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SUSTAINABLE FISHERIES MANAGEMENT PROJECT (SFMP)

Performance Evaluation Survey– (Ahotor oven)

JUNE 2017

THE UNIVERSITY OF RHODE ISLAND
GRADUATE SCHOOL OF OCEANOGRAPHY
CRC COASTAL RESOURCES CENTER

SNV SMART DEVELOPMENT WORKS

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Cover photo: Survey team interviewing a processor at Axim (Credit: SNV)

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ACRONYMS

AOR	Agreement Officer's Representative
DAA	Development Action Association
DQF	Daasgift Quality Foundation
CEWEFIA	Central and Western Fish Traders Association
SFMP	Sustainable Fisheries Management Project
SNV	Netherlands Development Organization
USAID	United States agency for International Development

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EXECUTIVE SUMMARY

Fish smoking in Ghana is traditionally carried out by women in coastal towns and villages, along river banks and on the shores of Lake Volta. In most fishing communities, in fact, the main economic activity of women is fish processing.

Traditional ovens were used to smoke fish in the olden days. Until the end of the 1960s, the ovens most used for smoking fish in Ghana, were cylindrical or rectangular and made of mud and metal. Using these ovens had considerable disadvantages such as low capacity, inefficient fuel usage, poor quality smoked fish and some associated health hazards to the fish processors.

In view of the constraints and disadvantages associated with these earlier ovens, an improved traditional fish smoking oven, the Chorkor, was developed and introduced in 1969 by the Food and Agriculture Organization of the United Nations (FAO) and the Food Research Institute of the Council of Scientific and Industrial Research (CSIR) in Ghana (FAO, 1997). Decades later, another improved oven, Morrison oven was designed. The fish smoking oven was first piloted and used at New Takoradi in the Western Region with the support of Daasgift Quality Foundation and CHF International, in 2008. The Morrison oven is 40% fuel wood efficient than the Chorkor oven, and produces less smoke, thus protects the women from smoke related diseases.

In August and September, 2016, an improved fish smoking oven, the Ahotor oven was developed by a team of local and international consultants with guidance from SNV, CSIR-Food Research Institute and the Fisheries Commission, and with testing support from the Ghana Standards Authority and the CSIR-Institute of Industrial Research. The Ahotor oven is 32% more fuel efficient than the Chorkor oven and emits cleaner smoke in far less quantities as compared to the Chorkor oven. The most important value of the Ahotor oven is the highly reduced PAH deposits on smoked fish.

As part of SNV, SFMP, it is imperative to monitor and evaluate the performance of the Ahotor oven and beneficiary satisfaction with the use of the oven. A sample size of 30 fish processors out of 33 hosts who were supported with the Ahotor oven were selected for the survey across eight communities; namely Elmina, Apam, Winneba, Mumford, Moree in the Central Region, Anlo Beach, Takoradi and Sekondi in the Western Region. All respondents in exception of 1, were females. Of the 30 Ahotor ovens, 4 ovens were installed at Apam, 6 at Winneba, 2 at Axim, 1 at Takoradi, 1 at Sekondi, 4 at Mumford, 7 at Elmina and 5 at Moree.

The survey showed that 71.9% of the respondents had a Chorkor oven whiles 28% had Ahotor oven. The respondents expressed their interest in acquiring the Ahotor oven (single, double and triple ovens) because it gives good fish outlook, it is energy efficient and thus more money is saved on fuelwood, smoke emission is reduced and burns and other accidents are also reduced. However, some challenges were encountered by the respondents concerning the Ahotor oven. These are: the fat collector cuts easily because of the sharp edges and it slows down cooking because it reduces heat rising to the top trays, the wood entrance at the base is too small, the opening on the hood allows easy access to the fish by rodents, dogs and cats. The respondents suggested that appropriate corrections of the defective parts should be done.

Some financial institutions respondents prefer to make their payment through are Opportunity International, Nzemaman Susu Company, Ahantaman Rural Bank, GN Bank, ASA Savings and Loans, Women's World Bank, GT Bank and Royal Bank.

1.0 BACKGROUND

Fish is an important source of food and income to many people in the developing world. Various traditional methods are employed to preserve and process fish for consumption and storage. These include smoking, drying, salting, frying and fermenting. In Ghana, smoking is the most widely practiced method. In general, fish is made up of 70 – 84 percent water, 15–24 percent protein, 0.1– 22 percent fat and 1–2 percent minerals. The high moisture content of fish renders it extremely perishable. It has been estimated that in the high ambient temperatures of the tropics, fish spoils within 12–20 hours of being caught, depending on species and size.

Fish smoking in Ghana is traditionally carried out by women in coastal towns and villages, along river banks and on the shores of Lake Volta. In most fishing communities, in fact, the main economic activity of women is fish processing.

In the early 1950s, awareness of the limitations of traditional ovens had stimulated the development work on new improved smoking ovens, such as the Adjetey, Altona, Ivory Coast and Nyegesi models. For various reasons, however, none of them were accepted when introduced in Ghana. Until the end of the 1960s, the ovens most used for smoking fish in Ghana, were cylindrical or rectangular and made of mud and metal. Using these ovens had considerable disadvantages. The ovens had a low capacity, were inefficient in fuel usage and could not cope with the large volumes of fresh fish landed during bumper fish seasons. This contributed to high post-harvest losses and, since the fish season coincided with the rainy season, the fish could not be sun-dried. Because the traditional ovens were inefficient, more firewood than necessary was used for the smoking process, which contributed to forest depletion. The health of women fish smokers was at risk, because the smoke enters their eyes and lungs, they burned their fingers and they were exposed to direct heat. The fish smoking procedure was very laborious and poor quality smoked fish was produced.

In the light of lessons learned from the constraints and disadvantages associated with these earlier ovens, an improved traditional fish smoking oven, the Chorkor oven, was developed and introduced in 1969 by the Food and Agriculture Organization of the United Nations (FAO) and the Food Research Institute of the Council of Scientific and Industrial Research (CSIR) in Ghana (FAO, 1997). Decades later, another improved oven, Morrison oven was designed. The fish smoking oven was first piloted and used at New Takoradi in the Western Region with the support of Daasgift Quality Foundation and CHF International, in 2008. This improved oven reduces fuel wood use and produces less smoke, thus protects the women from smoke related diseases. The oven is reported to be 40% more fuel wood energy efficient than the Chorkor oven. The fish smoking sector in Ghana is highly dependent on fuelwood as source of energy, and in a 2014 study, SNV found that there were over 120,000 fish smoking ovens in near-constant use along Ghana's coastline and the Volta Lake basin. Contributing to this high rate of deforestation is the widespread use of inefficient fish smoking technologies, with the most popular being the Chorkor oven. However, using this technology, women work under often strenuous conditions (exposure to heat and smoke) and for marginal incomes. The World Health Organization estimates that harmful cook stove smoke is the fifth leading cause of death in developing countries.

SNV Ghana under the SFMP is committed to combating deforestation, enhancing the viability of agro-processing businesses in Ghana and improving the working environment for women entrepreneurs through the introduction of energy efficient and clean cooking technologies. Improved ovens have the potential to significantly reduce fuelwood consumption and excessive exposure to heat and smoke (which can cause cancer as result of PAHs). Under EU food standards, the level of PAH4 in smoked food products should not

exceed 12 µg/kg and for benzo[a]pyrene (BaP) 2 µ/kg. Recent SFMP analyses have shown that smoked fish in Ghana contains PAH levels that are well above those recommended for human health (by the EU), with the Chorkor oven about 25 times higher than the EU standard depending on the indicator used.

In view of this an improved fish smoking oven, the Ahotor oven has been developed by a team of local and international consultants with guidance from SNV, CSIR-Food Research Institute and the Fisheries Commission, and with testing support from the Ghana Standards Authority and the CSIR-Institute of Industrial Research. The Ahotor oven is 32% more fuel efficient than the Chorkor oven and emits cleaner smoke in far less quantities as compared to the Chorkor oven. More so, the PAH level of the Ahotor oven is 59 µg/kg compared to the Chorkor at 298 µg/kg, thus making the Ahotor oven healthier than the Chorkor oven. It is easy to use and user friendly and produces high quality smoked fish. The oven emits far less smoke which is cleaner and does not pose any health threat to the oven users.

