfi 2014)
Options for energy efficiency in India and barriers to their adoption	The limiting factor for adoption is information and the most important source of information is those who have already adopted the use of fuel efficient cook stoves hence therefore there's lack of knowledge amongst the people. Adoption itself generates information for people outside which do not know about fuel efficient stoves hence more	(Bhattacharya and Cropper 2010)

	programs for the adoption should be held.	
A social and environmental evaluation of fuel efficient cook stoves and conservation in Uganda	Matasiya shows that people have knowledge regarding the use of fuel efficient cook stoves as they indicated the benefits of cook stoves which included time saving, pollution reduction to mention but just a few	(Massei, Bacon et al. 1998)
An Analysis of Socio Economic Conditions of Homeless People's in Madurai City, Tamil Nadu.”	<p>1 Results showed that people's perceptions of fuel-efficient stoves are positive but that projects face many obstacles connected to socio-economic conditions.</p> <p>2 Knowledge on how to get stoves and access to financial capital is main obstacles for further spreading. Hence knowledge can affect the adoption of fuel efficient cook stoves</p>	(Massei, Bacon et al. 1998, Swamikannan and Periyamayan 2019)

According to a study published in the journal Energy Research & Social Science in 2020, knowledge and awareness of tsotso stoves among rural households in Zimbabwe is generally high. Hence tsotso stoves are popular in Zimbabwe as they are cost effective and efficient than traditional open fires and can reduce fuel combustion by up to 50% (Tuyishime, Memba et al. 2015). In addition tsotso stoves are easier to use and maintain than traditional stoves, which can help to encourage their adoption in communities (Ziuku, Seyitini et al. 2014). They are made from clay and are designed to burn small amounts of wood or other biomass fuel.

2.4 PEOPLES ATTITUDES TOWARDS THE USE OF FUEL EFFICIENT STOVES.

STUDY PARTICIPANTS	KEY FINDINGS	REFENCES

<p>Improved stoves in developing countries. Problems and opportunities</p>	<p>1 Fuel efficient cookstoves cannot meet the needs of users for example space heating and repelling of insects hence this makes people to have negative attitudes towards the use of fuel efficient stoves.</p>	<p>(Manibog 1984)</p>
<p>A study in Kenya. Factors influencing the adoption of energy-efficient cooking technologies in developing countries</p>	<p>1 Generally people have positive attitudes towards the use of tsotso stoves and perceive them to have several benefits.</p> <p>2 People perceived tsotso stoves to be more efficient, cleaner and safer than traditional stoves which indicate positive attitudes</p> <p>3 The study also find out that participants were willing to pay up to 28 US dollars for a tsotso stove which shows the willingness of people to use tsotso stoves which is a positive attitude</p>	<p>(Lim, Allen et al. 2016)</p>
<p>Fuel Use and Children's Health in Rural Ethiopia.</p>	<p>1 The adoption and use of tsotso stoves can be influenced by a range of social, cultural, and economic factors hence it is important to consider those factors in order for the adoption of fuel efficient stoves to be a success</p> <p>2 The study also found out that women are interested in learning more about fuel efficient stoves since they provide them with several benefits.</p>	<p>(Oyedun, Gebreegziabher et al. 2014)</p>

	<p>3 Men are not interested in learning more about fuel efficient stoves since they believe that only women benefit from their use it also applies in Zimbabwe this indicate a negative attitude and can affect adoption.</p>	
<p>Attitudes towards adoption of improved cookstoves in Zimbabwe: An analysis of household energy usage in urban and peri-urban areas, Journal of Energy in Southern Africa</p>	<p>1 A study which was conducted in Zimbabwe found out that people preferred the taste of food cooked on traditional stoves, which could be a barrier to the adoption of tsotso stoves.</p> <p>2 The study indicated that some people are not willing to change particularly old ages this is affecting the adoption of fuel efficient stoves to a larger extent</p>	(Mataba 2019)

Understanding people’s attitudes towards the use of FES is important for their adoption as well as their use. Therefore several studies have investigated the people’s attitudes towards the use of tsotso stoves. Generally people have positive attitudes tsotso stoves and perceive them to have numerous benefits. People perceived FES like tsotso stoves and jengetahuni stoves to be more efficient, cleaner and safer than traditional stoves (Lim, Allen et al. 2016) and they are also perceived to be more durable and easier to use than traditional stoves (Tulashie, Boadu et al. 2019).