To ensure that the beneficiaries are satisfied with the oven, an evaluation survey was carried out in eight communities between the 16th and 201th of January, 2017, on the oven performance and the beneficiaries' level of satisfaction with the oven. This report presents detailed information on the evaluation survey.

1.1 Objectives

The evaluation survey was aimed at:

- Assessing the satisfaction of the oven users and
- Assessing the performance of the Ahotor oven

1.2 Brief

SNV in August and September 2016 constructed 12 demonstrations, Ahotor ovens and an additional 20 Ahotor ovens for under-privileged women who cannot afford the ovens; 1 stove was also purchased. These ovens were constructed in Elmina, Apam, Winneba, Mumford, Moree in the Central Region, Anlo Beach, Takoradi and Sekondi in the Western Region.

SNV in January 2017 conducted an evaluation of the performance of the oven and beneficiary satisfaction with the use of the oven. 30 Ahotor oven hosts were interviewed during the process. The additional 2 stoves were stationed at the Cewefia processing shed as demonstration units. A questionnaire was used for the interview.

The outcome of this assessment will be the baseline information for carrying out the necessary technology development interventions needed to make the Ahotor oven more user friendly.

2.0 METHODOLOGY

For the beneficiary satisfaction survey, a sample size of 30 beneficiaries out of the 33 population size were interviewed in Apam, Winneba, Axim, Elmina, Takoradi, Mumford, Sekondi and Moree.

Standard questionnaires and personal observations were used to collect the needed data for the survey. Analysis for various aspects of the survey is represented in the following sections of this report.

2.1 Limitations

Even though all the 30 people of the sample population size were interviewed, the results still have limited representation because only 40.7% of respondents had used the oven between the period of 3-5 months, 22.6% had used it between less than a month and two months and

36.4% had not yet used the oven. This may affect respondents' judgments and therefore the quality of data.

Due to minimum use period of the oven some respondents could not answer properly some questions that needed specifics, which may also affect data quality.

3.0 RESULTS AND DISCUSSION

3.1 Oven Use

3.1.1 Understanding the target group

Women are the main users of fish smoking ovens and as such 97% (29) of the respondents were females and 3% (1) was a male. The sample size for the survey was 30.

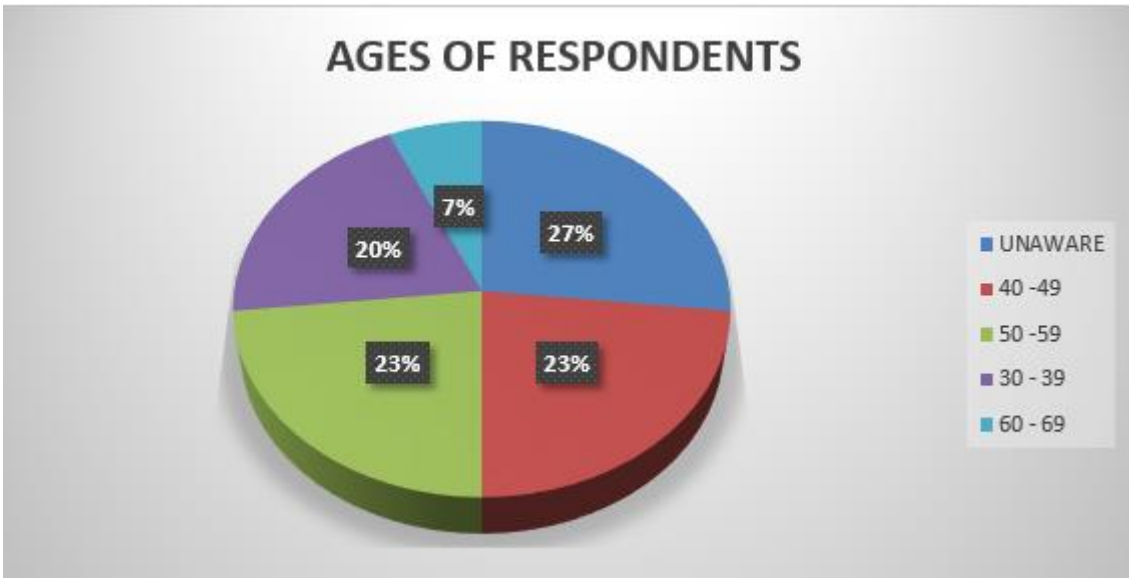

Figure 1 Ages of Respondents

A majority (27%) of the beneficiaries were unable to report their specific ages. 23% were within the age range of 40-49, whiles another 23% were within the age range of 50-59. 20% were within the age range of 30-39 whiles the least respondents (7%) were within the age range of 60-69.

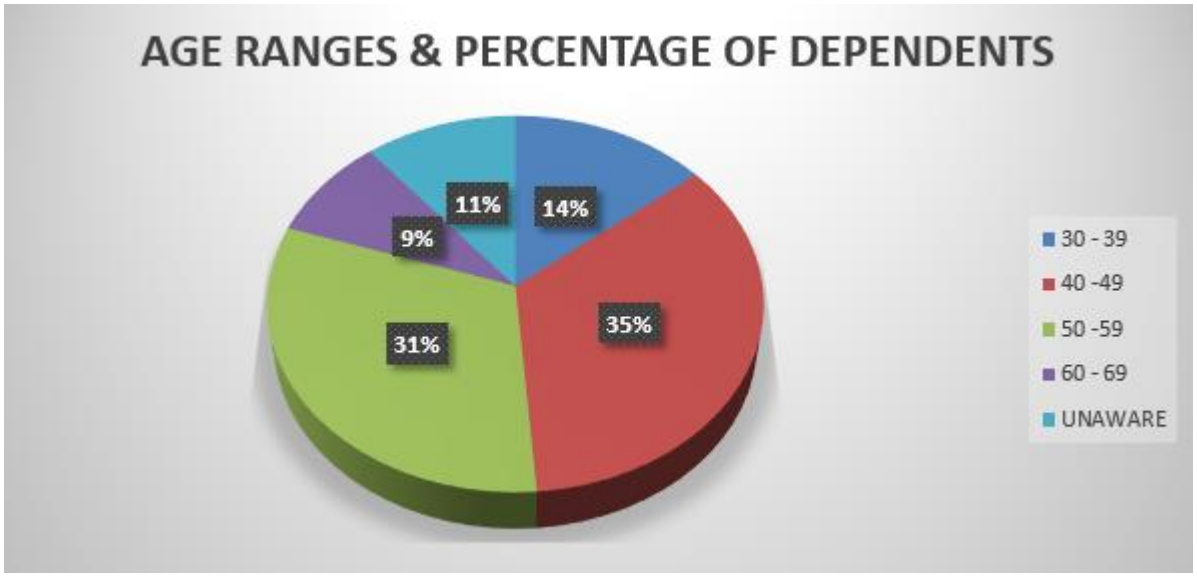

Figure 2 Age ranges and percentage of dependents

The age range of 40-49 had the highest number (54) of dependents, making 35% of the total number of 156. This was followed by the age range of 50-59 which had 49 dependents, forming 31%. The age range of 30-39 had 22 dependents making 14%, whiles beneficiaries who were unaware of their ages had a total of 17 dependents, forming 11%. The age range of 60-69 had the least number (14) of dependents, making 9% of the total number of dependents. This shows that beneficiaries in the middle age group supports more people than the older age group.