2.5 PEOPLES PRACTICES ON THE USE OF FUEL EFFICIENT STOVES.

STUDY PARTICIPANTS	KEY FINDINGS	REFERENCES
<p>The potential and prospects of improved cookstoves</p>	<p>1Fuel efficient stoves are not being used because the majority of users are also fuel gathers hence fire wood is</p>	<p>(Makonese, Chikowore et al. 2011)</p>

(ICS) in Zimbabwe	<p>not a problem to them hence adoption is very low</p> <p>2 Many poor people in villages are not capable of maintaining the fuel efficient cook stoves for instance replacing the chimney hence few practice the use of fuel efficient stoves</p>	
Survey conducted by WHO in 2017	<p>1 65% of households in Zimbabwe use solid sources of fuel such as wood for cooking which are burned using open fires. This proves that a few are practicing the use of fuel efficient cook stoves.</p> <p>2 Despite the challenges that come with the use of fuel efficient stoves some people are using them in Africa hence the use of fuel efficient stoves is being practiced and different stakeholders for instance non-governmental organisations are funding these initiatives.</p>	(Coady, Parry et al. 2019)

According to a report by the Zimbabwe Energy Regulatory Authority, the adoption of tso tso stoves in Zimbabwe has been growing steadily in recent years, with an estimated 2.5 million households using clean cookstoves, including tso tso stoves, as of 2017 (Tagwireyi, Mduluza et al.). This suggests that a significant number of people in Zimbabwe are using tso tso stoves as a way to reduce deforestation, improve indoor air quality, save on fuel expenses and

improved health outcomes. Hence this shows that people in Zimbabwe are practising cooking with fuel efficient stoves.

CHAPTER 3

3.1 DESCRIPTION OF THE STUDY AREA.

Manhenga communal area (Fig 3.1) is situated in Bindura District which is in Mashonaland central and it is approximately 16 Km from Bindura town. The District is primarily covered by Miombo woodlands which are drought-resistant trees that dominate the region due to its dry climate and soil conditions (Mafongonya et al., 2006). This miombo woodland include trees like *Julbernardia globiflora*, *Brachystegia speciformis*, *Brachystegia boehemii* to mention but just a few and these type of trees takes time to grow. The average annual rain fall in Bindura district is around 850 mm, with the rainy season lasting from November to April ((Mukwada, Manatsa et al. 2021)Average temperatures range from 15°C to 30°C. Most parts of Bindura district is dominated by sandy, gravel, and rocky with high levels of aluminium and manganese (Dube, Fairweather et al. 2009). According to the Poverty Reduction Forum Trust (PRFT 2019) the population of the Manhenga communal area was estimated at 5 200 people in 2019. The majority of residents are subsistence farmers who practice rain-fed agriculture and engage in small scale livestock production. Overall, Bindura District is a significant contributor to Zimbabwe's agricultural and mining sectors, and offers a unique blend of natural resources, cultural heritage and business opportunities.