3.1.2 Stove type and uses

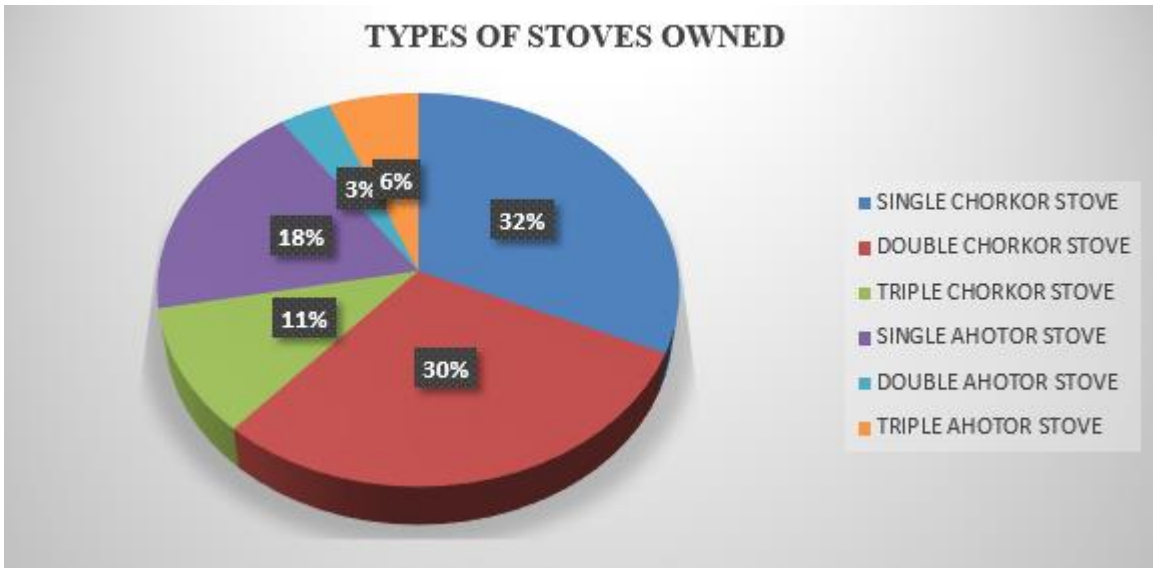

Figure 3 Percentages of the various types of ovens owned by the respondents

Ahotor and Chorkor ovens were the key ovens studied during the survey. Out of the total of 114 ovens owned by the respondents, 36 of them were single unit Chorkor ovens, representing 32%, whiles 34 of them were double unit Chorkor ovens, representing 30% and 12 triple Chorkor ovens representing 11%. Single, double and triple Ahotor ovens were owned by 18%, 3% and 6% of the respondents respectively. Also, 5 of the respondents had only the Ahotor ovens (3 out of the 5 had not used the oven yet whereas the other 2 have used it within a month of our visit. 1 of the 2 purchased the oven herself). The other 25 respondents have both the Chorkor and Ahotor ovens.

Twenty respondents obtained the oven within the context of vulnerable household category, this represents 52.4% of the sample size, making the majority. Nine respondents obtained the oven by demonstration and this represents 38.1%. One respondent purchased the oven, and another was using a CEWEFIA demonstration unit, representing 4.7% each of the sample size as shown in figure 4.

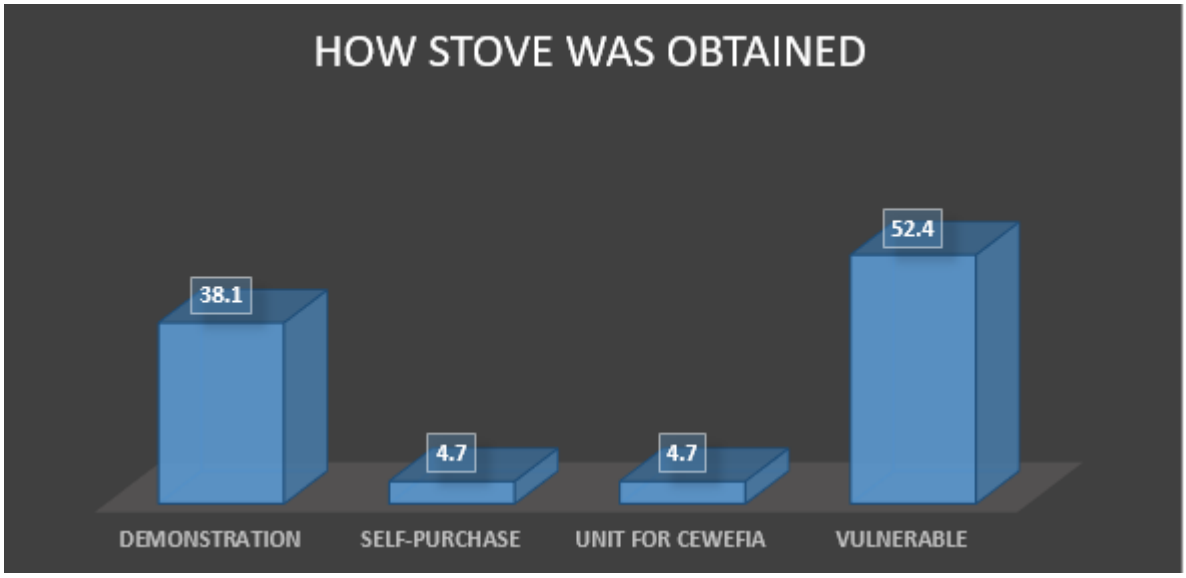

Figure 4 How oven was obtained by the beneficiaries

27% of the sample size could not recollect how long they had been using the Ahotor oven they obtained, likewise beneficiaries who have not used the oven yet. 13% have used the oven for four months, whiles 10% had used it for two and three months. Only 7% of the beneficiaries had used the oven for five months and this represents the highest number of months the oven had been used in the study area. 3% used the oven for a month and less than a month.

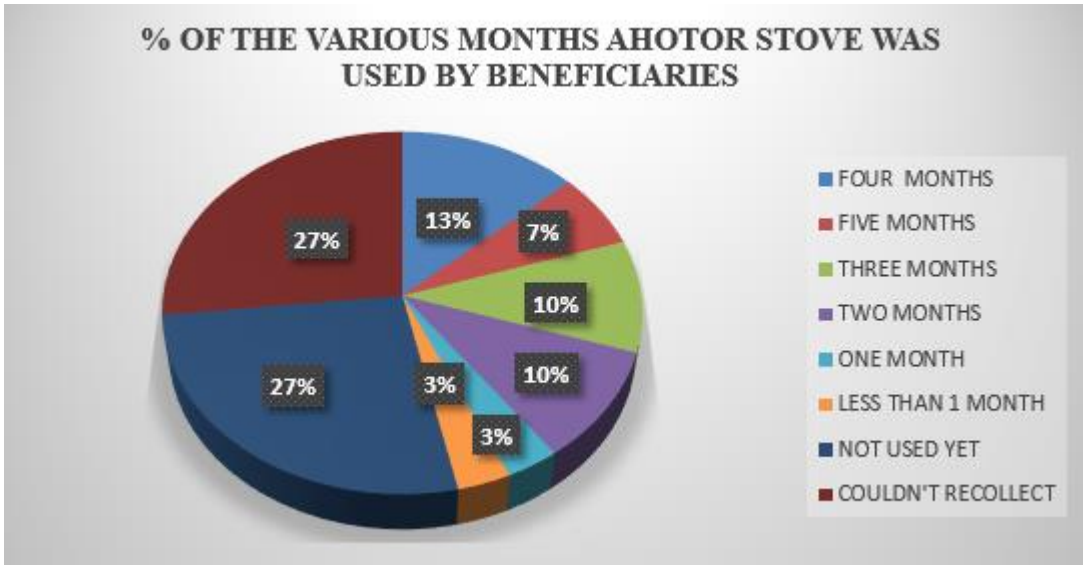

Figure 5 Percentage of the period of use of the Ahotor oven.

Eleven of the respondents did not state how often they used the Ahotor oven for smoking fish. Eight of them used it 6 days per week followed by 5 respondents who used it two days in a week. Two respondents used it 3 days per week whiles one respondent each used it once and four days per week. The frequency of stove use depends on fish availability, especially for processors who depend on fish from the sea. All the same, most of the processors engaged substitute their fish supply from the cold store.