STUDY AREA MAP: MANHENGA COMMUNAL AREA

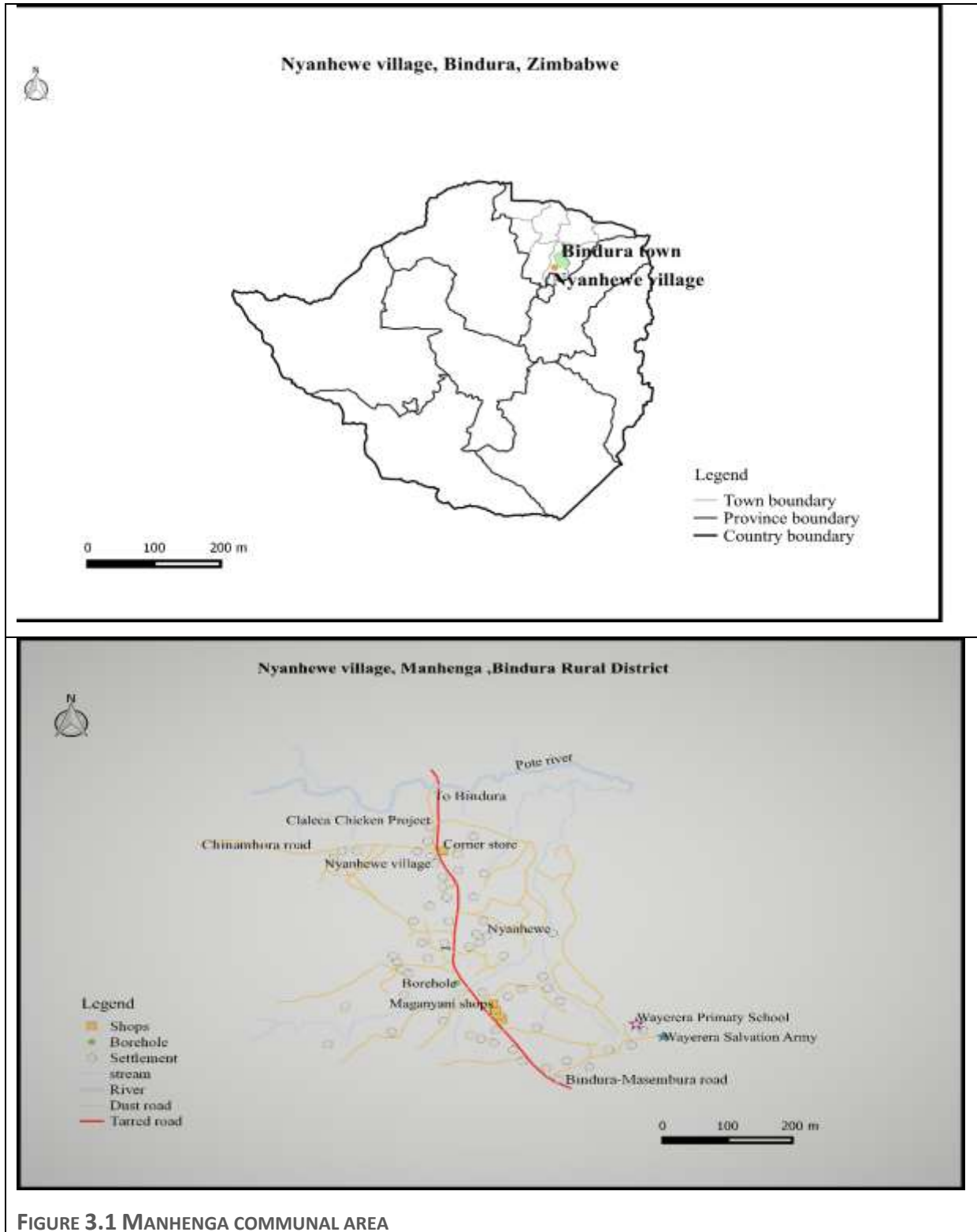


FIGURE 3.1 MANHENGA COMMUNAL AREA

3.3 RESEARCH DESIGN

A cross sectional survey design was adopted for the study. The key informants included the village head of Nyanhewe village in Manhenga communal areas and some of the households in the village, the targeted population was Nyanhewe village and it included the people who were using FES and those who were not using them. Semi structured questionnaires were used to identify age, gender to mention but just a few. Interviews were also used to ask questions face to face for further clarification on some issues. These data collection tools included KAP survey questionnaires to obtain peoples knowledge attitudes and practices regarding the use of fuel efficient cook stoves.

3.4 SAMPLING METHOD AND SAMPLE SIZE

The research employed multiple sample design to make sampling method more realistic because of the large population in Manhenga community. Population was divided into smaller groups and people were taken from the smallest of those groups which is known multistage sampling

Manhenga community was divided into strata according to the wards and the areas is divided into 13wards. Ward 10 was selected using convenient sampling. The ward consist of six villages namely Wayerera, Madzvanya, Chingwaru, Gunyere, Mhizha and Nyanhewe. The Nyanhewe village was chosen due to its proximity. The convenient sampling was employed to make it easier for the researcher to collect data ((Frischer, Landers et al. 2022)).

Lastly to choose 85 respondents, simple random sampling was used and households were selected solely by chance and this method was not subjected to bias. This was due to the fact that each person had the likelihood of being chosen.

3.5 DATA COLLECTION INSTRUMENTS

3.5.1 THE QUESTIONNAIRE

Questionnaires were used to collect data from ward 10 of Bindura District which was selected. The questionnaires were administered to people of Nyanhewe village in Manhenga communal area. Ninety questionnaires were administered to the people in the village using simple random sampling technique and out of ninety questionnaires eighty five returned. The questionnaire consisted 4 sections, section A with background information, section B with questions regarding people knowledge on FES, section C with questions regarding people's attitudes towards the use of FES and section D with peoples practices questions which helped

to meet the main objective as well as the specific objectives. The questionnaire was selected since it is accompanied by a lot of advantages.

3.5.2 INDIVIDUAL INTERVIEWS WITH KEY INFORMANTS.

Interviews were conducted to the village head of Nyanhewe and some of the households' members who were willing to answer the questions in order to gain in-depth understanding. The interviews from this participants was conducted face to face and it was based on simple random sampling as well so as to avoid bias.

3.5.3 ADVANTAGES OF THE INTERVIEW

1. The interviews was especially preferred were complex issues were involved.
2. There was an opportunity of giving a full detailed explanation of the purpose of the study to the respondents.
3. By using interviews the questions which were misinterpreted were rephrased for further clarification.

3.5.5 DISADVANTAGES OF INTERVIEWS

The interviews were sometimes hesitant to express their opinions freely.

3.6 ETHICAL CONSIDERATIONS

The study abided by the fundamental standards outlined in the declaration of Helsinki.

Permission was graded to the researcher to carry out a survey in Nyanhewe village of Manhenga with the help of the supervisor. More so the researcher was given permission to carry out a survey by the village head of Nyanhewe village. Privacy of respondents was a priority during the survey this was achieved by excluding names of respondents as well as their physical address. In addition no participants were excluded from the study because of socio-economic factors and those who were not willing to participate were not forced to do so.

3.7 DATA ANALYSIS.

The Statistical Data for the Social Sciences (SPSS) was used since it offers a reliable and fast answers and it also useful in both quantitative and qualitative data analysis. Score 1 was used for each selected answer and score 0 was used for each unselected answers. The scores were combined to obtain a total KAP score which was used to determine people knowledge, attitudes and practices on the use of fuel efficient stoves. The responses were categorised as

very good if the average score was above 70% and fairly good if it was above 50% and poor if the average score was below 50%. Tables were mainly used to present data as well as graphs.

CHAPTER 4: DATA PRESENTATION

4.1 PRESENTATION.

85 questionnaires were distributed to the respondents and 85 were returned this shows that the response rate was 100% and data were presented using pie charts, graphs and mostly the tables

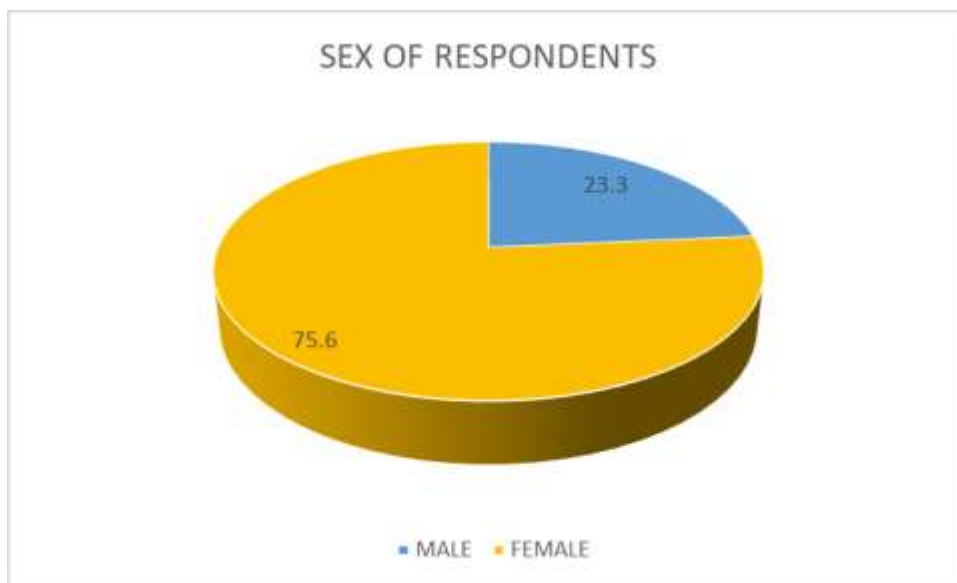


Figure 4.1 Sex of respondents

75.6 % of respondents were female and 23.3 % of respondents were male. This was because most of many are bread winners and they were at their work places during the survey but in some cases they were not willing to fill questionnaire because they believed that fuel efficient stoves program is meant for women.

TABLE 4.1 DEMOGRAPHIC CHARACTERISTICS

Demographic variable	Participant response	Frequency N= 85	%	Score
1. SEX	Male	20	23	0.233

	Female	65	75.	0.756
2. AGE	18-25	12	14	0.140
	26-33	27	31.4	0.312
	34-41	23	26.7	0.267
	42-49	8	9.3	0.93
	50+	15	17.6	0.176
3 MARITAL STATUS	Married	67	77.9	0.776
	Single	6	7	0.7
	Widowed	12	14	0.14
LEVEL OF EDUCATION	Primary	25	29.1	0.291
	Secondary	56	65.1	0.651
	Tertiary	4	4.7	0.47

Table 4.1 indicated that 23.3% were identified as male and the highest percentage was of women which was 75.6%. 14% of participants were in the age range of 18-25, 31.4% of participants were in the age range of 26-33, 26.7% of participants were in the age range of 34-41, 9.3% of participants were in the age range of 42-49, 17.6% of participants were age 50 and above. 77.9 % of participants were married people, 7% were sing and 14% were widowed. The table 4.1 is also indicating that most people had a secondary level of education followed by primary level of education and lastly was people who had tertiary level of education which was 4.7%

TABLE 4.2 PEOPLE'S KNOWLEDGE ON FUEL EFFICIENT STOVES.

Knowledge variable	Participant response	Frequency N= 85	Percentage	Score
K1. Have you heard about a tsotso stove	Yes	79	91.9	0.919
K2. Tsotso stove reduce fuel consumption	Agree	72	83.7	0.837
K3. Tsotso stoves produce less smoke and emit fewer pollutants	Agree	66	76.7	0.767
K4. Tsotso stoves are safe to use	Agree	61	70.9	0.709
K5. Tsotso stoves reduce deforestation	Agree	65	75.6	0.756
K6. Tsotso stoves can act as climate change mitigation measure	Agree	24	27.9	0.279
K7. Tsotso stove are made up of	Agree	54	62.8	0.628

clay, metals, river sand, cow dung				
K8. Metals on tsotso stoves are used to distribute heat more evenly and effectively than traditional stoves	Agree	64	74.4	0.744
K9 The use of tsotso stoves save time	Agree	68	79.1	0.791
Total score				6.43

Average Score = Total score (6.43)/Total possible (9) ×100% = 71.4%

The total knowledge of people regarding the use of fuel efficient stoves was 6.43 and it was divided by 9 participant responses to give 0.71444. To find the percentage knowledge average score the score was then multiplied by 100% to give 71.4% which is good.