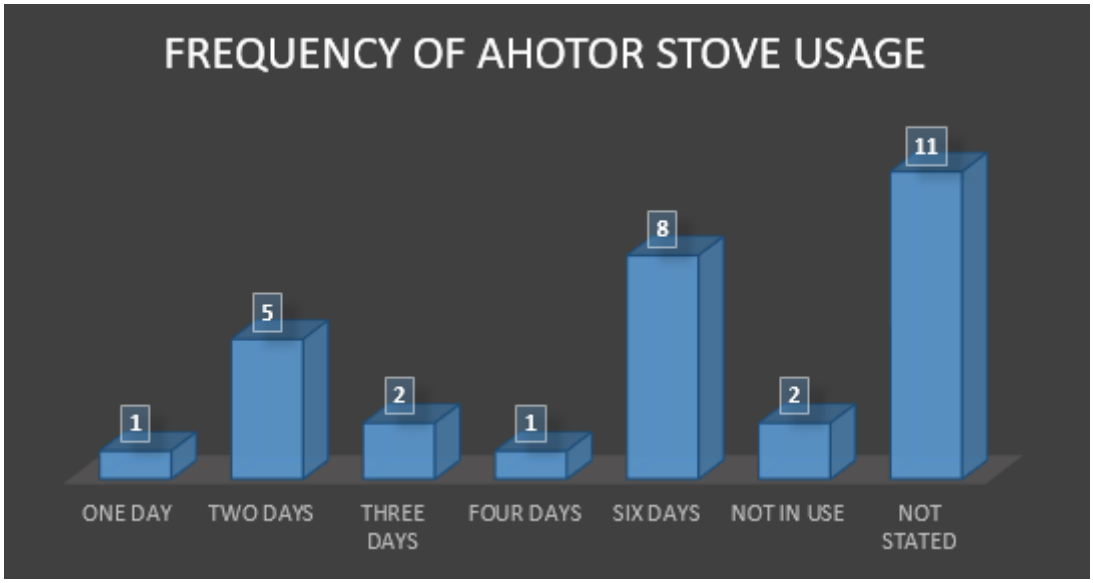

Figure 6 Frequency of Ahotor oven usage per week.

Twelve respondents out of the 30 have used the Chorkor oven for 10 years. This represented 40%. Eleven respondents did not state their duration of usage and this make up 37% of the total number of respondents. Four respondents have been using the Chorkor oven for over 10years, making 3%, whiles one respondent each have used the oven for 7, 4 and 3 years as represented in Figure 7.

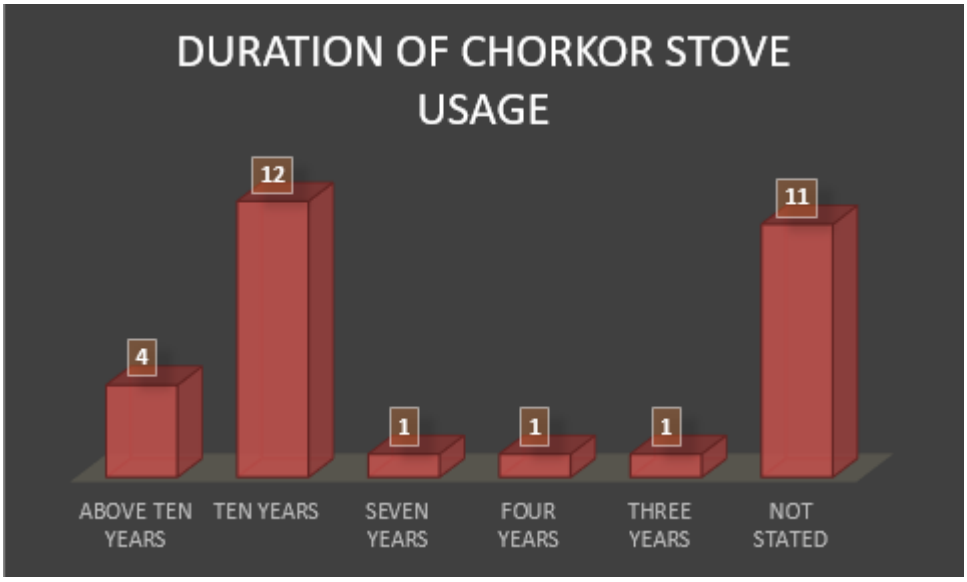

Figure 7 Duration of Chorkor oven usage by respondents

Figure 8 presents information on respondents still using the Chorkor. 64% of the respondents were still using the Chorkor oven for smoking fish. 33% gave no response as to whether they were still using the Chorkor oven. 3% had stopped using the Chorkor oven for smoking fish. Most of the Ahotor ovens provided were single unit ovens especially in Elmina and Moree, thus the capacity for smoking fish was not enough, therefore the need to continue working with the Chorkor ovens. Others explained that processing fish on the Ahotor is slow as compared to the Chorkor; which was discussed at length. The team noticed that, the users needed to be trained better on how to use the oven and secondly there was a need to improve the design of the fat collector in order to improve heat distribution and transfer to the fish; in order to facilitate a faster cooking session. Some respondents said the Chorkor oven works better for hard smoking sessions.

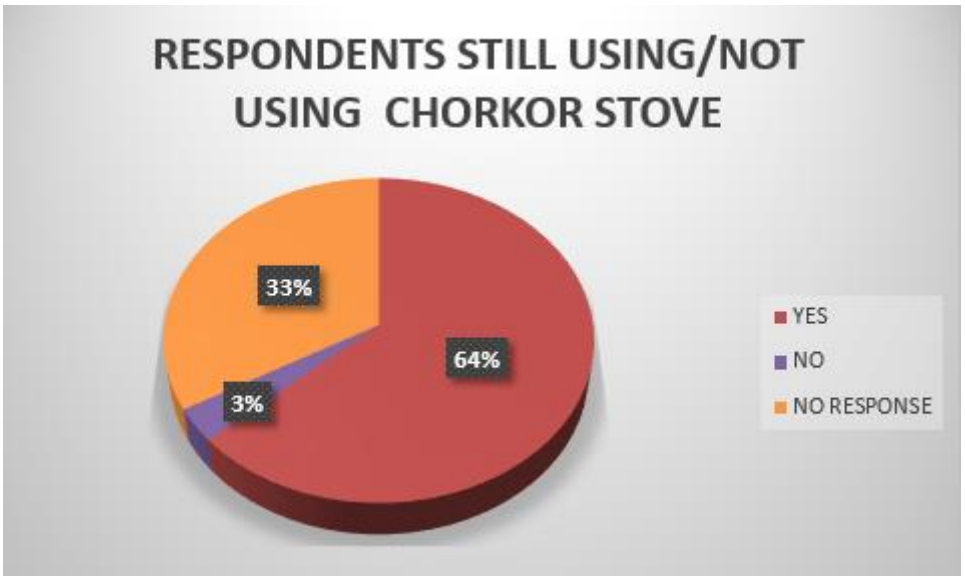

Figure 8 Respondents still using or not using the Chorkor oven

Thirteen respondents preferred Ahotor oven over the Chorkor oven for smoking fish. This number represents 43.3% of the sample size. The respondents explained that the Ahotor oven emits less smoke making the working environment accessible and safe, thus there is a reduction in eye irritation and respiratory diseases. They use less amount of fuel as compared to the Chorkor and therefore save money on fuelwood. There is minimal exposure to heat, thus a low incidence of burns and accidents. The smoked fish from Ahotor has a better and more attractive appearance (golden brown).

However, 47% of the respondents had some challenges with the use of the Ahotor oven. They expressed difficulty in removing and fixing the fat collector. They also explained that the fish in the middle does not cook well and this was related to the design of the fat collector. Also, the heat does not rise very high to smoke the fish on the top trays.

Seven respondents, which represents 23.3%, preferred the Chorkor oven to the Ahotor oven. Their reasons are; the Chorkor oven smokes fish faster and also smokes large quantities (15 trays) of fish at the same time. The prescribed number of trays for the Ahotor is 10 trays at a time, to allow for even and faster cooking of fish. Ten respondents representing 33.3% gave no response. Figure 9 shows the preferred fish smoking oven by the respondents.