The table 4.2 indicated that (91.9%) have heard about tsotso stoves. Most participants also agree that tsotso stoves reduce fuel consumption (83.7%), produce less smoke and emit fewer pollutants (76.7%), are safe to use (70.9%), and reduce deforestation (75.6%) which shows that most people have knowledge on the environmental benefits of using FES. However, fewer participants (27.9%) agree that FES can act as a climate change mitigation measure hence they have few knowledge regarding the fact that they can act as climate change mitigation measure. Additionally, while a majority of participants agree that the stoves are made up of clay, metals, river sand, and cow dung (62.8%), distribute heat more evenly and effectively than traditional stoves (74.4%), and save time (79.1%), the percentage agreement for these statements is slightly lower than for the statements about the environmental benefits of FES.

TABLE 4.3 PEOPLES ATTITUDES TOWARDS THE USE OF FUEL EFFICIENT STOVES (TSOTSO STOVE).

Attitude variable	Participant responses	Frequency N= 85	Percentage	Score
A1. Are you interested in learning more about tsotso stove	Yes	77	89.5	0.895
A2. Would you recommend others to use tsotso stoves	Yes	74	86	0.860
A3. Women benefit more from using tsotso stoves as compared to men	Yes	77	89.5	0.895
A4. Handling pots is easier with tsotso stoves	Yes	59	68.6	0.686

A5. Tsotso stoves are easier to use	Yes	64	74.4	0.744
A6. tsotso stoves are safer because they are protected from wind	Yes	44	51.2	0.512
A7. Tsotso stoves improve your health	Yes	38	44.2	0.442
A8. Tsotso stoves are easy to construct	Yes	21	24.4	0.244
A9. Are there any social / cultural norms that might make it difficult for you to adopt	No	79	91.9	0.919
A10. Are you willing to use tsotso stove	Yes	79	91.9	0.919
A11. Tsotso stoves destroy pots	No	20	23.3	0.233
A12. It is difficult to find wood size for tsotso stoves	No	58	67.4	0.674
A13. Tsotso stoves are difficult to use in open spaces during rains	No	14	16.3	0.163
A14. I am able to build a tsotso stove	Yes	29	33.7	0.337
A15. Most women cannot build a tsotso stove	No	17	29.1	0.291
Total Score				8.814

Average Score = Total score (8.814)/ Total possible score (15) ×100 = 58.8%

The table provides information on the attitudes of the respondents. The average score was 8,814 and was divided by 15 and multiplied by 100 to get the average score percentage of 58.8% which was fairly good.

Table 4.3 above indicted that 89.9% of people are interested in learning more about fuel efficient stoves and most of them would recommend others to use tsotso stoves which present good attitudes towards the use of tsotso stoves. 89.5 % of participants agreed that women benefit more from using tsotso stoves as compared to men. 68.6% agreed that handling pot is easier with tsotso stove, 74.4% of participants said that FE stoves are easier to use. 51.2% of participants FES are protected from wind. Few people agreed the stoves can improve their health, most participants indicated that FE stoves are difficult to construct this indicated that people have negative attitudes towards some issues. 91.9% of respondents said that there are no cultural or social norms which restrict them from using FES. The P Score was 58.8 % which was the average percentage agreement across all questions.

TABLE 4.4 PEOPLES PRACTICES IN THE USE OF FUEL EFFICIENT COOK STOVES

Practice variable	Participant responses	Frequency N= 85	Percentage	Score
P1. Have you used a tsotso stove before	Yes	45	52.3	0.523
P2. Are you currently using a tsotso stove	Yes	14	16.3	0.163
P3. Dou you cook outdoor with a tsotso stove	Yes	1	1.2	0.120
Total score				0.806

Average score = Total score (0.806)/ Total possible score (3) × 100 = 26. 9%

The average score was 26.9% which was very poor, this suggests that there is relatively low familiarity and adoption of tsotso stoves among the participants. While more than half of the participants (52.3%) have used a FES before, only a small minority (16.3%) are currently using one, and very few participants (1.2%) reported using a tsotso stove for outdoor cooking.

4.2 THE RELATIONS BETWEEN KNOWLEDGE, ATTITUDES, PRACTICES AND SOCIO-ECONOMIC VARIABLES.

There was a ($P=0.02$, $\chi^2=17.910$, $df = 8$) significant association between age and the perception that women benefit more from using FES. The 23-33 age group agreed more and the 42-49 age group least agreed. There was a ($p=0.01$, $\chi^2=12.852$, $df = 4$) significant association between age and the knowledge that FES reduce indoor pollution. In addition to the significant associations there was also a ($p=0.05$, $\chi^2= 9.321$, $df = 4$) significant relationship between age and the perception that fuel efficient stoves are easy to construct and the age group 26-33 agreed more and 18-25 agreed less.

There was a ($p=0.00$, $\chi^2=90.172$, $df = 9$) significant association between marital status the fact that fuel efficient stoves reduce fuel consumption with married participants more dominated and single being the least. ($p= 0.00$, $\chi^2 =88.420$, $df = 9$) with more married participants and the least was single participants which shows a significant.

There was a ($p=0.00$, $\chi^2= 96.114$, $df = 9$) significant association between education and the fact that climate change can act as a climate change mitigation measure with more people who had secondary level and the least who had primary level. There was also a ($p= 0.00$, $\chi^2=87.580$, $df 6$) significant relationship between level of education and the practice of using fuel efficient stoves.

CHAPTER 5: DISCUSSION

5.1 DEMOGRAPHIC CHARACTERISTICS.

The study showed that most participants were women 75.6% and there was a small number of male participants this was because most were at their work places whilst most women are house wives. This was also because men have the negative attitudes towards the use of fuel efficient stoves and they need to be educated that these stoves are not only meant for women because men are responsible for the collection of firewood. The largest age group among the participants was 26-33 years old, with 31.4% of participants falling within this age range. The age range of 18-25 years old was the second-largest group, with 14% of participants. The smallest age group was 42-49 years old, with only 9.3% of participants. This is because most people who occupied manhenga work in Bindura town for instance in mines which requires people who are still economically active. The majority of participants (65.1%) had a secondary level of education, while 29.1% had a primary level of education and only 4.7% had a tertiary level of education. This suggests that the survey was successful since most people understood about the study since most of them were able to read and write.

5.2 PEOPLES KNOWLEDGE REGARDING THE USE OF FUEL EFFICIENT COOK STOVES.

The average score of people's knowledge regarding the use of FES was 71.4% which was very good and it indicated that the majority of respondents know about FES.

The majority of participants (91.9%) have had heard about fuel efficient stoves. This suggests that there is high level of awareness and promotion of these FES in the district. A large percentage of participants (83.7%) agreed that FES reduce fuel consumption. Studies have also shown that the use of improved cookstoves, such as tsotso stoves, can significantly reduce fuel consumption and save households money on fuel expenses (Wei, Patadia et al.

2010). Many participants (75.6%) agreed that tsootso stoves reduce deforestation. This is consistent with the design and function of FES, which use less fuel and therefore reduce the demand for firewood. Studies have shown that the use of FES, such as tsootso stoves, can reduce deforestation and promote sustainable land use practice (Urmee and Gyamfi 2014). Few participants (27.9%) agreed with the fact that FES can act as a climate change mitigation measure. While tsootso stoves alone may not be enough to mitigate climate change, they can contribute to reducing greenhouse gas emissions by reducing the demand for firewood since trees can act as carbon sinks and the use of tsootso stoves can reduce indoor air pollution, which can have a negative impact on climate change. Additionally, the use of FES, such as tsootso stoves, is recognized by the United Nations Framework Convention on Climate Change as a potential climate change mitigation measure (UNFCCC, 2011). Therefore, there is a need to raise awareness among participants about the potential contribution of fuel efficient stoves to climate change mitigation.

Overall, there is some level of awareness and promotion of FES in the Bindura district, and participants generally have positive perceptions of the benefits of these FES. However, there is still a need to raise awareness through forest departments in the district about the potential contribution of them to climate change mitigation since most participants didn't know that FES can act as climate change mitigation measure.

5.3 PEOPLES ATTITUDES TOWARDS THE USE OF FUEL EFFICIENT COOK STOVES.

The average score for people's attitudes towards the use of fuel efficient stove expressed in percentage was 58.8% which was fairly good and these indicate a positive attitude towards the use of FES.

The majority of participants expressed interest in learning more about fuel efficient stoves which was 89.5%, and 86% of participants were willing to use them and they also recommend others to use FES. This indicated that the majority of people have positive attitudes towards the use of FES. However, most participants expressed that most women find it difficult to build tsootso stoves and also the majority of participants didn't know how to build the stoves which indicated negative attitudes towards the construction of FES.

Some had the perception that fuel wood used in FES like tsootso stoves are hard to find which make them not to adopt to the use of tsootso stoves. The benefits of fuel-efficient stoves are

well documented. They can reduce indoor air pollution, which is a significant health hazard in many developing countries where traditional stoves are commonly used (Ezzati, Lopez et al. 2004). The use of fuel-efficient stoves can also reduce the time and effort required for cooking and collecting firewood, particularly for women who are often responsible for these tasks (Mendes et al., 2014).