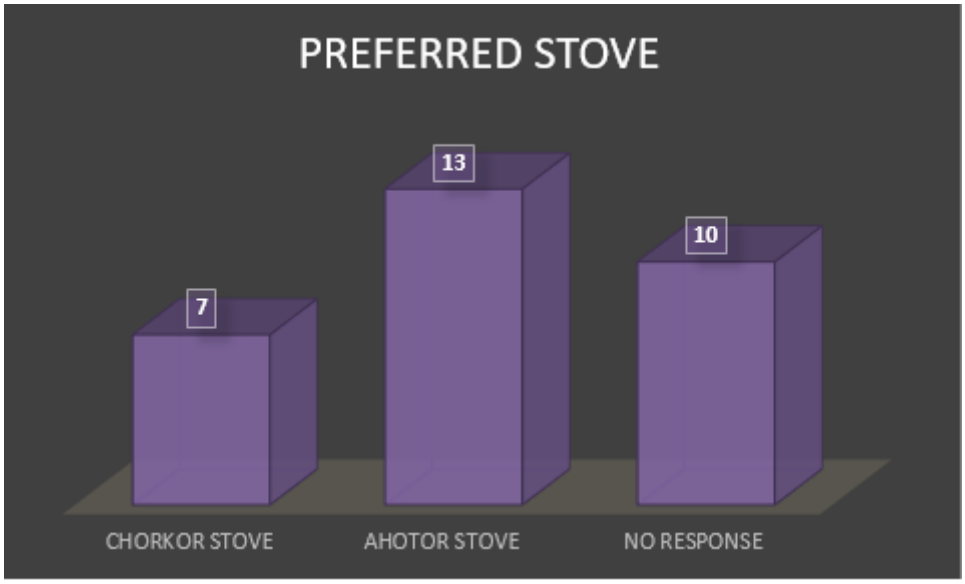

Figure 9 Preferred fish smoking oven by the respondents

The respondents expressed their opinions about the different components of the Ahotor oven. The combustion chamber had no issues. Some of them confirmed that the combustion chamber conserves heat so protects the user from excessive heat. According to some respondents, the wood entrance of the base was too small and a bit high. The fat collector cuts at users easily and also reduces the amount of heat that rises to the top trays. A need for an opening in the middle of the fat collector was suggested. The opening on the hood allows easy access to the fish by rodents, dogs, cats and goat. Respondents requested for an improvement in the hood so as to prevent invasion by these organisms.

3.2 Resource Efficiency

A total of 40% of the respondents have realized some improvements in their resource use. They save time as smoking with Ahotor is faster and they make savings on fuelwood use,

thus reduced production cost. The less smoky environment makes it easy for processors to carry out other cooking needs alongside the smoking session, thus more savings on time. The improved outlook of fish also increases their profit levels.

The average daily work capacity of respondents is, smoking between 4 and 20 pans of fish at daily depending on the fishing season. And type of fish determines the smoking option; either soft or hard smoking. Mostly the small pelagic are hard smoked whiles the large fish such as Tuna are soft smoked. At least 3 bundles of fuelwood are used to smoke one pan of fish, which usually fills up three smoking trays.

Respondents use between forty minutes to 3 hours for the soft smoking cycle and 5 to 8 hours for hard smoking, when using the Chorkor oven. For smoking on the Ahotor, respondents use 1 hour to 3hours for soft smoking depending on fish type and size, whiles 5 to 8 hours is required for hard smoking using the Ahotor oven. In carrying out a normal day's smoking activity using both Chorkor and Ahotor ovens; fish, fuelwood, transport and labor were the key inputs the respondents stated.

Other expenditure made from net to plate for smoking fish on the Chorkor oven includes

- Transport of fish to the market and it ranges between GHC15 to GHC150 (depending on distance to market and quantity of load).
- Average cost of packaging fish for the market is GHC25.00, which covers, cost of paper, ropelike sack, stick for tying sack and paint and brush for marking baskets. This depends on the quantity of fish.
- Market tolls range between GHC1.00 to GHC5.00 depending on the quantity of fish and the market center.
- Other expenditure such as land and security depended upon the community in which the fish was being smoked.

3.3 Beneficiary Satisfaction

57% of the beneficiary had their processing needs met by the Ahotor oven whiles only 3% declined. There was no response from 40% of the respondents. The characteristics of the oven that the respondents were most satisfied with which informed their readiness and willingness to recommend the oven to others were:

- Less smoke emission; hence less eye irritation and respiratory diseases
- Less fuelwood consumption; saving more money on fuelwood
- Gives attractive outlook to fish
- Reduction in burns and accidents
- The hood makes it nice, the fire entrance and the trays look good
- It is a clean oven.

The respondent whose fish processing needs were not met explained that the Ahotor oven does not smoke a lot of fish at the same time, and that she would not recommend the oven to others based on this limitation. Figure 10 expresses this information.

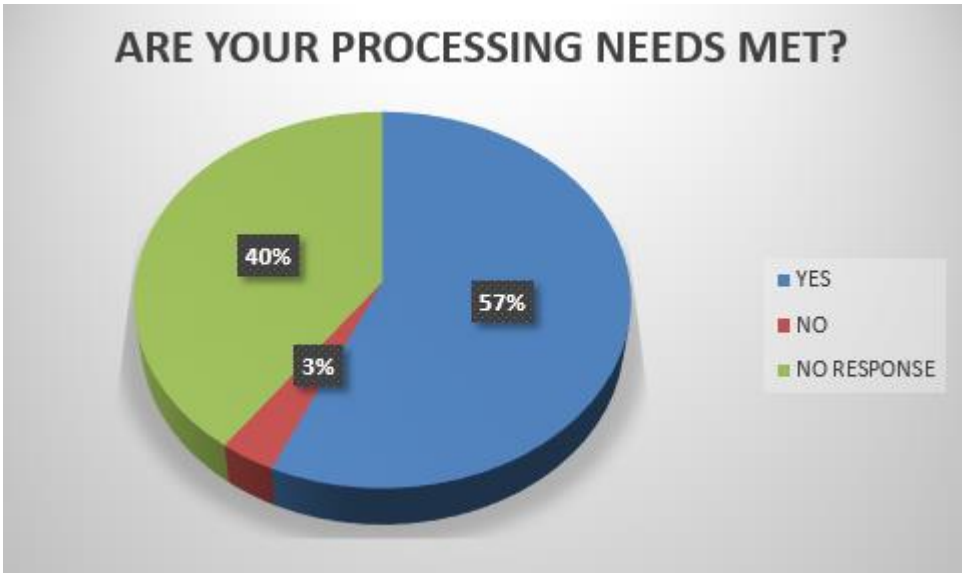

Figure 10 Whether or not the processing needs of respondents were met

Based on the experience with the oven, 53% of the respondents were willing to purchase more whiles 7% were not. 40% of the respondents did not give any answer. Figure 10 shows whether or not the respondents' processing needs were met.

Figure 11 Whether or not respondents are likely to purchase more Ahotor oven

The survey expressed that, 30% (which is 9) of the respondents said they will like to replace their traditional ovens with the improved oven, 13% (4 respondents) said they would like to use both together, 7% (two respondents) have no oven of their own, 3% (one respondent) have no money whiles 37% (11 respondents) gave no response. Figure 12 shows the percentage of respondents who would like to replace, support or use both ovens together.

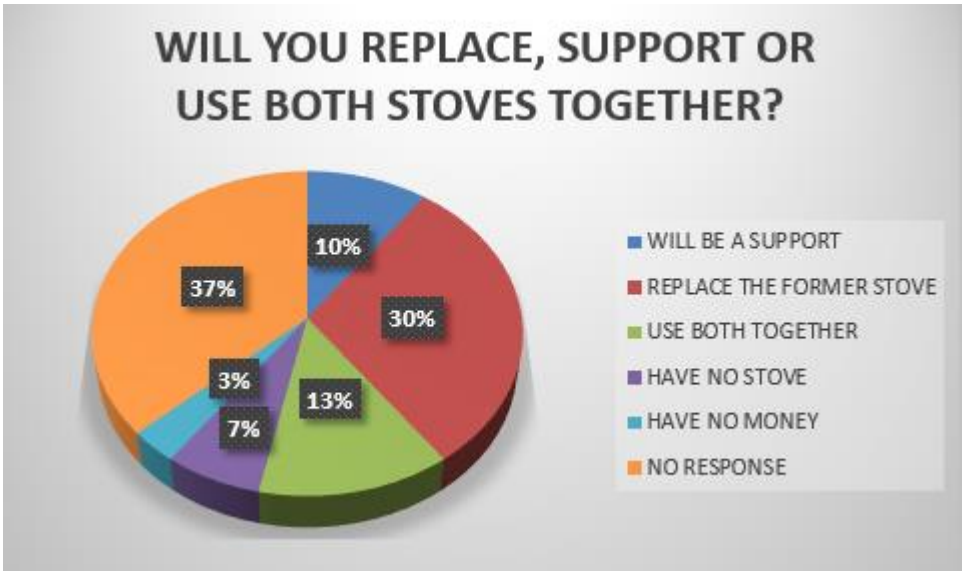

Figure 12 Whether or not respondents will switch to Ahotor oven

Generally, respondents were interested in the Ahotor oven because of less smoke emissions and the savings on wood but had concerns about the capacity of the Ahotor oven and the fact that smoking took a longer time as compared to the Chorkor. Thus most of the respondents preferred to use the Chorkor oven alongside the Ahotor to cater for capacity issues. The respondents proposed that more improvement work should be carried out on the Ahotor oven to cater for their concerns.

3.4 Financing

The realistic oven price for the Ahotor ovens given by the respondents were GHC 100 to GHC 700 for the single unit Ahotor oven, while GHC850 to GHC1500 was given for the double unit Ahotor oven. GHC200 was given as the realistic price for the retrofit.

37% of the respondents prefer loan from a Finance Institution, 10% prefer personal cash and 53% did not give any response as to the payment plan they prefer for the purchasing of the oven.

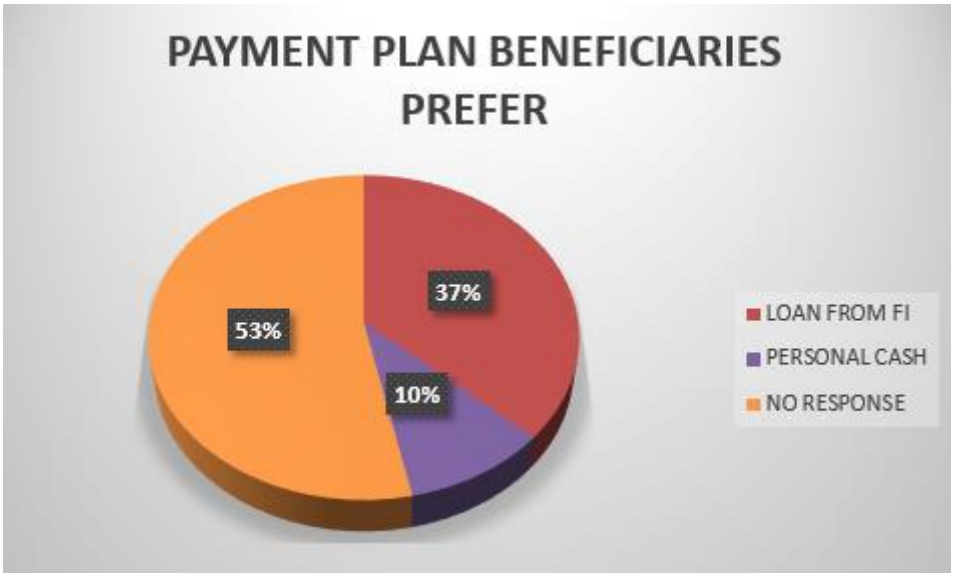

Figure 13 Payment plan respondents prefer for the purchasing of the Ahotor oven

Eleven (making 37%) respondents said they will like to make their payment through a Finance Institution. The Finance Institutions the respondents prefer are GN Bank, ASA Initiative, Know Thyself, Opportunity International, Nzemama Susu Company, Ahantaman Rural Bank, Women's World Bank, GT bank, Group dues, ASA Savings and Loans and Royal Bank. One respondent did not want to make her payment through a Finance Institution whiles 18 (representing 60%) respondents gave no response as represented in Figure 14.

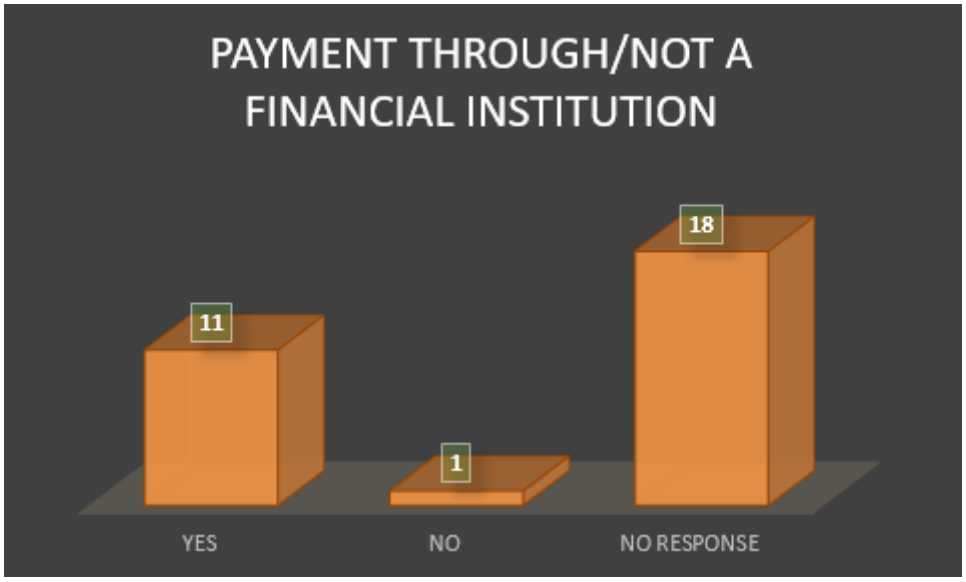

Figure 14 Means of payment

3.5 Satisfactory Construction Process

13 respondents (representing 43% of the respondents) would always like to work with the team that constructed the oven because they finished the construction in time whiles one

respondent (representing 3%) would not like to work with the Cook Clean staff because of delayed construction. There was no response from the majority of 16 respondents making 54% as shown in Figure 15.

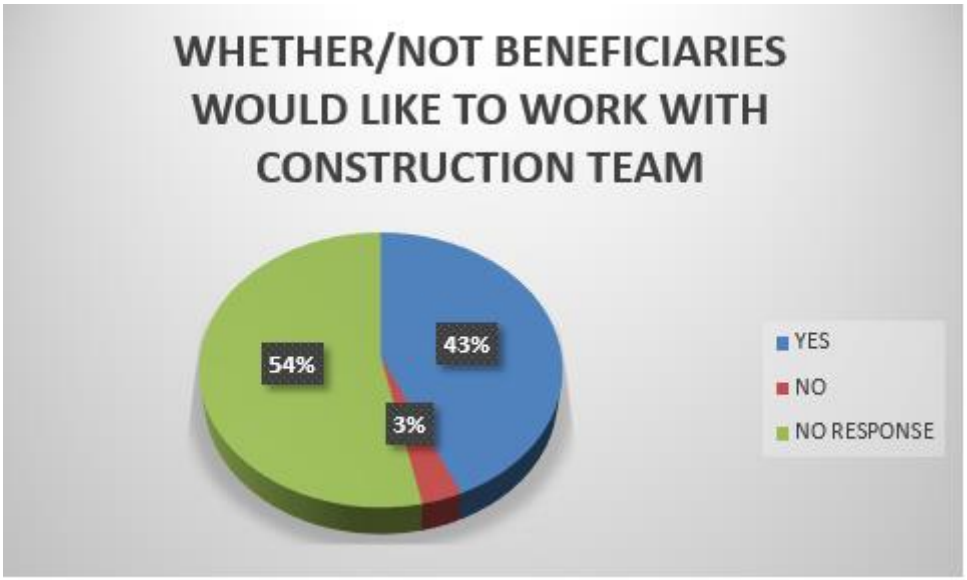

Figure 15 Whether respondents would or would not like to work with the construction team

4.0 GENERAL OBSERVATIONS ON OVEN QUALITY BY SURVEY TEAM

Table 1 General observations on oven quality by survey team

Trays	• Some processors prefer the round netted trays • Some handles are heavy, causing drudgery • Some nets break easily because of proximity to the sea • Some of the nets are too small in size. • Should be double instead of single
Combustion chamber	• Conserves heat • The heat produced is not able to rise high through the trays • The ire place entrance area should be increased
Base	• The base heat up but does not burn • The base is quite higher than normal; it should be reduced
Fat Collector	• Does not disperse heat evenly • The round cut out plates are sharp and can cut the user • Some have difficulty in removing the fat collector • It slows down the cooking • There is a need for an opening in the middle
Combustion grate	• Easy to use • Some need to learn how to use it effectively • 3 users did not have the grate. This was supplied by the team
Hood	• The opening should be netted to prevent pest infestation • The hood protects the fish from infestation

4.1 General Observation on Entire Evaluation Process by Survey Team

- About 36% of the stove hosts have not used the Ahotor oven before, especially in Moree, main reason being lack of capital to purchase fish and some received their stove components late. Two women were nursing their babies.
- All the women interviewed in exception of two processors still use their Chorkor ovens because the Ahotor oven capacity is low and it delays in smoking fish.
- Some of the women were using the Ahotor oven to smoke fish for their home needs and not for the market, because it gives them healthy fish.
- Most of the women also explained that they will use the Ahotor oven as a support to the Chorkor, because of capacity issues.
- The women also mix the smoke fish from Chorkor with that from the Ahotor, thus there is no clear information on smoked fish consumer preference. There is therefore a need for a research in this direction.
- The respondents have strong desire for the Ahotor oven and are ready to change entirely from Chorkor oven to Ahotor oven if their concerns will be worked on.
- Some respondents think that the Ahotor oven is for small scale processors because the large processors' demand was not met by the oven's capacity and performance.