Tsotso stoves are a type of fuel-efficient stove that has been developed specifically for use in Zimbabwe. They are designed to be user-friendly and require less effort to operate compared to traditional stoves therefore they are easy to use and the majority of people which were interviewed were aware of that. They are also designed to be more stable and protected from wind, which can reduce the risk of accidents and injuries associated with traditional stoves (Mugadza et al., 2018). However, the participants had misconceptions about the use and benefits FES for example, the majority of people said that the FES destroy pots which is not consistent with the design and function of FES. FES are designed to be gentle on pots and reduce the risk of damage compared to traditional stoves (Mugadza et al., 2018) hence people need to be educated so that they will not have misconceptions about the use and the benefits of fuel efficient stoves.

Additionally, a minority of participants agreed that FES are not difficult to use in open spaces during rains, which may be due to a lack of understanding of the suitability of these stoves for outdoor use.

Further education and awareness-raising efforts may be needed to address these misconceptions and promote the benefits and proper use of FES. This could include training programs on how to construct and use tsotso stoves, as well as campaigns to raise awareness of the health and environmental benefits of fuel-efficient stoves. The use of fuel-efficient stoves can have significant health and environmental benefits, particularly in developing countries where traditional stoves are commonly used.

5.4 PEOPLES PRACTICES IN THE USE OF FUEL EFFICIENT COOK STOVES.

The score for people's practices was 26.9% expressed in percentages which was very poor. 52.3% have used fuel FES but only 16.3% are still using them. This difference was mainly because rocket stoves which are made up of clay, river sand and cow dung are not durable as stated by many participants.

Some participants have used tsotso stoves before, but there is relatively low familiarity and adoption of these stoves among the participants. This is consistent with findings from other studies, which have highlighted the challenges of promoting the adoption and sustained use of improved cookstoves, including tsotso stoves (Ruiz-Mercado, Masera et al. 2011)

The low adoption of fuel efficient stoves is due to lack of access and availability of these stoves in the region. Studies have shown that the availability of improved cookstoves, including tsotso stoves, is often limited in rural areas and low-income communities (Wei, Patadia et al. 2010), and usually the selection of people who participate in program is limited. Additionally, the affordability of these stoves may be a barrier to adoption, particularly for low-income households (Heltberg et al., 2000).

The other possible reason for the low adoption of FES is the lack of awareness and understanding of the benefits of these stoves. Education and awareness campaigns can play a critical role in promoting the adoption and sustained use of improved cookstoves, including tsotso stoves ((Ruiz-Mercado, Masera et al. 2011)There is a need to raise awareness among participants about the benefits of tsotso stoves, including their potential to reduce fuel consumption, indoor air pollution, and deforestation, as well as their potential to save time and contribute to climate change mitigation.

Furthermore, it is important to involve local communities as well as community leaders like village heads in the design, production, and distribution of FES, including tsotso stoves. This is because traditional leaders can influence the community to adopt to the use of FES since they have power over them. Studies have shown that involving local communities in the development and implementation of clean cooking solutions can increase their acceptance and adoption (Wei, Patadia et al. 2010). There is some level of familiarity with FES among the participants, the low adoption and usage of these stoves highlights the need for increased access, durability and portability of stoves, education, and community involvement in promoting the adoption and sustained use of improved cookstoves, including tsotso stoves.

5.5 THE RELATIONS BETWEEN KNOWLEDGE, ATTITUDES, PRACTICES AND SOCIO-ECONOMIC VARIABLES.

There was a ($P=0.02$, $\chi^2 =17.910$, $df = 8$) significant association between age and the perception that women benefit more from using FES. The 26-33 age group agreed more and the 42-49 age group least agreed. These was because the age group between 26-33 are the

ones which adopt the use of fuel efficient stoves more and sometimes old ages for example the group from 42-49 are resistant to change hence they continue using open fires. There was a ($p=0.01$, $\chi^2=12.852$, $df = 4$) significant association between age and the knowledge that FES reduce indoor pollution and they have been educated. The 26-33 agreed more because they are ones who are practicing cooking using FES. In addition to the significant associations there was also a ($p=0.05$, $\chi^2= 9.321$, $df = 4$) significant relationship between age and the perception that fuel efficient stoves are easy to construct and the age group 26-33 agreed more and 18-25 agreed less. The 18-25 group agreed less because they are not yet household owners hence they tend to be ignorant on how to construct FES.

There was a ($p=0.00$, $\chi^2=90.172$, $df = 9$) significant association between marital status the fact that fuel efficient stoves reduce fuel consumption with married participants more dominated and single being the least this is because married people cook more for their families. There was a ($p=0.00$, $\chi^2= 96.114$, $df = 9$) significant association between education and the fact that climate change can act as a climate change mitigation measure with more people who had secondary level and the least who had primary level. This is because people with secondary level understand the benefits of using FES more because of their level of education. There was also a ($p= 0.00$, $\chi^2=87.580$, $df 6$) significant relationship between level of education and the practice of using fuel efficient stoves as people with secondary level practised the use of fuel efficient stoves as compared to those with primary level. This is because they understand the significance of using FES as compared to those with primary level.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

Based on the results of the KAP survey it was discovered that there is a high level of knowledge about fuel efficient stoves among the respondents. The majority of the respondents have heard about fuel efficient stoves and most of the respondents know that these FES reduce the rate of deforestation. In addition they understand the benefits of using fuel efficient cook stove although they didn't know much about FES as a mitigation measure of climate change.

In addition, attitudes towards the use of FES was fair as most of respondents were willing to learn more about FES and they could recommend others to use them hence this is a sign of positive attitudes towards the adoption of fuel efficient cook stoves.

In addition to the findings, although people's knowledge regarding the use of FES is very good there is low level of practicing the use of fuel these fuel efficient stoves. This suggests that there's a gap between awareness and behaviour when it comes to the adoption of tsotso stoves. It should be stated that the use of FES alone cannot fight against deforestation but should be part of a bigger strategy, thus includes socio-cultural changes, such as a reduction of the birth rate.

6.2 RECOMMENDATIONS

- ✓ There's need for further education and awareness-raising through training and awareness campaigns.

- ✓ The construction of fuel efficient stoves need to be improved by replacing materials which are being used with some durable materials so as increase their life span since it will encourage their adoption.
- ✓ The fuel efficient stove program should continue, and efforts should be made to spread the stove's use. To make this happen, the responsible departments must be equipped with resources to initiate more programs of fuel efficient stoves.
- ✓ Further research is needed to better understand the reasons why people are not using fuel efficient stoves.

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APPENDICES

APPENDIX A: THE QUESTIONNAIRE

QUESTIONNAIRE FOR THE KNOWLEDGE, ATTITUDES, PRACTICES TOWARDS
THE USE OF TSOTSO STOVES.

My name is Ardelaide V Masarakufa. I am in the process of conducting a study as a part of my requirements for a Bachelor of Science Honours Degree in natural resources Management. You are kindly requested to answer every question honestly and your contribution shall be treated with confidentiality and used for the purpose of this research only. I would be grateful if you could respond to this study.

SECTION A : BACKGROUND INFORMATION

DATE /...../20.....

1 Sex Male Female

1 Age (Years) 18- 25 26- 33 34-
41 41-49 50+

3 Marital Status Married Single Widowed

4 What is your highest level of education?

Primary Secondary Tertiary

SECTION B: People's knowledge on fuel efficient stoves.

5. Have you heard about a tsotso stoves? YES NO

Question	Agree	Disagree	Don't know
6. Tsotso stoves reduce fuel consumption			
7. Tsotso produce less smoke and emit fewer pollutants			
8. Tsotso stoves are safe to use			
9. Tsotso stoves reduce deforestation			
10. Tsotso stoves can act as climate change mitigation measure			
11. Tsotso stoves are made up of clay, cement, metals			
12. Metals on tsotso stoves are used to transfer heat from the combustion chamber to the cooking surface			
13. Tsotso stoves are designed to distribute heat more evenly and effectively than traditional stoves			
14. The use of tsotso stoves saves time			

SECTION C: People's attitudes on the use of fuel efficient stove

Question	YES	NO	DON'T KNOW
15. Are you interested in learning more about Tsotso Stoves			
16. Would you recommend others to use tsotso stoves			
17. Women benefit more from using tsotso stoves as compared to men			
18. Handling the pot is easier with tsotso stove			
19. Tsotso stoves are easier to use.			
20. Tsotso stoves are safer because they are protected from wind.			
21. Tsotso stove can improve your health			
22. Tsotso stoves are easy to construct.			

23. Are there any social/ cultural norms that might make it difficult for you to adopt FES			
24. Are you willing to use tsotso stoves			
25. Tsotso stoves destroy pots			
26. It's difficult to find wood sizes for tsotso stoves			
27. Tsotso stoves are difficult to use in open spaces during rains			
28. I am able to build a tsotso stove			
29. Most women cannot build a tsotso stove			

30. What other things do you like on fuel efficient stoves?

.....

.....

.....

31. What do you dislike about fuel efficient stoves?

.....

.....

.....

SECTION D: Peoples practices on fuel efficient stoves

32. Have you used a tsotso stove before? YES NO

QUESTION	YES	NO
33. Are you currently using a Tsotso Stove		
34. What kind of stove are you using		
35. What type of fuel do you use		
36. Do you cook outdoor with your tsotso stove		

37. If not currently using, why did you stop?

.....

.....

38. What challenges have you faced in using Tsotso Stoves?

.....

.....
.....
THANK YOU.

APPENDIX B: THE INTERVIEW GUIDE FOR KEY INFORMANTS.

- 1 Why are you not using a tsotso stove?
- 2 Have you observed any changes in deforestation reports in your area since the promotion of fuel efficient stoves?
- 3 Was the selection of the tsotso stove compulsory?
- 4 What are the impacts of FES on the environment and forest resources?