4.1.1 Advantages of Ahotor oven as expressed by Respondents

- It saves fuel, most processors use about a third of what they use for Chorkor
- Smoke emission is drastically low
- The fish outlook is attractive
- Less problems with eye irritations
- It is user friendly
- Reduces production cost
- Less burns and accidents
- The taste of the fish is remarkable
- There is no need to turn the fish, it cooks wholly
- It is a clean oven
- Products from Ahotor oven has a potential market
- Smoked fish is not smoky
- Low heat emitted to the immediate environment
- It dries the fish better than the Chorkor
- Time saving, smokes fast, when you pre heat the stove

4.1.2 Issues

- The Ahotor takes longer time to smoke fish than the Chorkor if not preheated
- Capacity is currently low, because it's a single unit
- The fish in the middle does not cook well and needs to be redistributed to cook
- The stove needs to be pre heated in order for fish to cook in time
- Smoking all 10 trays at a time slows down the cooking, thus they reduce the quantities
- Where the fat collector is not cleaned before being used again, it produces smoke and foul odor.

5.0 DATABASE OF AHOTOR OVENS CONSTRUCTED TILL DATE

Region	District	Community	Unit	Number of Stoves	Name of Beneficiary	Date of Construction	Cost of Stove GHC	% Subsidy	Latitude	Longitude	Accuracy (m)	Elevation (m)
Volta	Keta		Single	1	Faustina Ami Gavor	3/3/2017	1,220	100%				
Volta	Keta	Adina	Single	1	Mama Senyeabor	27/03/2017	1,220	100%	N 06.02545	E 001.04539	6	6.2
Volta	Keta		Single	1	Cecilia Amedey	25/02/2017	1,220	100%	N 05.46353	E 000.47909	4.7	11.9
Volta	Ketu	Aflao	Single	1	Axoeta Azadzi	17/03/2017	1,220	100%	N 06.06563	E 001.11425	5.2	6.3
Central	KEEA	Elmina Bantoma	Single	1	Adwoah Mansa		1,220	100%	N 05.08186	W 001.36288	5.4	8.3
Central	KEEA	Moree Alata	Single	1	Ama Bentuma		1,220	100%	N 05.13248	W 001.20192	4	22.2
Central	KEEA	Moree Esrem	Single	1	Araba Kyere		1,220	100%	N 05.13163	W 001.20695	4.4	37.1
Central	KEEA	Moree Alata	Single	1	Aba Mansah	2/9/2016	1,220	100%	N 05.13169	W 001.20073	3.5	14.3
Central	KEEA	Moree Alata	Single	1	Ama Kumma	6/9/2016	1,220	100%	N 05.13270	W 001.19903	3.3	17.1
Central	KEEA	Moree Tammsaase	Single	1	Akua Mansah		1,200	100%	N 05.12903	W 001.19947	3.9	15.3
Central	Effutu Municipal	Winneba-Osakam	Single	1	Afua Laterle		1220	100%	N 05.34390	W 000.61814	5.3	13.6
Central	Effutu Municipal	Winneba-Oyibi Road	Single	1	Regina Amamu		1220	100%	N 05.34200	W 000.61845	6	13.8
Central	Effutu Municipal	Winneba-Osakam	Single	1	Esi Nkeeba		1220	100%	N 05.34498	W 000.61835	5.8	16.2

Central	Effutu Municipal	Winneba-Woarabeba	Single	1			1220	100%	N 05.36021	W 000.58247	4	11.6
Central	Gomoa West	Apam	Single	1	Grace Bondzi		1220	100%	N 05.28692	W 000.72871	4.9	11.5
Central	Effutu Municipal	Winneba-Oyibi Road	Single	1	Esi Kum		1220	100%	N 05.20513	W 000.37146	4.8	13.8
Central	KEEA	Elmina Bantoma	Single	1	Peace Gavor		1220	100%	N 05.07959	W 001.36383	5.1	13.1
Central	KEEA	Elmina Nyaae	Single	1	Hannah Kalangi		1220	100%	N 05.05684	W 001.19983	6.6	19
Central	KEEA	Elmina Gyawurado	Single	1	Grace Ahor		1220	100%	N 05.08094	W 001.35592	5	10
Central	Gomoa West	Apam Paado	Double	1	Rebecca Arthur		2330	100%	N 05.28509	W 000.73061	5	28.1
Central	Gomoa West	Mamford Mpoanokwan	Single	1	Mary Mawuko		1220	100%	N 05.26150	W 000.75671		
Central	KEEA	Elmina Ayisa	Double	1	Esi Nua		2330	100%				
Central	KEEA	Elmina Nyiaye	Single	1	Juliana Kudanu		1220	100%	N 05.09419	W 001.33412	5.8	17.4
Central	KEEA	Elmina (Demo Site)	Double	1	Maame Tawiah		2330	100%	N 05.08157	W 001.38358	5.6	12
Central	Gomoa West	Apam	Single	1	Esi Amason		1220	100%	N 05.28155	W 000.73057	5.4	27.4
Central	Gomoa West	Mamford Mpoanokwan	Single	1	Ama Mensimah		1220	100%	N 05.26240	W 000.75738	3.1	15.7
Central	Gomoa West	Mamford Mpoanokwan	Single	1	Agnes Sheburah		1220	100%	N 05.26198	W 000.75740	4.8	12.1
Central	Gomoa West	Mamford Mpoanokwan	Single	1	Araba Adadzwa		1200	100%	N 05.26194	W 000.75740	5.3	11.5
Western	Sekondi	Afua Tawiah Village	Single	1	Victoria		1200	100%	N 04.56323	W 001.42523	5.9	7.2

Western	Takoradi	Apremdo	Double	1	Agartha Cudjoe		2330	30%	N 04.54211	W 001.48520	5	6
Western	Nzima East Municipality	Axim Akyenem	Single	1	Anna Donkor		1220	100%	N 04.52701	W 002.14791	6.4	9.2
Western	Nzima East Municipality	Axim Apeosika	Single	1	Eunice Eshun		1220	100%	N 04.51511	W 002.14408	5.2	22.3
Central	Effutu Municipal	Winneba Langasta	Double	1	Hannah Mpae		2330	100%	N 05.33469	W 000.62393	4.9	28.1
Volta	Keta				Kwashiewor Ametapee			100%	N 05.54039	W 000.59520	4.4	8.8
Ashanti	Asante Akyem Central Muni.	Konongo	Double	1	Kofi Oti Acheampong		2330	30%	N 06.36909	W 001.12648	6	223.4
Ashanti	Ejisu-Juabeng Municipality	Asomdwe Krom	Double	2	Lila Prempeh		4660	30%	N 06.77396	W 001.43683	4.5	280.8
Central	Gomoa West	Apam Amamudo	Double	1	Peter Edzie		2330	100%	N 05.28602	W 000.72935	4.3	18.8

6.0 CONCLUSION

Despite the fact that modern methods of fish preservation, such as freezing and refrigeration, are available to some extent, the demand still persists in Ghana for the traditional flavor, longer shelf life, taste and color obtained by smoking.

The respondents were happy with the improved oven and actually gave some ideas on the areas they expect further improvements to meet. They complained that the fat collector cuts easily at them because of the sharp edges and it slows down cooking because it reduces heat rising to the top trays. They suggested an opening in the middle of the fat collector to increase heat getting to the top trays. For the base, a bigger wood entrance was suggested since it is too small. The opening on the hood allows easy access to the fish by rodents, dogs, cats and goats and this has to be netted.

The need for a consumer preference research to be carried out became a necessity as the women wanted to be sure they could make much profit on their fish.

7.0 RECOMMENDATIONS

- Beneficiaries need to be trained and coached on how to use and maintain the Ahotor oven.
- Apart from training, there is a need for continuous coaching and monitoring to ensure that the support provided to the beneficiaries achieves its objective.
- There is a need to explore other financing opportunities and also build a savings culture in the respondents.
- There is the need for training in healthy fish processing and improved fish storage techniques.

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APPENDIX A: PHOTO GALLERY FOR STOVE EVALUATION

Figure 16 Monitoring at Elmina (Left) and Monitoring at Axim (Right)

Figure 17 Monitoring atTakoradi (Left) and Fish processor explaining her view on the oven (Right)

Figure 18 Monitoring at CEWEFIA demonstration site

APPENDIX B: EVALUATION TOOL

PERFORMANCE EVALUATION SURVEY- (AHOTOR OVEN)

QUESTIONNAIRE FOR FISH PROCESSORS (STOVE USERS)

Date of Interview		
Community & Actual location		
District:		**Region:**
GPS Coordinates for the stove location	**Longitude:** **Accuracy:**	**Latitude:** **Elevation:**
Name of Beneficiary		
Telephone Number		
Age:		**No of dependents:**

Section A: Stove Usage

A1	How many fish smoking stoves do you own?	Chorkor: Single Unit [ ] Double Unit [ ]	Ahotor: Single Unit [ ] Double Unit [ ]
A2	How long have you been using the Ahotor oven?	Six months [ ] Five months [ ] Four months [ ] Three months [ ]	Two months [ ] One month [ ] less than a month [ ] Not used it yet [ ]
A3	How long have you been using the Chorkor oven?	Six months [ ] Five months [ ] Four months [ ] Three months [ ]	Two months [ ] One month [ ] less than a month [ ] Not used it yet [ ]
A4	Are you still using the Chorkor oven?	Yes [ ] why…… …….. No [ ]	

		Why…… …….
A5	Which Oven will you prefer?	Chorkor oven [ ] Why?…… ……. Ahotor oven [ ] Why?…… …… None of the above [ ] Why? …… ……..
A6	How often do you use the Ahotor?	7 days a week [ ] 3 days a week [ ] 6 days a week [ ] twice a week [ ] 5 days a week [ ] once a week [ ] 4 days a week [ ] don't use it [ ]
A7	Do you have any challenges with the use of the Ahotor oven? If yes, kindly state them.	Yes [ ] No [ ] 1. 2. 3. 4.
	List of challenges; for interviewer	Difficult to use [ ] Less capacity [ ] Needs continuous maintenance [ ] Resource (Time & Cost) intensive [ ] Other (specify): …….
A8	Despite any challenges, how beneficial is the Ahotor oven to you?	Saves fuel [ ] less burns and accidents [ ] Cooks fast [ ] less respiratory diseases [ ] Reduced smoke [ ] less eye irritation [ ] Saves money [ ] better quality product [ ] Clean working environment [ ] Other (specify) …… …….

A9	Can you give me your opinion about the different components of the stove?	Chimney: …… …… Trays: …… …… Combustion chamber: …… …….. Base: …… …….. Fat Collector …… …….. Combustion grate …… …… Other (specify): …… ……..

Section B: Beneficiary Satisfaction

B1	Would you say this stove meets your processing needs?	Yes [ ] No [ ]
B2	If No, what characters would you wish for the stove to have to make it more comfortable for your use / Any possible improvement suggestions?	1. 2. 3.
B3	If Yes, what characters of the stove are you most satisfied with	1. 2. 3.
B4	Will you recommend the stove to others	Yes [ ] Why…… …… No [ ] Why:

		…… ……..
B5	Based on your experience with the stove, are you likely to purchase more.	Yes [ ] No [ ]
B6	Will you like to replace your traditional stoves with the improved stove or you will like to use both stoves together.	I will replace the former stoves [ ] I will use both together [ ] The improved one will be a support to the traditional stoves [ ] The traditional stove will be a support to the improved one [ ]
B7	What benefits does the Chorkor oven have over the Ahotor oven?	Can take large fish capacity at a time [ ] It smokes fish faster [ ] Easy to work with [ ] Other (specify): …… ….
	Any other comments?	

Section C: Resource Efficiency

C1	Have you noticed any improvements in your resource use, with the use of the improved stove?	Yes [ ] No[ ]
C2	If yes, what are some of these improvements	Use less firewood [ ] Smoking process is faster [ ] Time saving [ ] Less smoky environment [ ] Increased profit [ ] Other (specify): ……
C3	Define your average daily work capacity (Smoking cycle). Amount of fish or tray loads per day.	Fish quantity: Fish cost:
C4	How much (quantity & cost) firewood were you using on average, for a smoking cycle on the Chorkor stove?	GHC: Quantity:

	For soft smoking and for hard smoking (specify)	
C5	How much (quantity & cost) firewood do you use on average with the Ahotor oven for a smoking cycle? For soft smoking and for hard smoking (specify)	GHC: Quantity:
C6	How much time do you use on average for a smoking cycle, when using the Chorkor oven? For soft smoking and for hard smoking (specify)	Less than 3hrs [ ] 6 - 7hrs [ ] 3 – 4hrs [ ] 7 - 8hrs [ ] 4 – 5hrs [ ] 8 - 9hrs [ ] 5 – 6hrs [ ] Above 9hrs [ ]
C7	How much time do you use on average for a smoking cycle, when using the Ahotor oven? For soft smoking and for hard smoking (specify)	Less than 3hrs [ ] 6 - 7hrs [ ] 3 – 4hrs [ ] 7 - 8hrs [ ] 4 – 5hrs [ ] 8 - 9hrs [ ] 5 – 6hrs [ ] Above 9hrs [ ]
C8	In carrying out a normal day's smoking activity, what resources do you need as inputs? State resource, by quantity and by cost. For interviewer: It could be Fish, firewood, labour, fire lighter, transporting fish to processing site	Chorkor Resource Quantity Cost …….. ……. …… …… ……. …… …… …….. …… …… …… Ahotor Resource Quantity Cost …….. ……. …… …… ……. ……

		…… …….. …… …… …… ……
C9	After a normal day's fish smoking activity, how much is the smoked fish worth? Quantity and Cost.	**Chorkor** **Ahotor** Quantity of smoked fish:…… …… Cost of smoked fish: …… ……
C10	What other expenditure is made from net to plate for fish smoking?	**Chorkor** Transportation of fish to market: GHC Cost of packaging fish: GHC Other (Specify): **Ahotor** Transportation of fish to market: GHC Cost of packaging fish: GHC Other (Specify):
C11	What was your average income per week when you were using the Chorkor oven?	Below GHC50 [ ] GHC150 – GHC199 [ ] GHC50 –GHC99 [ ] GHc200 – GHC 249 [ ] GHC100 – GHC149 [ ] GHC250 – GHC300 [ ] Other (specify): ……..
C12	What is your average income per week when you use the Ahotor oven?	Below GHC50 [ ] GHC150 – GHC199 [ ] GHC50 –GHC99 [ ] GHc200 – GHC 249 [ ] GHC100 – GHC149 [ ] GHC250 – GHC300 [ ] Other (specify): ……..

Section D: Financing

D1	What will be a realistic stove price for you?	GHC:
D2	What payment plan will you prefer?	Personal Cash [ ] Loan from FI [ ] Savings with FI [ ] Instalment: [ ]

		Other: …… ……..
D3	Will you want to make your payment through a Finance Institution?	Yes [ ] No [ ]
D4	If yes, which Finance Institution do you prefer?	
D5	Would you propose another financing medium as more preferable to you?	

Section E: Satisfactory Construction Process

E1	Would you like to always work with the team that constructed the stove for you?	Yes [ ] No [ ] Why
E2	If the answer to E1 is Yes, please explain what you liked about the construction team	
E3	What are the challenges you had with the construction team?	Delayed construction [ ] Poor quality of work [ ] Poor interpersonal relations [ ] Other:
E3	What characteristics will you propose for an ideal construction team?	Specify

General Observation On Stove Quality (Tick Yes √ / No X)

Specifications	**Tick**	**Specifications**	**Tick**
Stove base is according to standard dimensions and in good condition		Fat collector is in use and in good condition	
Brick combustion chamber is in good condition		Hood is in use and in good condition	
Number of trays up to 20		Combustion grate is in use	
Trays are according to standard dimensions		Trays in good condition	

Personal Observation

Beneficiary Preference:
Stove quality: