KENYA SPECIFIC E-COOKING APPLIANCES PROJECT

Figure 1: E-Appliances courtesy Agnes Kalyonge

Produced by: KISAMBARA VENTURES LIMITED & JIKONI MAGIC

For: FCDO and Loughborough University

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eCooking Capacity Building & Market Development Programme (eCAP)

The eCooking Capacity Building & Market Development programme (eCAP) was implemented in 2023 as a partnership between Kenya Power and two UK-Aid-funded programmes, MECS and UK PACT. eCAP was managed collaboratively by Kenya Power and MECS via the STEER (Sustainable Transitions in Energy, Environment and Resilience) Centre at Loughborough University, UK and Gamos East Africa, Kenya.
Kenya Power owns and operates most of the electricity transmission and distribution system in the country and sells electricity to over 9 million customers. Kenya Power's *Pika na Power* (Cook with Electricity) campaign aims to stimulate demand for electricity and increase the social and environmental impacts of electricity access.

Modern Energy Cooking Services (MECS) and United Kingdom Partnering for Accelerated Climate Transitions (UK PACT) are UKAid-funded programmes with the shared vision of supporting Kenya to transition from unsustainably harvested biomass to renewably-generated electricity.
eCAP aims to accelerate the uptake of eCooking in Kenya by building the capacity of key market actors and driving forward the development of a sustainable eCooking sector by:

- Developing institutional capacity within Kenya Power
- Designing and implementing a pipeline of scalable activities in parallel with the Kenya National eCooking Strategy (KNeCS)
- Identifying pathways for scaling up the *Pika na Power* campaign
- Bringing together Kenya's clean cooking and electricity access sectors to empower a network of eCooking Champions.
- Generating evidence on the role of eCooking as a tool for stimulating demand and increasing the social impact of electricity access to inform decision-making by Kenya Power's Board of Directors

For more information on eCAP, visit www.MECS.org.uk.

EXPLANATION OF TERMINOLOGIES

- Frying: cooking food in hot fat or oil, typically in a shallow pan
- Shallow frying: a method in which you fill a shallow pan with oil, let it bubble and heat up, and place the food in the pan, making sure that the food sizzles as soon as it hits the pan.
- Sauté: a method of cooking that uses a relatively small amount of oil or fat in a shallow pan over relatively high heat.
- Stir frying: Chinese cooking technique that involves cooking food over high heat in a wok, similar to the French technique sauté. Constantly tossing the ingredients allows the food to become crispy without getting scorched.

LIST OF ABBREVIATIONS

EPCs : Electric Pressure Cooker
LPG : Liquefied Petroleum Gas

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EXECUTIVE SUMMARY

Introduction:

There has been, in the recent past, a proliferation of energy efficient cooking appliances in the Kenyan market and this has been as a response of the growing interest by the Kenyan populace in clean cooking. However, these appliances are not specifically suited for the local consumer because majority of them tend to have menus that are more suited to their countries of origin. They, therefore, might have foods or cooking processes that are not familiar to Kenyans, for instance, sous vide (means cooking under vacuum) is not a method that most Kenyans would use to cook their foods.

In this project, Kisambara Ventures undertook the task of providing the international manufacturers with tips on how to modify their appliances to suit the Kenyan consumer and the cooking culture. This was done using the following two ways;

1. Testing different popular Kenyan foods against generic functions on the energy efficient appliances to see which ones would be a near perfect or perfect match. This resulted in interesting finds like having Minji (garden peas) stew cooking very well on the oat setting (which, not most Kenyans cook).
2. Deploying a questionnaire to 20 participants in order to gather data that was aimed at providing tips to manufacturers on what the consumer on the ground values on their appliance and what is considered redundant. This ranged from the functionalities, accessories that come with the appliances to safety of the gadgets. We also gathered data on how the consumers would like to have the instructions packaged for them, this included local language and pictorials.

Objectives of the Project:

Kisambara Ventures' Limited aim in this project was to enable the international appliance manufacturers to develop and produce appliances that are well adapted to the Kenyan cooking culture. The aim of this project is to also help them to better understand what Kenyans mostly cook and the best ways in which they can communicate their product's functionality to their target market. We achieved the objectives in 3 main ways;

1. **Appliance modifications:** Produced a set of tips to enable manufacturers produce products that have menus and functionalities that are tailor made for the Kenyan market
2. **Typology of Kenyan Cuisine:** We developed a typology of Kenyan cuisine listing the most popular Kenyan foods and sample recipes for each category of cooking process. Popular international dishes that follow similar cooking processes to Kenyan foods were identified and the compatibility with different types of energy-efficient appliances.
3. **Brand-neutral social media content:** We produced unbranded content geared towards showing both the Kenyan consumers and the international manufacturers how cooking of local popular foods compares across different energy efficient cooking appliances.

Methodology:

We started by conducting a literature review that enabled us to categorize Kenyans into different ethnic groups and their predominant cultural practices. This, in turn, helped us develop a typology of Kenyan cuisine which shows a list of foods that are typically cooked in Kenyan homes and their different cooking processes. This typology, summarized in the table below, also shows how different foods are compatible with different e-cooking appliances.

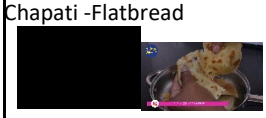
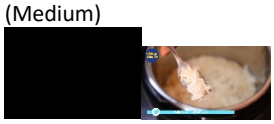
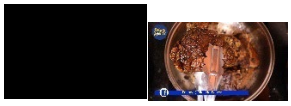
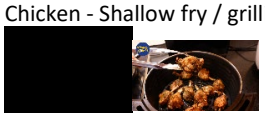
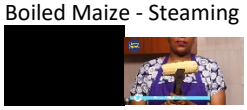
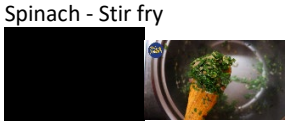
				COMPATIBILITY WITH ENERGY EFFICIENT APPLIANCES			
			INTERNATIONAL EQUIVALENT	EPC	RICE COOKER	INDUCTION COOKER	AIR FRYER
FRY	Stir fry	Green leafy vegetables, cabbages,eggs	Callaloo (Jamaican amaranth)				
	Deep fry	Mandazi (donut) Fried chicken,chips(bhajia) fish,omena, peanuts	Beignets (American) vs donuts or mandazi, puff puff (Nigerian) and liquamats (Arabic) vs kaimatis (East African) Bhajia (Indian) has similar cooking process in Kenya and India				
	Shallow fry	Sausages, chicken, chicken wings plantains, Fish, bacon, katlesi za nyama na kuku	Tostones (Mexican made using plantains), Cutlets (stuffed potatoes, coated with breadcrumbs then shallow fried vs katlesi)				
	Dry fry	Peanuts, sim sim, kumbe kumbe (Termites / flying insects)	honey sesame seed bars (pastelli - Greek) and sim sim balls Kenya				
FRY, BOIL & SIMMER	Short	tomato egg stew	Bhurji has similar cooking process in Kenya and India				
	Medium	cereals (kamande, ndengu), omena, roots (nduma), beef, green bananas (matoke) potatoes, omena, soft cuts of beef, pilau.	Moong dal curry (Indian) vs Ndengu (Kenyan)				
	Long	Beans, Matumbo (tripes), meat dishes (aliya, matumbo, oxtail, osso bucco, short ribs, shanks (Chinese hot pot broth), githeri (muthokoi), kienyeji chicken,	Aliya (for the Luo community) vs beef jerky (American). chilli con carne				
BOIL & SIMMER	Short	Tea, porridge, minji, spaghetti, eggs	African mixed chai (Indian chai with tea leaves, milk and spices)				
	Medium	Ndizi mzuzu (plantains), potatoes, boiled maize, whole peanuts, nzenga (crushed maize), rice	Samp (south African) and Nzenga kenya, ndizi mzuzu za nazi vs ladob banan (Kreol dessert)				
	Long	Peanut sauce	Satay sauce				
ROASTING /GRILLING	Medium to Long	Beef, chicken, maize, ngwaci, arrow roots, fish Mutura, Mbuzi choma	Black pudding vs mutura				
STEAMING		Ngwaci, green maize, nduma, green bananas, pumpkins	Tamales (Mexican food e,g., beef, wrapped in maize husks), Luwombo (Ugandan chicken in banana leaves), Kai Hor Bai Tong (Chicken in Banana Leaves)				
FLAT BREAD	Short	Chapati, pancakes, vibibi	paratha compares to chapati. Chitau pitha - steamed rice pancakes from Odisha in eastern India compares from kibibi in Kenya				
SHALLOW FRY	Medium	Vitumbua	Takoyaki from Japan				
TRADITIONAL BAKING		Mkate wa sinia (rice and coconut cake),	Chinese coconut sweet rice cake vs makte wa sinia				

Fully compatible with the cooking processes

Partially compatible with the cooking processes

Not compatible with the cooking processes

Kisambara also produced 9 videos that are brand neutral for social media and they showcase how different foods can be cooked in different appliances and their compatibility. For instance, we demonstrated how eggs can be boiled in different appliances, namely: rice cooker, air fryer, electric pressure cooker (EPC) and induction cooker. We gave tips on how to have them come out successfully on each appliance. The same was done for rice, chapati, etc.

BRAND NEUTRAL RECIPE VIDEOS / COOKING PROCESS	**DESCRIPTION**	**RESULTS & USER EXPERIENCE**
Chapati -Flatbread 	Flat bread made using wheat flour and is often shallow fried on a flat pan	The chapatis from the induction cooker were soft, flaky just the way Kenyans love them. This was the **best suited** appliance for cooking chapatis.
Rice - boiling / simmer (Medium) 	This is a cereal grass that can be boiled, stir fried with vegetables or meat, or cooked aromatically like pilau	The induction cooker yielded good rice that had a water to rice ratio at 2:1.
Beans - Long boiling / stewing 	These are legumes that are usually boiled and then finished off in a tomato based stew or as a mixture with maize known as githeri	It was a simple process in the EPC and the best suited because it was fast and efficient on time, cost and energy consumed.
Mbuzi - Grilled 	This is goat meat which can either be grilled, stewed or dry fried.	The goat was cooked very well in the air fryer and it gave us well cooked, crispy mbuzi.
Eggs - Short boiling 	They are either boiled, shallow fried or stir fried.	All the appliances rated very well in terms of user experience because the eggs were just dumped and forgotten until they cooked.
Chicken - Shallow fry / grilling 	This is part of the chicken's breast quarter. Prepared by grilling, cooking in soup or deep frying.	The best wings were from the air fryer because they were crispy on the outside while still remaining moist and juicy on the inside.
Boiled Maize - Steaming 	Soft green maize is often boiled or steamed either with or without the husk.	All the appliances were hassle free with the EPC being slightly in the lead because it was the most energy efficient.
Spinach - Stir fry 	Large green, leafy vegetables. They are often stir fried and eaten with ugali or a starch of choice.	The rice cooker and induction cooker were fast and best suited in this test.
Mkate wa Sinia – Tradit. baking 	A rice cake that's full of fresh coconut and freshly ground cardamom.	The air fryer yielded the best results, springy / spongy cake that was browned on top, (mimicking the traditional baking results that are desired).

A questionnaire was developed that was used to gather data from 20 participants to inform electric appliance manufacturers and the clean cooking sector in Kenya as a whole. 18 out of the 19 EPC owners considered functionality as a very important factor when purchasing their appliances. This is important because we also got insights into what consumers like in their devices, the redundant functionalities, which appliances are most owned, among others. We found that some of the generic functions that come with these devices are rarely

used or in some instances, not at all. For example, slow cook and congee in the EPC and the milk function on the induction cooker. We also found out that a beginners guide to using the e-appliances would be appreciated and have given our detailed suggestions on how to go about it.

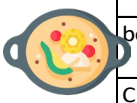
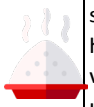
Based on the importance of functionalities by the participants and the typology that we developed, we came up with a mock-up of what we envisioned as the ideal interface of an EPC and air fryer mock up that would cater to the needs of most Kenyans. It has two columns for the EPC (to represent wet cooking) and air fryer (to represent dry heat cooking).

The appliance will be sold as an EPC and air fryer lid separately. This was felt to be the best option for a consumer, depending on their financial situation and cooking needs, because they can start by purchasing the EPC first, and then later the air frying lid.

<table>
<tr><td></td><td colspan="3">EPC INTERFACE / AIR FRYER INTERFACE</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>PRESSURE COOK</td><td colspan="3" rowspan="3"></td><td>AIR FRY</td></tr>
<tr><td>SAUTE/ KUKAANGA</td><td>SCONES</td></tr>
<tr><td>PRESSURE COOK / MANUAL</td><td>CAKE / KEKI</td></tr>
<tr><td>RICE / MCHELE</td><td colspan="3" rowspan="2">START</td><td>CHIPS / VIBANZI</td></tr>
<tr><td>BEANS / MAHARAGWE</td><td rowspan="2">TIMER</td><td rowspan="2">TEMP</td><td>CHICKEN / KUKU</td></tr>
<tr><td>MEAT / NYAMA</td><td>BEEF / NYAMA</td></tr>
<tr><td>BROTH / SUPU</td><td></td><td></td><td></td><td>SAUSAGES</td></tr>
<tr><td>UGALI</td><td rowspan="2"></td><td>TEMP</td><td rowspan="2"></td><td>FISH / SAMAKI</td></tr>
<tr><td>CHICKEN / KUKU</td><td>TIMER</td><td>PASTRIES</td></tr>
<tr><td>STEAM / MVUKE</td><td></td><td></td><td></td><td>PIZZA</td></tr>
<tr><td>MATOKE</td><td>FISH</td><td>KEEP WARM</td><td>CANCEL</td><td>VEGETABLES / MBOGA</td></tr>
</table>

Mock-up of Ideal EPC / Air Fryer Interface

In addition to the ideal EPC / Air fryer interface mock-up we came up with a sample of a sticker that can be stuck to the side of the appliances for easier understanding of the typical settings to use for popular Kenyan foods.

STICKER FOR IDEAL EPC					
PRESSURE COOK / MANUAL			**AIR FRYER**		
Rice / mchele		Brown 22 mins	Scones		180 - 200 C FOR 8 - 15 Mins
		White 12 mins	Cake / keki		160 C 30 Mins
Githeri & Beans / maharagwe		Mbaazi 30 mins			
		Ndengu 15 mins	Chips / vibanzi		200 C 1- 22 Mins
		Wairimu 20 mins			
		Yellow beans 40	Chicken / kuku		180 - 200 C FOR 20 Mins
		Njahi 60 mins			
Meat / nyama		Osso bucco 45 mins	Meat / nyama		180 - 200 C 25 Mins
		Ox tail 45 mins			
		Aliya 1 hour	Sausages		
		Athola 35 mins			180 C FOR 7 Mins
		Matumbo 45 mins	Fish / samaki		Fillet 180 C 8 - 10 Mins
		Beef 20 mins			Whole tilapia 200C 35 mins
			Pastries		Meatpie 180 C 15 - 28 mins
Broth / supu		pork bones 4 hours			Cookies 180 C 12-15 mins
		beef bones 4 hours			Cinnamon rolls 180 C 15 mins
		Chicken bones 2 hours			Puff pastry 180 C 7 Mins
Ugali		15 minutes; Requires special setting. Initial high heat to boil water and pound ugali. Five minutes lower temperstures to bake ugali	Pizza		170 C for 20 mins
Chicken / kuku		Kienyeji 30 mins			
		Broiler 15 mins	Vegetables / Mboga		Carrots180 C 10 - 20 mins depending on if it's glazed or steamed, etc.
Steam/mvuke		Nduma, Ngwaci 20 mins			Broccoli 180 C 10 Mins
		maize (mutungo), potatoes 10 mins			Miciri (French Beans) for 190 C
		Eggs 5, Broccoli 5			Roast potatoes 195 C for 10 mins
		Carrots, Minji, Miciri 1 - 3 minutes			Ngwaci (Sweet potatoes) 200 C 30 - 35 min
Matoke		Minji stew, matoke stew, potatoe stew			
Fish		Omena 5 mins			
		Tilapia whole 10 mins			

Recommendations:

Recommendations	Description

Combine generic functions	One generic function can be set optimally to cook foods that cook in a similar manner. For example, githeri / beans button could include different types of cereals.
Use of pictorials	It will eliminate any confusion that might arise because a picture of a chicken can never be confused with green leafy vegetables.
Include braille feature	This will cater to the visually impaired members of the society.
Set the generic function to mimic the local cooking process	There are local foods that require an intricate balance of cooking temperatures and if possible should have a button dedicated to them. E.g., Ugali
Have a local menu	Remove generic functions which are redundant or have them replaced by popular Kenyan foods.

Further recommendations for EPCs, air fryers, rice and induction cookers.

Top and bottom heating elements for air fryers:	Should be introduced into the Kenyan market because food will cook much faster and also eliminate the need to shake the food midway through cooking.
Add more functionalities to the rice cooker:	Having more functionalities other than keep warm or cook was found to be desirable for more versatility (e.g. fry).
Make some accessories optional	Our recommendation would be for the manufacturers to sell some of the less used accessories as optional.
Have beginners' manual and recipe booklets as QR codes:	The manufacturers can have both the manual and recipe book as soft copies downloadable via a QR code.
Full insulation for safety and energy efficiency	Manufacturers should fully insulate their appliances in order to keep their users safe and to provide them peace of mind whenever they use them.
An extra inner pot	Extra inner pots should be available, but as an optional additional accessory instead of being part of the package to reduce the upfront cost to the consumer.

Conclusion:

There is a huge untapped market for energy efficient cooking appliances in Kenya, however can be due to the language or operational aspects can present substantial barriers. The findings and recommendations from our report are multi-pronged because they will enable the manufacturers unlock the barrier that exists between the consumers and their products and, at the same time, have the consumer fully embrace and utilize the appliance. Manufacturers can start by incorporating the idea of using the stickers because it is a lower investment cost as opposed to overhauling the entire user interface. More research and development is required to build upon the modification tips provided in the report in tailoring specific appliances to suit the Kenyan market.

TABLE OF CONTENTS

1. INTRODUCTION

Clean cooking has been garnering a lot of interest from Kenyans and some manufacturers have introduced energy efficient cooking appliances in the market to meet the growing interest. However, these are usually generic and more suited to their countries of origin as opposed to the Kenyan market. These appliances usually cater to the majority of common cooking needs the world over such as sautéing, meat, chicken or even rice. Nonetheless, manufacturers tend to tweak appliances to suit the needs of the regions they're targeting. For example, congee, rice porridge, is popular in the Chinese culture while in Kenya it is not a widely known meal.

Apart from what has been mentioned above, the uptake of e-appliances has also been hampered by a lack of understanding that accompanies the devices. This ranges from the instruction language to the complexity of operation.

In this project Kisambara carried out some tests to see what modifications could be made to the appliances for them to better suit the Kenyan cooking culture. This was done in two ways;

1. We tested popular Kenyan meals on some of the already existing generic functions to see how suitable the functions could be. From here we gave suggestions of some of the modifications that could be done which in some instances would simply mean changing the label on the program menu. For example, minji (garden peas) and potato stew cooked very well on the oatmeal setting, which is not as popular in Kenya.
2. A questionnaire was developed by Kisambara Ventures whose main aim was to collect data that would provide a set of tips to help manufacturers in their quest to modify their appliances to suit the Kenyan market. The information that was gathered will help guide manufacturers on what functions to keep in their appliances, the ones to be removed, enhanced or even which generic functions could be substituted for local foods. Over and above this, we also got data that gives tips to the manufacturers on how to best communicate the functionalities to consumers of their products, for instance, the language used or pictorials.

Kenya is made up of different ethnic groupings that have a variety of dishes that are similar yet different in the styles of their executions when cooking them. Some foods are more popular in certain regions when compared to others. For example, fish is very popular at the coast, western and Nyanza regions as compared to the central region. At the same time, the style of cooking this fish varies between the regions. The coastal region tends to grill their fish more while the Nyanza and Western regions tend to deep fry their fish. To address the above issue, Kisambara ventures developed a typology of Kenyan cuisine that showed the most common types of dishes cooked by Kenyans at home, with a selection of sample video and written recipes for each type. At the same time, we came up with reference points by identifying popular international dishes that follow similar cooking processes to the local foods, and how compatible each type of dish is with different types of energy-efficient appliances.

Kenyans tend to be set in their ways when it comes to how they want certain dishes cooked. For example, when it comes to cooking nyama choma, it usually goes without saying that it will be grilled over charcoal. Kisambara Ventures produced brand neutral videos using a variety of energy-efficient electric appliances which could be used as teaching material for the Kenyan public. The videos demonstrate that some foods, for instance, nyama choma, can be cooked across a variety of appliances, not just the air fryer which closely mimics what charcoal does. These videos could also be used as research material for manufacturers to reference in order to make their appliances more suitable for the Kenyan market.

1.1. Aims of the project

Kisambara Ventures Limited aim in this project was to support international appliance manufacturers to be able to develop and adapt their e-Cooking products and services to suit the Kenyan cooking landscape. In addition, we also aimed to help them to better understand what Kenyans mostly cook. And, finally, to propose the best ways in which they can communicate their product's functionality in ways that are easy for the Kenyan consumers to understand.

1.2. Objectives of the project

1.2.1. Appliance modifications:

To Produce a set of tips showing that the e- appliances that land in the Kenyan market can be made more suitable for the Kenyan market as opposed to having generic functions that do not really resonate with most Kenyan consumers.

1.2.2. Typology of Kenyan Cuisine:

Develop a typology of Kenyan cuisine that lists the most popular or common foods that are usually cooked in Kenyan homes. In addition, come up with sample recipes for each typology type while also identifying popular international dishes that follow similar cooking processes and how compatible they would be with different types of energy-efficient appliances.

1.2.3. Brand-neutral social media content:

Produce unbranded content to demonstrate to Kenyan consumers as well as the appliance manufacturers how these popular Kenyan dishes can be cooked with these new modern energy-efficient appliances.

2. METHODOLOGY

The following are three ways in which we realized the success of the project: - include numbering of points below

2.1. Appliance modifications:

We engaged in the following two activities that enabled us to unlock the needs of Kenyans or what they highly desired when it comes to the energy efficient appliances in the market. They are as follows;

2.1.1. 20 Participants Questionnaire:

2.1.1.1. Overview of approach:

We carried out interviews of 20 participants to find out user experiences of electric cooking appliances. The criteria that qualified the participants for the survey was owning an energy efficient cooking appliance for more than six months.
The questionnaires were recorded on Kobo Toolbox.
The survey was developed and administered by Kisambara Ventures Limited and covered a range of areas including:

- Length of appliance ownership
- Appliances owned by participants
- Functionality, cost, ease of use, as a factor of importance
- What their ideal appliance would look like
- Most used features on their appliances

2.1.1.2. Participant selection criteria:

Kisambara ventures sells EPCs and therefore it was easier for us to get participants from our existing list of clients who've owned them for more than 6 months and from there leveraged our social network to find more participants who owned other appliances like the rice cooker, air fryer and induction cookers.
Our aim was to find out what functionalities and features that they valued or thought were of least importance to them so that we could use that data to inform appliance manufacturers on the way forward.
We went for a questionnaire because we needed to get feedback from people who had owned their appliances for an extended period of time and had gotten to figure out what they liked or didn't like in them. This was important because it was going to give the real situation on the ground.

2.1.1.3. Challenges and Limitations:

Some participants did not have proper smartphones so we had to improvise to get them to fill the survey. This was tackled by calling them and having them answer our questions as we filled out the forms on their behalf.

We had to buy internet bundles for some so that they could fill and submit the forms.

When the questionnaires were developed the assumption was that they would have been easily understood and that the participants could easily handle them. However, our expectations were not met 100%. Some of the participants did not read the instructions properly, hence the reason why we had some errors in the data collected. For instance, some participants failed to read the hint to the answer for the question that concerned

length of ownership. It required someone to answer in months and not years. Some of them ended up by saying that they had owned EPCs for 2 months while in reality it meant two years.

2.1.1.4. Findings and Analysis:

The following graphs illustrate the data set that was collected in Kenya, demonstrating the personal preferences of 20 respondents who use electrical appliances for cooking. All percentages refer to the total number of respondents, although not all questions were answered, so where the percentages across a given question do not add up to 100%, refer to the original data set which will show the questions that remained unanswered. 100% in the case of the following graphs, refers to the 20 applicants that completed the questionnaire. When referring to respondents, this simply means those who participated in the questionnaire.

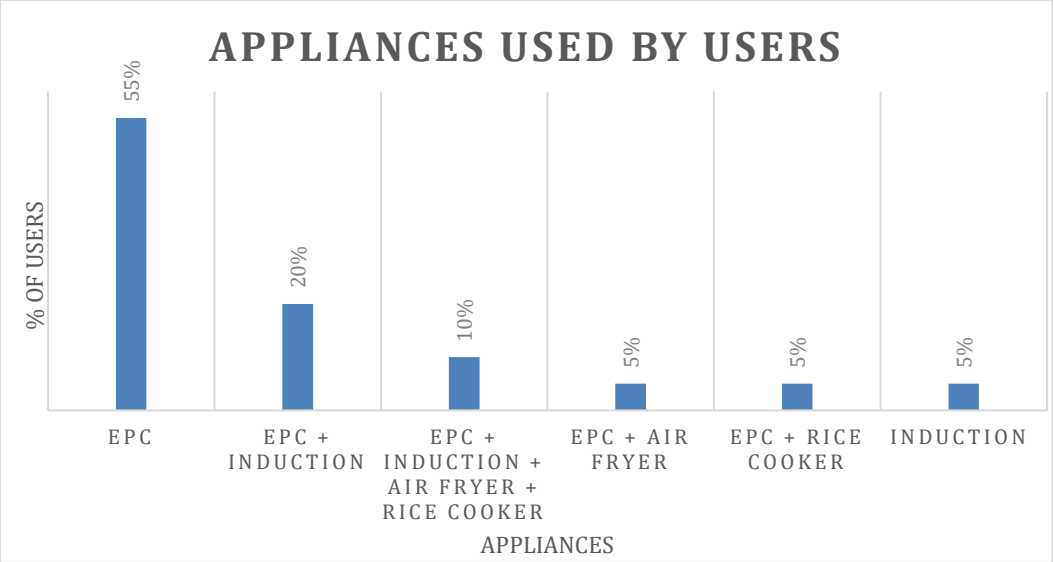


Figure 2: Combination of Appliances owned by 20 Participants

Figure 2 shows the percentage of appliances used in combination with one another, according to the individuals who answered the questionnaire. As the graph highlights, EPCs are the most commonly used electrical appliance and when another appliance is used, EPCs tend to be always used alongside them.

The high number of the people who own EPCs is due to the fact that we targeted people who owned them as a criterion for being participants in the questionnaire. This was due to the fact that Kisambara sells EPCs and it was easier to have that as a starting point and then advance to others who owned other appliances like the air fryer, induction and rice cookers.

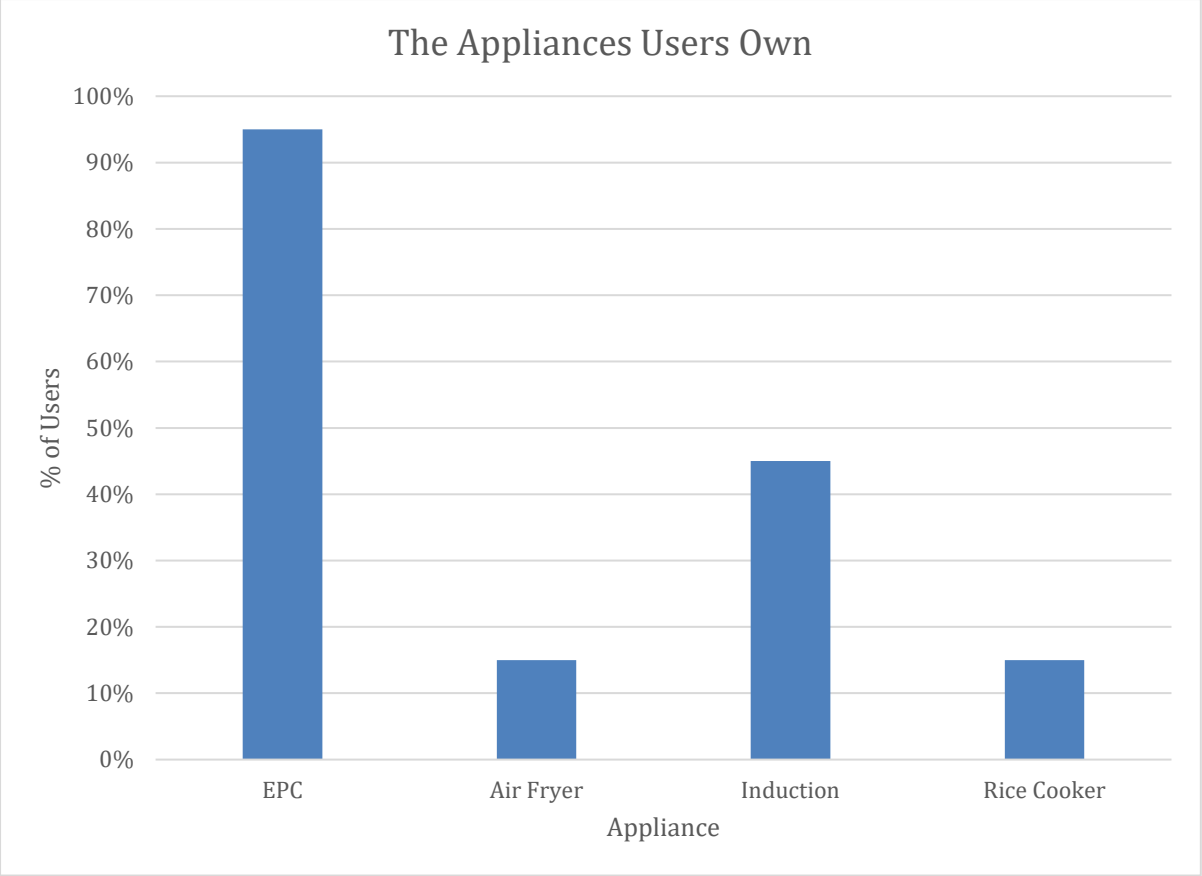


Figure 3: Individual Appliances Owned by 20 Participants

Figure 3 indicates that amongst the 20 respondents, 95% of them use an EPC. This graph only indicates the solitary use of an appliance however the original data set and figure 1 indicate that an air fryer, induction cooker and rice cooker are often used alongside an EPC.

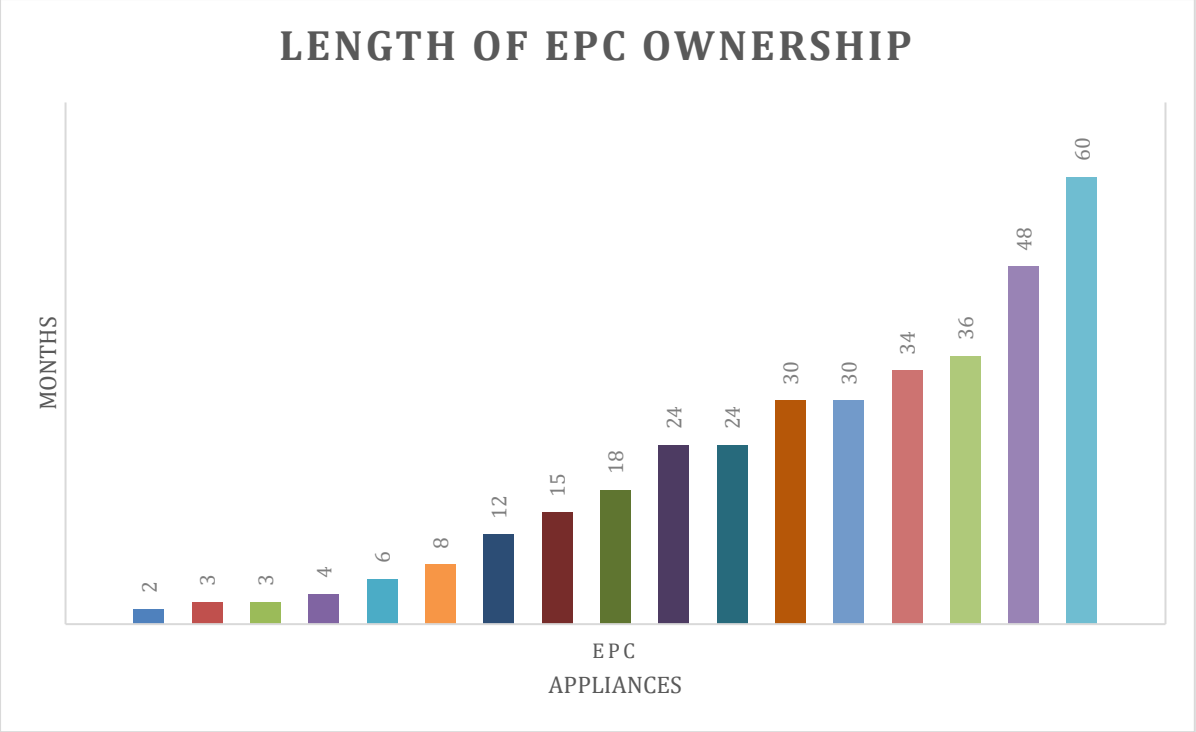


Figure 4: Length of EPC Ownership

Figure 4 displays the length of time the respondents have owned an EPC. Only this appliance has had a graph created for this question as the other appliances had a much smaller data set. However, if we were to compare the data set for this question across appliances, it is evident that EPCs have been owned for much longer, with an average of 21 months, compared to the other three appliances which have an average of 2 months.

The criteria for selecting the participants of the interview was having owned an EPC for more than 6 months. Therefore, there was an error with the ones who stated that they've owned the EPC for between 2 to 4 months. This error was picked up after analysis had been completed. The figures of 2 – 4 years are indicative of years owned as opposed to months. The correct figure should have been between 12 – 48 months.

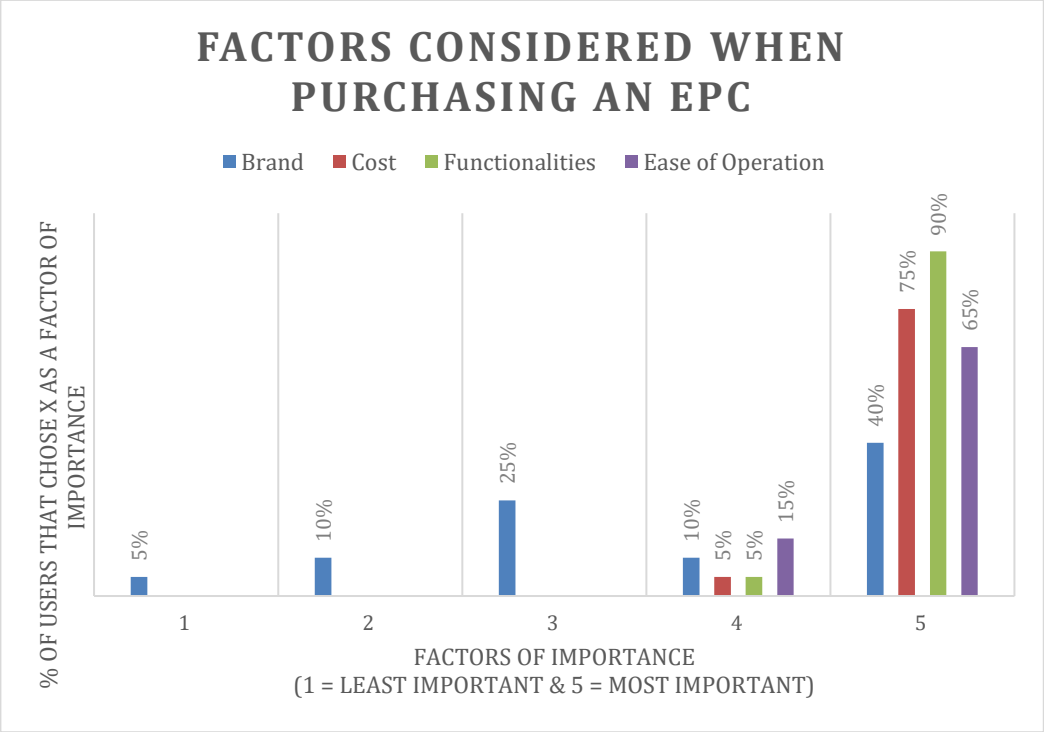


Figure 5: Factors Considered When Purchasing EPC

Figure 5 highlights the factors individuals consider when purchasing an EPC. The key at the top of the graph illustrates the feature, while the numbers at the bottom of the graph on the x-axis demonstrate the factors of importance which were used to measure the respondents [preference]. The graph shows that the respondents found the functionalities, cost and ease of operation of an EPC to be some of the most important factors when deciding to buy the appliances whereas respondents varied quite substantially when it came to the branding of the EPC, which appeared to be the least important choice factor. The biggest determining factor for choice of EPC was functionality.

All the participants that we interviewed bought their EPCs from us. The features that they all have in common are as follows; Sautee or shallow fry, meat, rice, slow cook and delay timer. One of the EPC brands has a localized menu that features common foods that are cooked in Kenya like ugali, ndengu, kienyeji chicken, matumbo. A feature that is very attractive to enthusiasts of brown rice is the brown rice function. This rice is usually difficult to get just the right results. The feature guarantees the owners of this EPC perfect results each time.

Most clients who buy EPCs from us always, without failure, ask about the functions that are found within the gadget. They gravitate to the ones that have beans, meat, chicken to start with. From there they ask for the other functions of yoghurt and cake.

The actual brand of the EPC is not usually a feature that is really considered because there are many consumers who purchase theirs from down-town areas where the warranties are not usually issued and after sales services are not guaranteed. In addition to this, most big name brands are usually priced out of most consumers' financial ability. Meaning that, in as much as they would want to go for all the added benefits of after sales service or assurance of quality they just cannot stretch their finances that far. So they end up purchasing any brand of EPC as long as it offers them the functionalities they are after.

Out of all the brands we sell, ease of operation is reported by the people as very important. They prefer interfaces that are very intuitive as compared in their operations.

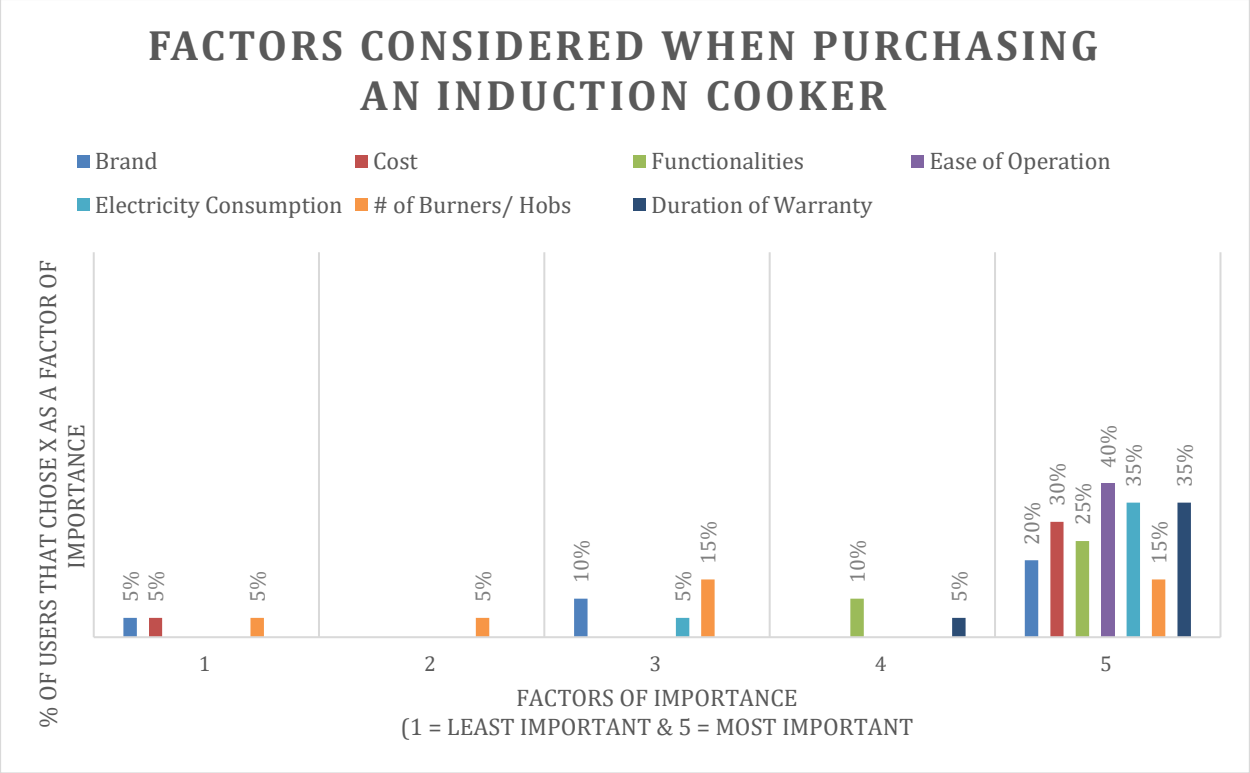


Figure 6: Factors Considered When Buying Induction Cooker

Figure 6 shows the factors individuals may consider when purchasing an induction cooker. Figure 5 accounts for brand, cost, ease of operation and functionalities but it also looks at electricity consumption, number of burners/ hobs and duration of warranty as factors that the respondents may consider when purchasing. The figure indicates that cost, ease of operation, electricity consumption and duration of warranty were the factors the respondent considered most strongly when buying an induction cooker. Overall, there were less strong preference than EPC features. The number of burners on the other hand, seem to be of the least important factors when buying an induction cooker. The Induction cooker is often looked at as a replacement or emergency stand in for when the LPG runs out as someone is cooking. It is usually not bought for long cooking foods, only the medium to short / fast cooking foods like ugali, eggs, vegetables, etc.

One of the reasons that more than one burner mightn't be desirable is the fact that the people who own them already have LPG stoves that have two burners on most occasions. This relegates the induction to a secondary role in the kitchen because the owners can already cook more than one meal on their LPG as it stands.

Duration of warranty is always important because of the fact that it's made of ceramic on top and most people find them to be fragile and hence need the assurance that they are covered in case of anything happening. In addition, most people expect a one-year warranty as the bare minimum.

Electricity consumption in induction cookers is also of importance because of the perceived high consumption of energy by any e-appliances. The participants we talked to were concerned with how high the bills were likely to be, hence why they mostly reserve it as a back-up for LPG running out.

Ease of operation and functionalities did not rank very high because all what the participants are looking for in their induction cookers is the fact that it can sauté or boil their food quickly. Most of the participants weren't able to name any of the functions found on their induction cookers without having to look at them.

We inquired from the participants why the brand was ranking low in their rating or ranking the induction cooker's desired features and the feedback was that the majority of the ones in the market were not popular brands or brands that they are used to seeing or hearing about. The major distributors (apart from Ramtons who

had two participants out of the seven who owned induction cookers) do not have induction cookers as one of their stock items.

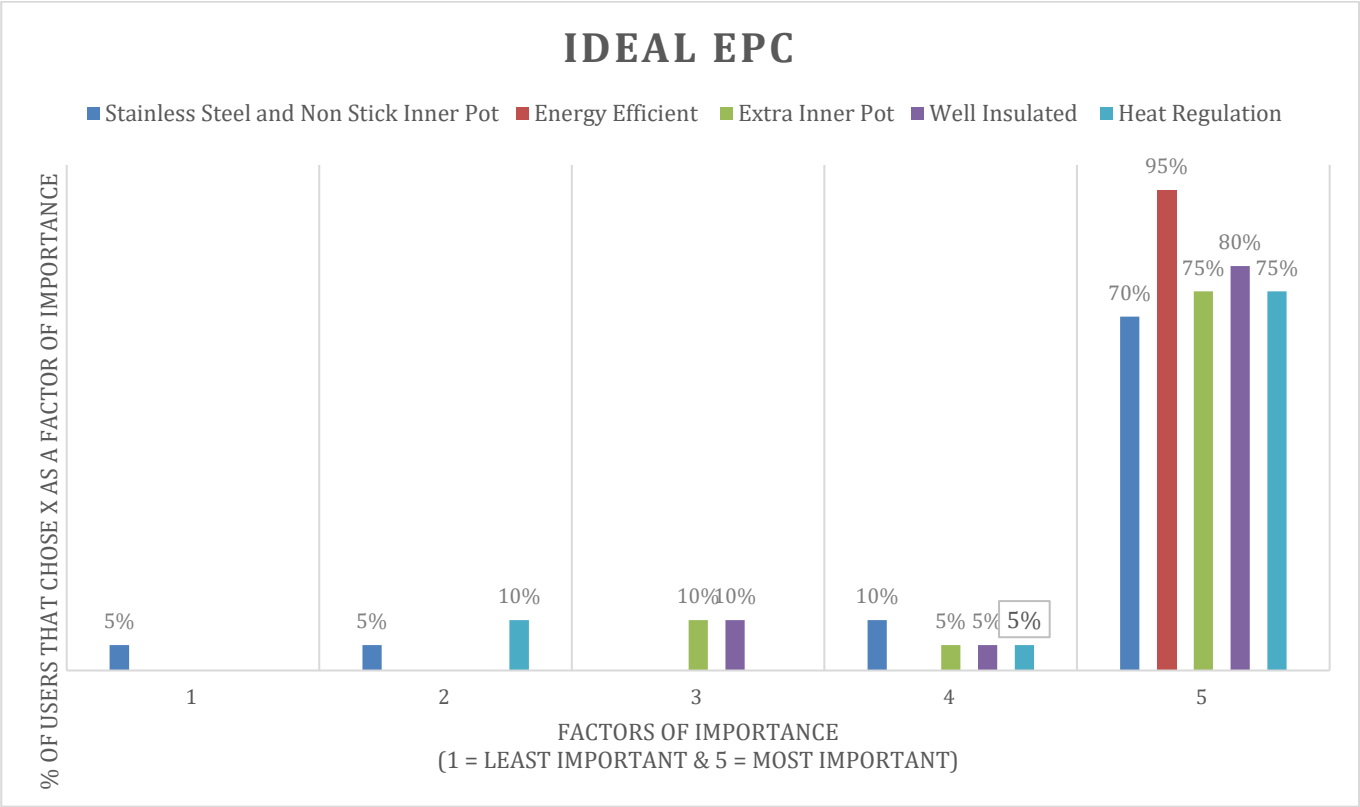


Figure 7: Ideal EPC

Figure 7 communicates the importance of certain features and whether they would result in an EPC being ideal for respondents and their individual needs. The data firmly shows that all 5 features would create the ideal EPC, and respondents felt strongly about all five features.

This can be analysed alongside Figure 9, which displays the most used features of an EPC. For example, it shows that 75% of the respondents would prefer an extra inner pot which matches the data from Figure 6, which portrays that an extra inner pot would make the appliance ideal. From the above graph, it can be seen that energy efficiency and proper insulation are very highly desired by the participants that we interviewed with both rating at 95% and 80% respectively. Safety came across as a key concern for the participants hence the reason why insulation ranked very high. The most ideal was said to be one that would be very well insulated both on the sides and the entire lid. There are some brands that have partially insulated lids which can cause serious burns to the users if someone becomes distracted for even a moment.

The participants who chose having both a non-stick and stainless steel inner pots said that this was to ensure that their cooking needs were met in one cooking appliance. There are some foods like the ones that are made using sweet sticky sauces that cook best in non-stick pots. This is a different scenario from the ones who would prefer to have an extra inner pot regardless of it being stainless steel or non-stick. This, they said, was due to the fact that they prefer to be able to cook a second meal without necessarily having to clean out the one they have just finished using. They also expressed a desire to be able to use the inner pots as serving dishes because of the convenience of not having to keep washing them for different meals.

As we were interviewing the participants, they expressed a desire to have the ability to regulate the heat of the EPCs because it enables them to control the rate at which their foods cook. There are some foods that require low heat for simmering and others that require high boiling temperatures.

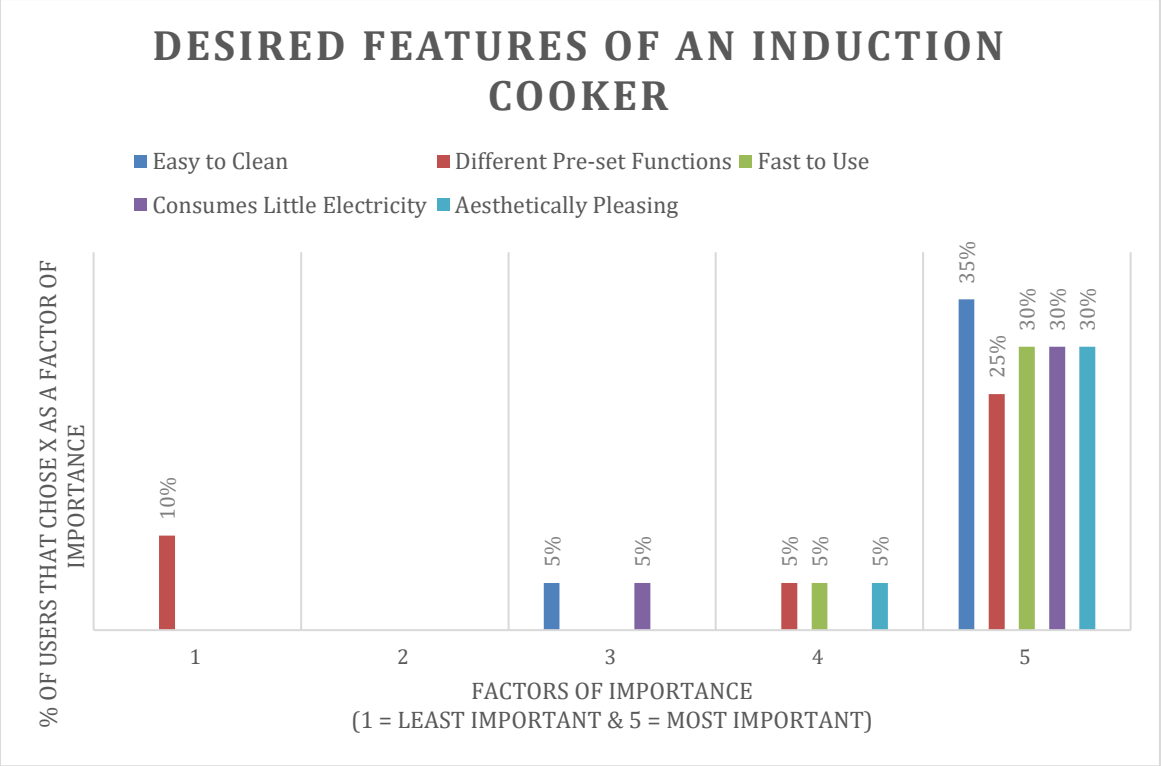


Figure 8: Desired Features of an Induction Cooker

Figure 8 goes on to illustrate the features respondents like on an induction cooker. There seems to be a general consensus amongst the respondents that all 5 features are more or less equally liked.

The respondents expressed the fact that the induction cookers have a ceramic top as an advantage in as far as clean-up is concerned in case of any spillages or splatters. One of the interesting facts that emerged was that the participants desired different functionalities on their induction cookers but they weren't using the ones that were already existing. They had mostly restricted themselves to the hot pot or sauté functions depending on the brand they owned.

The fact that the induction cookers are fast was something that was mentioned over and over during the interview, especially for quick frying and tea in the mornings.

As with all the e-appliances, consumption of as little electricity as possible is still one of the most desired features in an ideal induction cooker.

The participants liked the fact that induction cookers are usually very visually appealing when placed on the countertops. Their slim compact look combined with the sleek, shiny finish is a sure winner and conversation starter in their kitchens.

A beginners' recipe book was something that the participants felt strongly about because they figured that it would set them off to a good start and also increase their use of the appliance. Having a variation of easy to cook foods would have them using most if not all the available functions. 18 are satisfied with their current menus whilst only 1 was not satisfied.

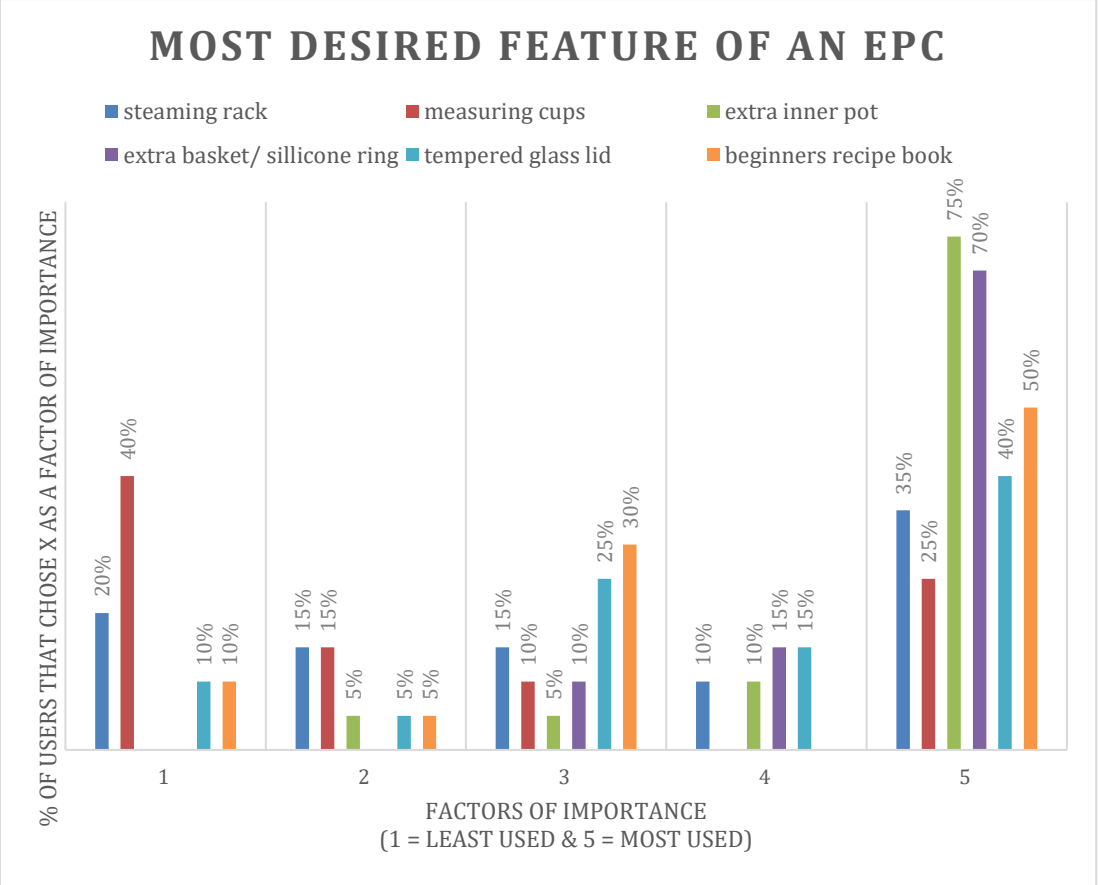


Figure 9: Desired Features of an EPC

We found that the steaming racks and measuring cups were one of the least used or desired features of the EPCs. What emerged was that once the EPCs were purchased, the measuring cups were put in a drawer and forgotten, and people went on using standard measuring cups or just regular water glasses to measure out their foods and liquids. The steaming racks were also soon forgotten by some people who would opt to boil foods like maize or sweet potatoes directly in water.

An extra gasket / silicone ring was a clear favourite for the participants because it would give the participants a chance to make yoghurt or cake that would not end up smelling of curry, for example. Having one gasket, it emerged, was a hindrance for some people enjoying or trying out some of the menu items. It's also desired to have as a spare part just in case the one someone has wears out or undergoes sudden damage.

An extra inner pot also ranked very highly in the answers that the participants gave. This was still for the same reasons as were discussed above.

A tempered glass lid was a surprise for us because a query that we get a lot of is this one. Customers ask if there are lids that they can use to cover their pots as they sauté or simmer their foods so that they monitor how their food is doing.

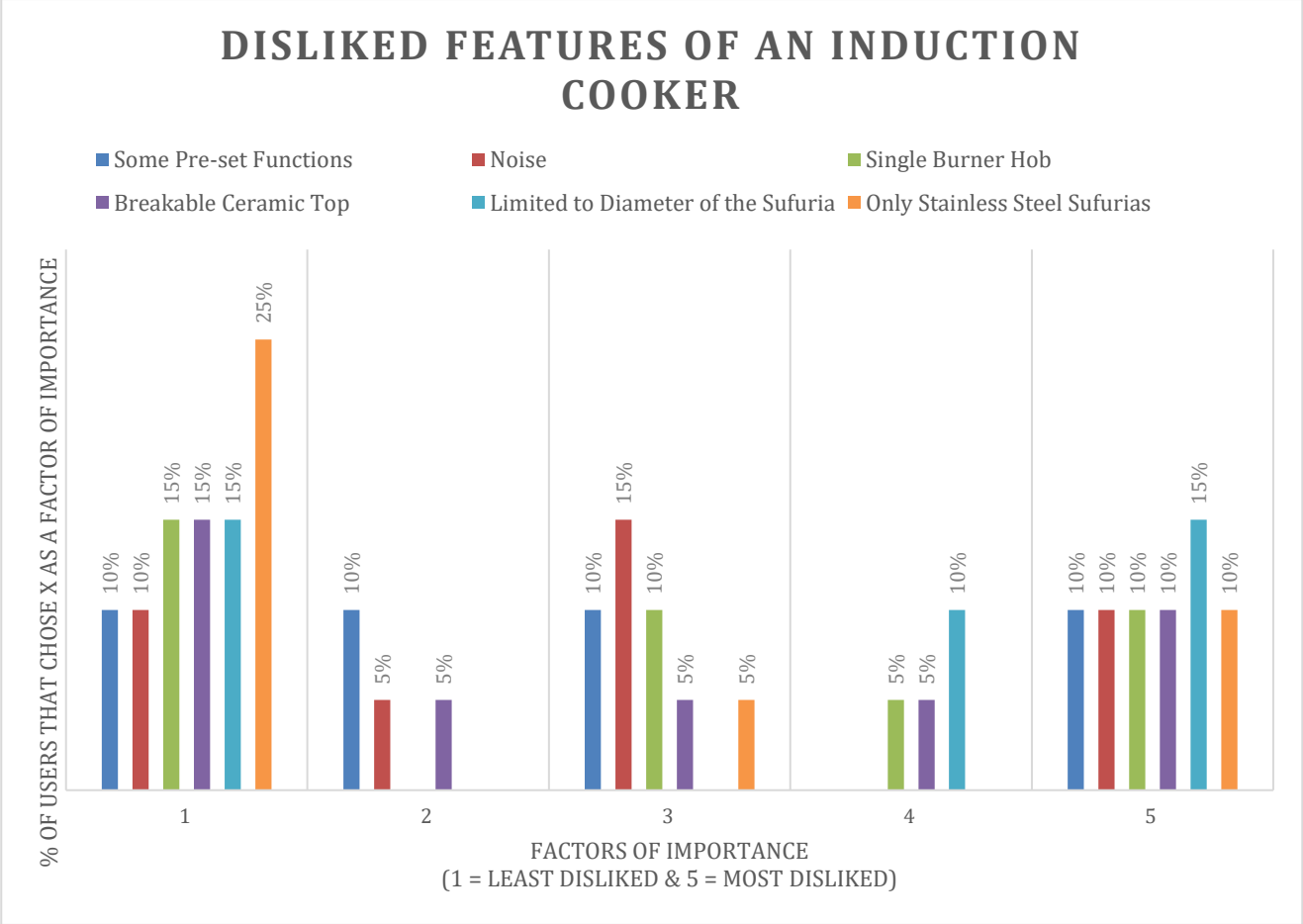


Figure 10: Disliked Features of an Induction Cooker

The data for this question is considerably varied with relatively consistent percentages across the factors of importance range.

The assumption that can be drawn for the above figures is the fact that most users usually restrict themselves to one function that they stick to when using the induction cooker and never really stray far to experiment. It could also be due to the fact that some of the users' view and operate it as a substitute for the LPG cooker which simply means either increasing or reducing the heat just like regular LPG cookers.

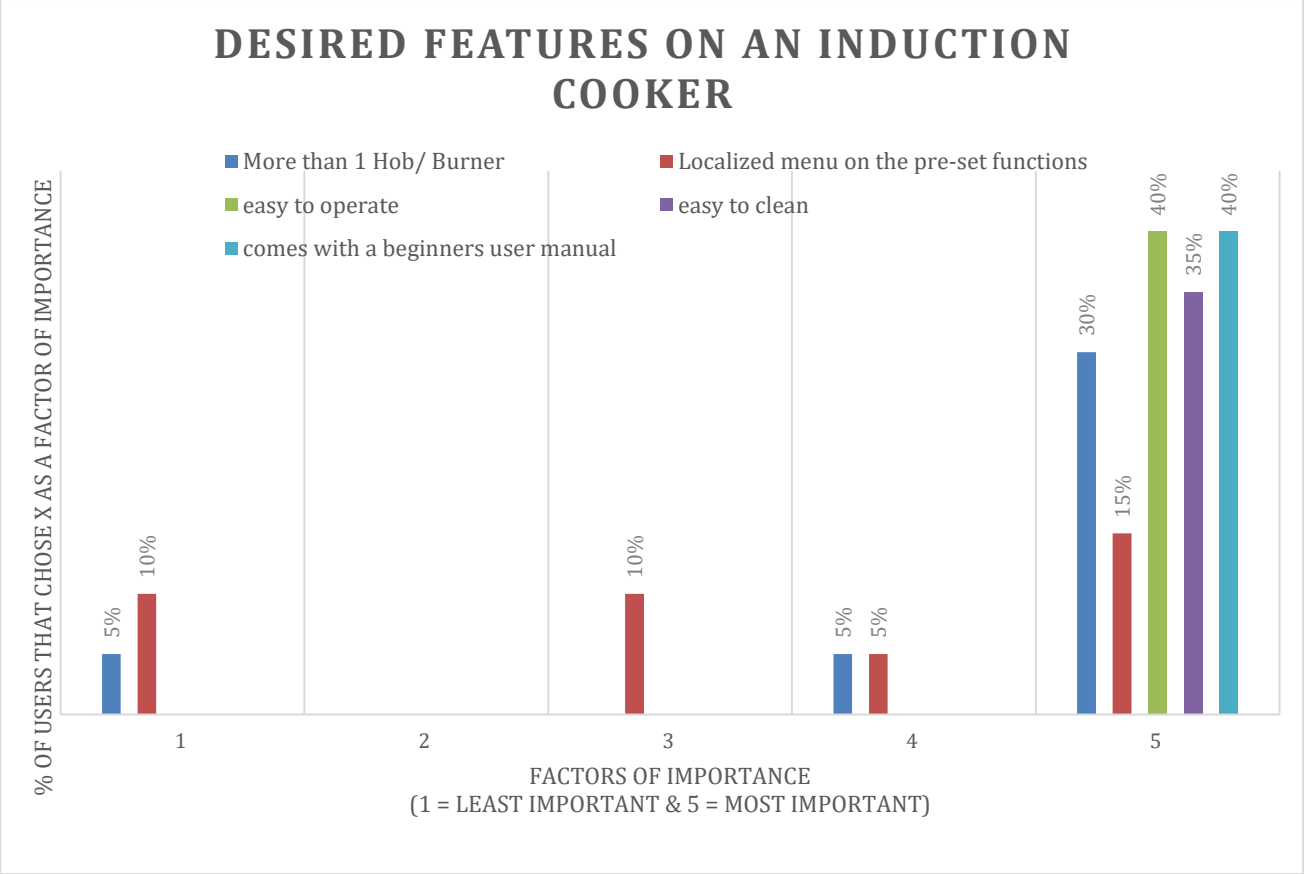


Figure 11: Desired Features of an Induction Cooker

Figure 11 shows us the usefulness of features on an induction cooker. This can be compared to Figure 8 which also shows a relatively high percentage of respondents that value a beginners' user/ recipe manual. It emerged that the participants valued the recipe book because it showed them the versatility that can come from the induction cooker. It also helps in making it easy to operate the appliance. The low score of the localized menu was quite unexpected in as far as the induction cooker was concerned, but this can be attributed to the fact that an induction cooker was being operated by just one function by some of the users. Figure 10 also demonstrates that a localised menu on the pre-set function isn't a particularly pressing need and actually, in the questionnaire the section concerning useless pre-set functions was not answered and even for those who answered the sections on EPCs and air fryers, minimal answers were given. According to the data set, respondents either used all of the pre-set functions or found that one of the pre-set functions could serve the same purpose as many of the other pre-set functions.

2.1.2. Recommendations and Conclusions:

Table 1 Recommendation for Ideal EPC and Air Fryer

Recommendations	Description
Combine generic functions	One generic function can be set optimally to cook foods that cook in a similar manner. For example, githeri / beans button will have different types of beans listed on the sticker and their cooking times. For instance, Wairimu that cooks for 20 minutes, yellow beans cooking for 40 minutes, etc.
Use of pictorials	This is particularly useful for those who are literacy challenged. It will eliminate any confusion that might arise because a picture of a chicken can never be confused with green leafy vegetables.
Include braille feature	A visually challenged person would only need to find the functionality they are after by touching the menu and pressing on the desired function.
Set the generic function to mimic the local cooking process	There are local foods that require an intricate balance of cooking temperatures and if possible should have a button dedicated to them. E.g., Ugali and wimbi porridge require similar sets of temperature variations in order to have them cook properly. They start off on very high heat and to finish cooking them off the heat is usually reduced for the last 5 minutes.
Have a local menu	Majority of the available menus contain foods or cooking processes that are not known or well understood by majority of the Kenyan population. For instance, sous vide is a method of cooking under vacuum which is not a cooking method that is used by most home cooks. The recommendation is to remove these functions because they are redundant or have them replaced by popular Kenyan foods.

2.1.3. Further recommendations for other energy efficient appliances (Induction and Rice Cookers):

Table 2 Recommendations for Ideal Induction and Rice Cookers

Top and bottom heating elements for air fryers:	These are already in existence in the international market and can be brought into the Kenyan market. They would also be much faster and convenient to cook with. Food would be cooking from both top and bottom, hence eliminating the need to shake the food midway through cooking.
Add more functionalities to the rice cooker:	Having more functionalities other than keep warm or cook was found to be desirable, E.g., a sauté function that allows one to cook pilau in the rice cooker straight away without having to prepare the base on the LPG hob then transfer everything to the rice poker to finish it off.
Make some accessories optional	We found that some of the features such as the measuring cups, serving spoons and trivets were not being used by everyone. Our recommendation would be for the manufacturers to sell them as optional accessories.
Have beginners' manual and recipe booklets as QR codes:	We found that participants felt that a beginners' appliance manual and recipe book were very important. However, we thought that they would end up being forgotten and tossed inside a drawer. The manufacturers can have both the manual and recipe book as soft copies downloadable via a QR code. This is environmentally friendly and cost saved could be used in other areas like product development to suit the local population.
Safety and energy efficiency	Users expressed the need to feel safe when using the appliances which also had to be energy efficient. Manufacturers should fully insulate their appliances in order to keep their users safe and to provide them peace of mind whenever they use them.
An extra inner pot	Participants felt that it makes the cooking process faster since they do not have to wash out one pot in order to cook the next meal in the EPC. We propose that the extra inner pot be sold as an accessory instead of being part of the package to reduce the cost to the consumer. The main issue has been that the extra inner pots are currently considered as spare parts by the manufacturers and are not very widely available.

2.2. Matching Generic Functions to Popular Kenyan Foods:

The second activity was to test different functions on various popular e-cooking appliances. This was to establish the generic functions that could be repurposed to cook Kenyan meals. We then came up with a 10 recipe pamphlet that highlighted the foreign generic foods functions that could be matched with the local ones and how to cook them using those functions, please refer to the appendix.

We found that having an understanding of the food and the cooking process made it possible to match the local foods to the generic functions of the appliances. From the typology table, we selected popular Kenyan foods, matched them to the closest cooking process they are normally cooked at on the appliances, then proceeded to test them.

The recipes cover all the four appliances and below is a brief description of each

2.2.1. PRESSURE COOKER RECIPES:

- **Proofing Dough on Yoghurt Setting**

The setting was used because it creates the perfect environment due to the constant temperature inside the pot. This is because it is set at controlled and consistent temperatures. Any yeasted bread can be proofed in the EPC. It is not a pressured setting, therefore, you can use any other lid as long as it sits well without letting in air.

- **Ndengu cooked on porridge setting:**

This generic porridge function was picked because it closely matched the time it took to cook ndengu in an EPC. The setting is set to 30 minutes. The ndengu came out soft without being too mushy, just right.

- **Minji (Garden Peas) Stew on Oatmeal Setting:**

Minji, carrots and potatoes usually cook for 5 minutes or less in an EPC. We looked for a setting that cooks at the exact time and found that the oatmeal cooks for 5 minutes. We sautéed the onions and tomatoes on the sauté setting and pressure cooked on the oatmeal function. The results were that the potatoes were soft, the carrots had a bit of bite to them and the carrots were just soft without being mushy.

2.2.2. AIR FRYER RECIPES:

- **Groundnut recipe:**

Groundnuts are typically dry fried in most Kenyan homes. They are mixed with a little water and salt to taste and then poured on a pan or sufuria and cooked over low heat until they cook and the skin becomes papery. Kisambara opted to do this in the air fryer as opposed to the induction cooker (which would have been the typical route) in order to offer an alternative use for the air fryer.

The groundnuts were air fried for 15 minutes at 180C and they were occasionally stirred to ensure the tops ones didn't burn

The results were perfectly cooked nuts that were crunchy and the skin came off very easily after cooling down.

- **Grilled Sweet Corn / maize**

This was done in order to offer an alternative to roasting over charcoal. We used the chicken setting where the temperature was set at 200 C (this was the highest heat available) for 30 minutes. We found that a lower temperature than this resulted in the sweet corn being in the air fryer for too long and it ended up hardening.

- **Hard "Boiled" Eggs**

The eggs were air fried at 180 C for 12 minutes in order to achieve the hard boiled state where the yolk was fully set. We used the manual setting because there was no pre-set function on the air fryer that we had that had the exact setting for the results we were after.

2.2.3. RICE COOKER RECIPES:

- **Egg and Tomato Stew:**

We decided to cook the stew in the rice cooker because it maintains a steady heat and the pan is non-stick. The non-stick property is important because it reduces the amount of sticking the eggs to the pot. There was no function to select on the rice cooker, only cook or keep warm. Once the eggs were cooked to our liking we removed the pot from the heat and served.

- **Sautéed Spinach:**

What we liked about the rice cooker for this particular dish is the fact that the heat is high enough to sauté the spinach fast and not have any liquid released by the vegetables pooling at the bottom. The process was super-fast and the results were spinach that still had crunch and wasn't soggy.

- **Scones:**

The keep warm setting of the rice cooker provided an ideal environment for the scones dough to proof. It is warm without scorching the scones and also the lid ensured that the scones did not dry out as they proofed. Once they had risen, we turned on the cook function and after 3 minutes it switched back to keep warm function. We left it to rest and cool down for about 7 minutes and then switched it back to cook function. After 5 cycles the scones were completely cooked through without having a scorched bottom. This was a bit inconveniencing because the rice cooker had to keep being monitored.

An alternative way of overcoming this would be to hold down the function button to the cook function for 10 minutes and the scones would be cooked through. This is not a method that is recommended by the manufacturers, however, we found that it worked.

2.3. Typology of Kenyan Cuisine:

2.3.1. Introduction

According to the Webster dictionary, typology is the study of or analysis or classification based on types or categories[1]. Going by this description, Kisambara went on to demonstrate the broad way Kenyans are typically divided, which is, into three major language groups, namely Bantus, Cushites and Nilotes. Different ethnic groups belonging to the same linguistic family share very similar cultures and food practices. These are heavily influenced by the areas they originally migrated from, although, over time their inter-mingling has resulted in the fusion of the cuisines[2.]

In the table 1 below, we have provided a breakdown of the different ethnic groups and their cultural practices that, to present time, still influence some of their cuisines. This table is based on the ethnic groupings and predominant cultural food practices.

2.3.2. Aims and objectives

- Develop a typology of Kenyan cuisine that shows the most common types of dishes cooked by Kenyans at home, with a selection of sample recipes for each type.
- Provide reference points by identifying popular international dishes that follow similar cooking processes (e.g. mandazis are similar to donuts).
- Highlight the compatibility of each type of dish with different types of energy-efficient appliances.

2.3.3. Methodology

We started by conducting a Google research and came up with the table below (Table 1) which provided us with an initial breakdown of the different ethnic groups and their predominant cultural practices that, to present time, still influence some of their cuisines.

Table 3 predominant cultural and food practices

LANGUAGE AND ETHNIC GROUPS	PREDOMINANT CULTURAL AND FOOD PRACTICES	REGULARLY / OFTEN COOKED FOODS	COOKING PROCESSES
Coastal Bantus (Mijikenda, Taveta and Swahili)	Farmers and some live along the river Tana and next to the Indian ocean.	Wali, (cooked rice), fish, seafood	Wali is boiled with coconut cream or milk. Fish grilled and finished off in coconut sauce. Seafood stir fried, shallow or deep fried
Central bantus (Agikuyus, Aembus, Akambas)	Primarily farmers and eat a lot of food from the ground	Maize, millet, sorghum, cassava, vegetables. githeri, Mukimo.	Foods are mostly boiled and then finished off in a tomato based stew. Mukimo is mashed potatoes, green garden peas, maize and pumpkin or stinging nettle leaves.
Western bantus (Luhyias, Kisiis)	Some are farmers and others live near Lake Victoria	Traditional veegetables (manage, Iseveve, murenda, omushenye (mix of sweet potatoes and beans), beans, chicken, omena.	Traditional vegetables are usually stir fried. Chicken and omena are normally stir fried. Sweet potatoes and beans are boiled first then pounded together.
Eastern Cushites (Orma, Somali, Borana) Semi-arid and arid Ethiopia Somalia	Originally migrated from Ethiopia and Somalia and live in arid and semi-arid areas of Kenya. Predominantly pastoralists their diet is very meat driven. Vegetarianism is rare especially considering they're pastoralists.	Meat, chicken, shaah (black leaves tea), injeera, canjeero & malawx (pancake like bread), eaten with liver. Asida. Ethiopians drink a lot of coffee and not tea. Consume more vegetables than meat.	Somali food is usually cooked in ghee, stewed or boiled. Asida is a lump of dough cooked by stirring wheat flour into boiling water, sometimes with added butter or honey
Highland nilotes (Kalenjins)	Traditionally they are pastoralists and farmers .	Fermented milk, ugali, mugelo (fried maize), rongorik (fermented millet or sorghum porridge), pendo (nyama), robwonik (sweet potatoes), korotik (cow's blood seasoned with salt and allowed to solidify)	Mugelo is made by frying cereals like maize in a pot, ronorik is feremented porridge made by boiling. Pendo is either grilled or steamed and eaten as a snack or with tea. Korotik is eaten with kimnyet.
River and Lake nilotes (Luos)	These are Luos and they are known for their love of fish because they live along Lake Victoria	Different types of fish ngege (tilapia), omena, ugali, osuga (vegetable), Athola, aliya (fully smoked meat) matoke, nyoyo (githeri), sweet potatoes, groundnuts and simsim, obwolo (mushroom) plantain, chicken, riga (cow blood)	Athola is slightly roasted meat, aliya is fully smoked until it dries. Nyoyo is traditionally boiled although it can be stewed and is eaten with porridge. Sweet potatoes are boiled, groundnuts and simsim are dry fried and seasoned with salt
Plain Nilotes (Maasai)	Pastoralists who are traditionally known for their diet of milk, meat and blood.	Beef, cow's blood, milk, honey, monono (ugali), vegetables (sukuma and traditional vegetables)	The milk is churned until the solids separate. Beef is grilled. Munono is prepared by boiling water, adding maize meal and stirring until solid. The vegetables are stir fried.

We later expanded our research to include the Food and Agricultural Organization Kenyan food recipes[3]. This combination gave more detailed findings that enabled us to come up with a typology of Kenyan cuisine by identifying the most predominant foods and referencing them to popular international dishes while at the same time highlighting the compatibility to different types of energy-efficient appliances.

Kisambara also came up with a list of reference points which showed internationally comparable dishes. For example, steaming of food wrapped in maize husks or banana leaves is very common in western Kenya while the same is known as tamales which is popular in Mexican cuisine. This dish can be steamed in either an EPC or rice cooker instead of over charcoal or LPG.

The international equivalents are in the Typology Excel worksheet that is attached, kindly check on sheet 2.

The dishes that we tested and made recipes for are the one highlighted in blue and are in bold font.

NB: Double click on the Excel work sheet, view it on 50 – 60 % zoom and use the vertical and horizontal scroll bars to navigate sheet.

The next step was to make brand neutral social media videos to highlight how the cooking processes of the popular dishes were compatible with different ecooking appliances. The videos contain the ingredients list and step by step process on how to make the dishes successfully. It's important to note that the recipes did not change regardless of the appliance used, the aim was to show that the same dish can actually be cooked across different appliances, even though the degree of success may vary.

Table 4: Typology showing dominant cooking processes and compatibility of the foods with the energy-efficient appliances

			COMPATIBILITY WITH ENERGY EFFICIENT APPLIANCES				ALTERNATIVE COMPATIBILTY WITH ENERGY EFFICIENT APPLIANCES			
			EPC	RICE COOKER	INDUCTION COOKER	AIR FRYER	EPC	RICE COOKER	INDUCTION COOKER	AIR FRYER
FRY	Stir fry	Green leafy vegetables, cabbages, eggs	Compatible for all foods listed	Compatible for all foods listed	Compatible for all foods listed	Not compatible for all vegetables	Not compatible for all vegetables	Not compatible for all vegetables	Not compatible for all vegetables	There are some vegetables that can be tossed in oil and then put in the air fryer and they still come out looking similar to stir fry vegetables although it's not technically stir frying. E.g., carrots, brocolli, aparagus, onions
	Deep fry	Mandazi (donut) Fried chicken,chips(bhajia) fish,omena, peanuts	Depends on EPC- it should be able to go to very high temperatures of above 175 C.	Not compatible	Compatible for all foods listed	Not compatible	Not compatible	Not compatible	Not compatible	The deep fried food can be air fried and still come out crispy.
	Shallow fry	Sausages, chicken, chicken wings, plantains, Fish, bacon	Compatible for all foods listed	Not compatible because a rice cooker needs to have some water at the bottom of the pot to keep it from going to the keep warm mode. Shallow frying uses oil and this will make the rice cooker to stay constantly in the keep warm mode of which the temperatures are too low for effective shallow frying.	Compatible for all foods listed	Not compatible	Not compatible	Not compatible	Not compatible	The shallow fried food can be air fried and still come out well
	Dry fry	Peanuts, sim sim, kumbe kumbe (Termites / flying insects).	Depends on the EPC - the temperature has to be able to be regulated to ensure that the temperatures are consistently low to prevent burning	Not compatible because it's not possible to regulate the heat. It's either too hot or too cool. The lack of water will keep the rice cooker in keep warm mode which in turn is too low to effectively cook any of the foods listed	Compatible for all foods listed	These foods are usually soaked in water and then cooked in a sufuria to dry them out and in the process cook them. This can work very well in the air fryer	Not compatible	Not compatible	Not compatible	Not compatible
FRY, BOIL & SIMMER	Short	Spaghetti	Compatible for all foods listed	Compatible	Compatible	Not compatible	Not compatible	Not compatible	Not compatible	Not compatible
	Medium	Some traditional vegetables, cereals (kamande, ndengu), omena, roots (nduma,) beef, green bananas (matoke) potatoes, omena, broiler chicken, soft cuts of beef,pilau.	Compatible for all foods listed	Compatible for all foods listed	Compatible for all foods listed	Not compatible	Not compatible	Not compatible	Not compatible	Not compatible
	Long	Beans, Matumbo (tripes), meat dishes (aliya, matumbo, oxtail, osso bucco, short ribs, shanks, githeri (muthokoi), kienyeji chicken.	Compatible for all foods listed	Compatible for all foods listed	Compatible for all foods listed	Not compatible	Not compatible	Not compatible	Not compatible	Not compatible
BOIL & SIMMER	Short	Tea, porridge, minji, spaghetti, eggs	Compatible for all foods listed	Compatible for all foods listed	Compatible for all foods listed	Not compatible	Not compatible	Not compatible	Not compatible	Eggs can be cooked in the air fryer with their shells still on and this will yield "boiled eggs" to the consistency of the person cooking
	Medium	Ndizi mzuzu (plantains), potatoes, boiled maize, whole peanuts, nzenga (crushed maize), rice	Compatible for all foods listed	Compatible for all foods listed	Compatible for all foods listed	Not compatible	Not compatible	Not compatible	Not compatible	Not compatible
	Long	Peanut sauce, osso bucco, oxtail, short ribs, beans.	Compatible for all foods listed	Compatible for all foods listed	Compatible for all foods listed	Not compatible	Not compatible	Not compatible	Not compatible	Some of the foods can be made in the air fryer to mimic boiling. Especially the meats like osso bucco, ox tail, by adding water to a small container together with the meat, cover with foil paper and leave to air fry until done to desired doneness
ROASTING /GRILLING	Medium to Long	Beef, chicken, maize, ngwaci, arrow roots, fish Mutura, Mbuzi choma	Not compatible	Not compatible	Not compatible	Compatible for all foods listed	Meats can be dry fried in their own juices until it cooks completely			Not compatible
STEAMING		Ngwaci, green maize, nduma, green bananas, pumpkins	Compatible for all foods listed	Compatible for all foods listed	Compatible for all foods listed	Not compatible	Not compatible	Not compatible	Not compatible	Steaming can be achieved by wrapping the food in a foil paper, adding some water and letting the steam build and in the process cook the food inside
FLATBREAD	Short	Chapati, pancakes	Not compatible	Not compatible	Compatible for all foods listed	Not compatible	Not compatible	Not compatible	Not compatible	Not compatible
SHALLOW FRY	Medium	Vitumbua	Not compatible	Not compatible	Compatible	Compatible	not compatible	not compatible	not compatible	Not compatible
TRADITIONAL BAKING		Mkate wa sinia (rice and coconut cake), mkate wa mayai (Swahili sponge cake)	Not compatible	Not compatible	Not compatible	Compatible for all foods listed	Compatible if steaming is done. The food can be placed on top of a steaming rack or trivet and then cooked under pressure. The results will mimic the baked foods but will not brown on top			Not compatible

In addition to the typology table above, we came up with ten sample recipes representing the different typologies that showed how they can be cooked in the different e-cooking appliances. Please find the recipes in the appendix 1.

2.3.4. IDEAL EPC AIR FRYER MOCK UP

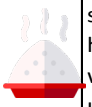
Below is a mock-up of how we visualized the ideal EPC and air fryer would look like based on the recommendations and conclusions stated below table 2. All the information is based off of our findings from the questionnaire and typology. The interface has two columns; therefore, depending on the budget and needs, one can choose to buy the air fryer part separately from the EPC. One side caters to the pressure cooking functions (wet processes) and the other side caters to air frying (dry processes). The ideal interface will have both a Kiswahili and English menu and it represents popular foods in Kenya which are in turn grouped into similar foods. For example, githeri and beans cook at almost the same time. The maize being cooked in the githeri usually cooks at the same time as the beans and if not, then the maize can be boiled separately from the beans and then the two can be mixed together afterwards.

Table 5 Ideal EPC / Air Fryer Interface

PRESSURE COOK				AIR FRY
SAUTE/ KUKAANGA				SCONES
PRESSURE COOK / MANUAL				CAKE / KEKI
RICE / MCHELE				CHIPS / VIBANZI
BEANS / MAHARAGWE	START	TIMER	TEMP	CHICKEN / KUKU
MEAT / NYAMA				BEEF / NYAMA
BROTH / SUPU				SAUSAGES
UGALI		TEMP		FISH / SAMAKI
CHICKEN / KUKU		TIMER		PASTRIES
STEAM / MVUKE				PIZZA
MATOKE	FISH	KEEP WARM	CANCEL	VEGETABLES / MBOGA

Below is a mock-up of how we visualized the sticker would look like. This sticker will be included in each package that is purchased by the customers and can be stuck to the sides of the appliances. It will be a very good reference point as someone cooks because it will provide them with the timings for different foods. This might also instil confidence in the users to try out a diverse range of foods once they have the information below.

Table 6 Ideal EPC/ Air Fryer Sticker

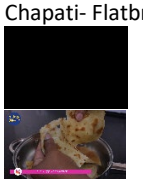
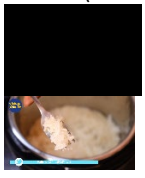
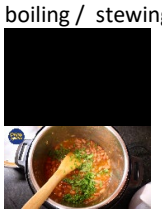
STICKER FOR IDEAL EPC					
PRESSURE COOK / MANUAL			**AIR FRYER**		
Rice / mchele		Brown 22 mins	Scones		180 - 200 C FOR 8 - 15 Mins
		White 12 mins	Cake / keki		160 C 30 Mins
Githeri & Beans / maharagwe		Mbaazi 30 mins			
		Ndengu 15 mins	Chips / vibanzi		200 C 1- 22 Mins
		Wairimu 20 mins			
		Yellow beans 40	Chicken / kuku		180 - 200 C FOR 20 Mins
		Njahi 60 mins			
Meat / nyama		Osso bucco 45 mins	Meat / nyama		180 - 200 C 25 Mins
		Ox tail 45 mins			
		Aliya 1 hour	Sausages		
		Athola 35 mins			180 C FOR 7 Mins
		Matumbo 45 mins	Fish / samaki		Fillet 180 C 8 - 10 Mins
		Beef 20 mins			Whole tilapia 200C 35 mins
			Pastries		Meatpie 180 C 15 - 28 mins
Broth / supu		pork bones 4 hours			Cookies 180 C 12-15 mins
		beef bones 4 hours			Cinnamon rolls 180 C 15 mins
		Chicken bones 2 hours			Puff pastry 180 C 7 Mins
Ugali		15 minutes; Requires special setting. Initial high heat to boil water and pound ugali. Five minutes lower temperstures to bake ugali	Pizza		170 C for 20 mins
Chicken / kuku		Kienyeji 30 mins			
		Broiler 15 mins	Vegetables / Mboga		Carrots180 C 10 - 20 mins depending on if it's glazed or steamed, etc.
Steam/mvuke		Nduma, Ngwaci 20 mins			Broccoli 180 C 10 Mins
		maize (mutungo), potatoes 10 mins			Miciri (French Beans) for 190 C
		Eggs 5, Broccoli 5			Roast potatoes 195 C for 10 mins
		Carrots, Minji, Miciri 1 - 3 minutes			Ngwaci (Sweet potatoes) 200 C 30 - 35 min
Matoke		Minji stew, matoke stew, potatoe stew			
Fish		Omena 5 mins			
		Tilapia whole 10 mins			

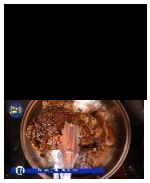
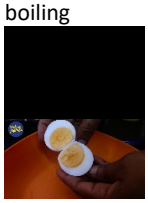
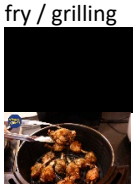
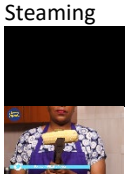
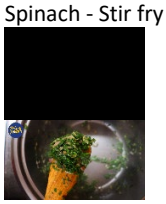
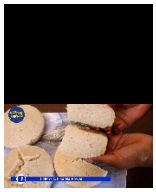
2.4. BRAND-NEUTRAL SOCIAL MEDIA

Nine sample video recipes, as listed in table 7 below, were developed for this project that show how different communities can cook the same food across different e-appliances and what the results would end up being for them. The videos are a way of encouraging the people watching so that they can cook the foods that they know in appliances that they wouldn't ordinarily think of using. As per the cooking techniques / processes for typical Kenyan dishes, from the Nuvoni KNeCS baseline study shows that eggs are usually made by boiling and frying, boiling making up 89.77% and frying 28.69%, We demonstrated that one could bake the eggs in the air fryer at 180 c and achieve cooked eggs. This shows that one does not have to restrict themselves. You can still achieve results with the appliances at home.

From the typology table, there are different cooking processes or techniques that we listed and we used those categories to inform us of the videos that we were going to make. They are representative of the different ways that Kenyans mostly cook their foods. One of the factors that influenced us to pick the foods was how often the dish is cooked in most Kenyan households. This is collaborated by the Nuvoni KNeCS baseline study[4] the meal that is prepared by most households in Kenya is supper (94.66 percent of the households), followed by breakfast (92.26 percent of the households, and lunch (76.28 percent of households) From the same study, typical cuisines in Kenya for lunch usually have rice being eaten 58.31% and ugali 52.07% and supper more household prepare vegetables, meat stew, chapati as compared to lunchtime. For snacks, most Kenyans consider eggs and mkate wa sinia to be snacks. The cooking process column lists the cooking process from the typology table that we used to cook the different foods. **Please click on the video icons to watch the different recipe videos.**

Table 7 Summary of brand neutral social media videos

BRAND NEUTRAL RECIPE VIDEOS	DESCRIPTION	RESULTS & USER EXPERIENCE
Chapati- Flatbread 	Flat bread made using wheat flour and is often shallow fried on a flat pan	The shape of the EPC and rice cooker pots made it difficult to turn the chapati over without burning. The EPC had a sauté button which can cook for 30 minutes without going off which resulted in soft chapatis. However, they weren't as soft as those of the induction cooker The rice cooker was not good, and kept switching to keep warm function, hence, chapatis took very long to cook. As a consequence, they weren't as soft as the EPC and induction cooker ones. The air fryer made the chapatis very hard and biscuit-like which snapped and cracked instead of being soft and pulling and flaking apart into different layers. The chapatis from the induction cooker were soft, flaky just the way Kenyans love them. This was the **best suited** appliance for cooking chapatis.
Rice - boiling / simmer (Medium) 	This is a cereal grass that can be boiled, stir fried with vegetables or meat, or cooked aromatically like pilau	The air fryer was not used in this test because it was not possible to cook rice from scratch. The rice cooker and EPC provided the best user experiences. The EPC has a dedicated rice button which usually takes between 12 - 14 minutes. The difference in their cooking processes was the water to rice ratio of 2:1 and 1:1 in the rice cooker and EPC respectively. The induction cooker yielded good rice that had a water to rice ratio at 2:1.
Beans - Long boiling / stewing 	These are legumes that are usually boiled and then finished off in a tomato based stew or as a mixture with maize known as githeri	It was a simple process in the EPC. The most involving part was sautéing and building flavour but once the beans were added it became a smooth, hands free cooking experience by using the beans function. If the pressure cookers that do not have a dedicated beans function, set a timer for 40 minutes for beans that are soaked for a minimum of six hours prior to cooking. This was the best suited method for cooking beans in terms of convenience, energy, cost and time savings. The induction cooker was easy to sauté in. We still had to monitor the beans for three hours to ensure that they did not run out of water. It was also not an energy efficient method especially compared to using the EPC.

		As for the rice cooker, the process of sautéing was similar to the EPC and the process after adding beans was similar to the induction cooker. It is not possible to cook bean stew in the air fryer.
Mbuzi - Grilled 	This is goat meat which can either be grilled, stewed or dry fried.	The goat was cooked very well in the air fryer. Once the time and temperature were set we only had to occasionally flip the meat around to ensure it cooked evenly on both sides. The air fryer gave us well cooked, crispy mbuzi. The EPC, rice cooker and induction cookers, we had to add a bit of water to them to ensure that the meat cooked all the way through. The meat cooked well but it was a hassle to get it done. The EPC placed second as the pressure function allowed the meat to cook evenly. The rice cooker and induction cooker were the most inefficient and time consuming.
Eggs - Short boiling 	They are either boiled, shallow fried or stir fried.	The EPC had a dedicated egg button which cooked the eggs for 5 minutes after pressure for hard boiled state. The induction and rice cookers cooked the eggs for 12 minutes to a hard-boiled state. The air fryer cooked the eggs for 12 minutes at 180 C and the results were very good. All the appliances rated very well in terms of user experience because the eggs were just dumped and forgotten until they cooked.
Chicken - Shallow fry / grilling 	This is part of the chicken's breast quarter. Prepared by grilling, cooking in soup or deep frying.	The best wings were from the air fryer because they were crispy on the outside while still remaining moist and juicy on the inside. The induction cooker, EPC and rice cookers yielded moist chicken wings that were cooked through, however, due to the moist nature of the cooking process the skin wasn't crispy. The results were, however, pleasant and enjoyable.
Boiled Maize - Steaming 	Soft green maize is often boiled or steamed either with or without the husk.	We used the pressure cooker function in the EPC for 10 minutes. We placed our maize in the pot, covered it and left it alone. The rice cooker we used had a steaming basket which we placed on top of it. We proceeded to steam for 30 minutes. If one does not have such a rice cooker, a trivet which can fit in their rice cooker would do, or just submerge the maize in water. The same applies to the induction cooker. All the appliances were hassle free with the EPC being slightly in the lead because it was the most energy efficient. We did not use the air fryer because that would have given us roasted maize.
Spinach - Stir fry 	What Kenyans call spinach is actually Swiss chard. They are large, green, leafy vegetables. They are often stir fried and eaten with ugali or a starch of choice.	We did not use the air fryer because that would have resulted in spinach crisps. The rice cooker and induction cooker were fast therefore no water pooled in the pot. The water pooling is not an issue, just something that we took note of. The rice cooker did not keep going to the keep warm function so the whole sauté process was quick and straightforward. The EPC was slightly slower than the rice cooker and induction cooker which led to water pooling in the pot. This can be addressed if one has an EPC which allows for adjustment of temperature.
Mkate wa Sinia - Traditional baking 	Very common delicacy found in East Africa. It's a rice cake that's full of fresh coconut and freshly ground cardamom.	The EPC produced the densest cake which could be attributed to the fact that the appliance was cooking it under pressure. The induction cooker and rice cooker gave a well risen cake, however, the top wasn't browned due to the fact that it was being steamed. The air fryer yielded the best results, springy / spongy cake that was browned on top, (mimicking the traditional baking results that are desired).

3. IMPLEMENTATION

3.1. GENDER INCLUSION AND LEAVE NO ONE BEHIND (GILNOB):

GILNOB concerns were incorporated into the project and methodology.

We only worked with the Kisambara team for this project which comprises three women and two men and in terms of other aspects of GILNOB and safeguarding, Kisambara did not work with people with disabilities, remote communities and nor engage with children during this project. No negative consequences (intended or unintended) resulted from Kisambara Ventures Kenya Specific Appliances activities.

4. NEXT STEPS

The results of this project are of relevance to the e-cooking appliances manufacturers, wider clean cooking sector and particularly useful to MECS, KPLC, Ministry of Energy, Clean Cooking Association of Kenya (CCAK) and the Clean Cooking Alliance (CCA). The findings will go a long way in ensuring that the energy efficient cooking appliances that will land in Kenya will be tailored to the Kenyan market. Although lack of finances may hamper the pace at which we might expand our clean cooking business, we intend to scale up the clean cooking agenda through the following activities:

- Expand our operations to other counties within Kenya, we will start by targeting the greater Nairobi Metropolis. We already started with Kenol in Murang'a county.
- Look for more funding opportunities by partnering with manufacturers to test their specific appliances and offer recommendations on how they can adapt them to specifically suit the local cuisine.
- Start a series on Jikoni Magic social media platforms that will be purely targeted at cooking using generic functions and showing Kenyans that it is possible to maximize the use of their gadgets.

5. CONCLUSION

From the data that was collected from the 20 participants' questionnaire it is evident to see that there is a lot of potential for the penetration of e-cooking appliances as long as there is clear messaging. This means that the appliances must contain the functions that resonate with the everyday Kenyan cook, are in a language that is understood clearly, are easy to operate and are safe.

Clean cooking, especially using energy efficient cooking appliances is an emerging trend that has not yet been fully tapped into and explored, therefore, more research is needed in order to unlock its full potential. This calls for concerted effort from all clean cooking sector stakeholders in order to reduce the barriers that exist for the full appreciation and uptake of the appliances.

The typology that we developed (showing the different food categories in Kenya, the popular foods, different cooking processes and their compatibility with different energy efficient electric cooking appliances) can be used as a basis or starting point by manufacturers who want to introduce their products into the market. This can be by further conducting research which will build on what is there in order to ensure that the appliances end up resonating perfectly with the needs of the local consumer.

The typology table, the mock-up EPC / air fryer interface and sample sticker can all be used in conjunction with the findings and recommendations above to minimize or eliminate the generic products that land in the market. What the consumers need are gadgets that they will maximize on their uses.

Going forward, we will keep developing more content as Jikoni Magic to encourage Kenyans to unlock the full potential of e-cooking.

6. APPENDIX 1

A - BRAND NEUTRAL RECIPES:

ELECTRIC PRESSURE COOKER RECIPES:

1. **Proofing Dough on Yoghurt Setting**

INGREDIENTS:

- 2 Cups all-purpose wheat flour
- 1 tsp Instant yeast
- ¾ cup warm water
- 3 Tbsps Sugar (adjust to your liking)
- 2 tsps vegetable oil

METHOD:

A. Add all the ingredients to a bowl, knead for 10 minutes or until it becomes a soft pliable dough. Apply oil all over it
B. Set the temperature of 35 C for 1 hour or until the dough doubles in size.
C. Brush the bottom and sides of the EPC with oil to prevent the dough from sticking to the bottom or the sides.
D. Press yoghurt function and after a few seconds it will beep and cover the EPC. Check on it after 30 minutes and see how it looks like. If it won't have risen to your liking, then, start making checking on it every 10 minutes until you attain your desired goal

Ndengu cooked on porridge setting:

- 1 ½ cups ndengu
- 3 Tbsps Vegetable oil
- 1 Large onion – diced small
- 1 Tbsp Curry powder
- 1 Tbsp smoked paprika
- 1 tsp dry thyme
- 1 Tbsp ginger garlic paste
- 2 medium sized tomatoes - pureed
- 1 Bunch dhania
- Salt to taste

METHOD

1. Turn on the sauté function for the EPC add the oil and onions and then shallow fry until they start turning brown at the edges.
2. Add the curry powder, smoked paprika, thyme, ginger garlic paste and cook for about three minutes until fragrant.

3. Pour in the pureed tomatoes and cook for about five minutes for them to reduce and some oil to start separating from the tomatoes.
4. Add the ndengu together with 3 ½ cups of water, cover, turn the ventilation valve to sealing position and set to EPC to porridge setting, which is a default of 30 minutes.
5. Once timer goes off, do a quick manual pressure release and add the dhania. Mix it in then serve with your favourite carbohydrate dish.

Minji (Garden Peas) Stew on Oatmeal Setting:

INGREDIENTS:

- 1 large onion – small dice
- 3 Tbsps vegetable oil
- 1 Tbsp Ginger garlic paste
- 1 tsp mixed herbs
- 1 Tbsp Mixed spices
- 2 medium sized tomatoes – grated or pureed
- 1 Tbsp soy sauce
- 1 Tbsp Worcestershire sauce
- 2 large carrots
- 2 cups minji
- 3 Medium sized potatoes – cut into 2" cubes
- Salt to taste
- 1 bunch dhania

METHOD

1. Turn on sauté function and add the onions and oil. Cook until translucent then add ginger garlic paste, mixed herbs and mixed spices. Proceed to cook until the mixture is fragrant.
2. Pour in the tomatoes, soy sauce and Worcestershire sauce and cook for about 3 minutes.
3. Add the carrots, minji, potatoes and salt, then pour in just enough water to cover the top of the mixture. Cover and ensure that the ventilation valve is sealed. Select oat setting which takes 5 minutes.
4. Once the timer goes off, do a quick manual release and then uncover the EPC.
5. Add in the dhania and mix it very gently then serve!

AIR FRYER RECIPES:

INGREDIENTS:

- Roasted Njugu (Ground Nuts)
- 1 cup raw njugu
- ¼ cup water
- Salt to taste

METHOD:

1. Mix the njugu, water and salt in a bowl. Ensure that all the njugu are properly seasoned.
2. Line the air fryer basket with aluminium foil to prevent the njugu from falling through the spaces.
3. Pour in the njugu and set the air fryer to 180C for 15 minutes. Keep turning them with a spoon or shaking the basket to prevent the top njugu from burning and also to ensure even cooking.

4. Once timer goes off pour into a wide and shallow container so that they can cool down and harden. This will enable them to peel more easily. Enjoy!

Grilled Sweet Corn / maize

INGREDIENTS:

- 4 Sweet corn / maize

METHOD:

1. Turn the air fryer to 200 C and set it 30 minutes.
2. Put in the sweet corn and occasionally turn it over until all the sides are browned to your liking.
3. Season with salt and butter if using and enjoy

Hard “Boiled” Eggs

INGREDIENTS:

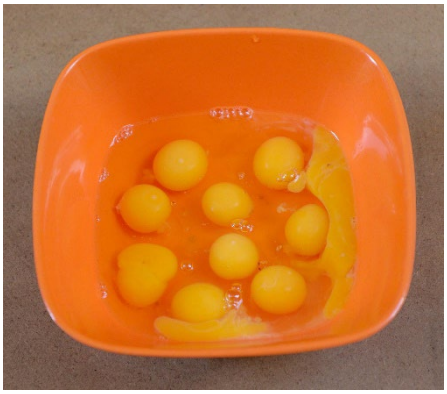
4 eggs

METHOD:

Place the eggs in the air fryer basket and turn set the air fryer to 180C for 12 minutes. Once the timer goes off remove the eggs and place them in a bowl of ice cold water, peel, season and enjoy!

RICE COOKER RECIPES:

Egg and Tomato Stew:



INGREDIENTS:

- 10 Eggs
- 1 large onion – small dice
- 2 Tbsps vegetable oil
- 2 large tomatoes- pureed or grated
- Salt to taste

METHOD:

1. Crack each egg in a small bowl and then transfer it to a larger bowl and the beat them lightly until all the yolks are broken.
2. Add oil to the rice cooker and then turn it on then sauté the onions until translucent.
3. Pour in the tomatoes and cook until the oil begins to separate then pour in all the eggs. Stir continuously to prevent burning and also to ensure that they mix in with the tomatoes.
4. Add salt and once the eggs are cooked to your desired consistency serve!

Sautéed Spinach:

INGREDIENTS:

- 1 Bunch spinach – washed and thinly sliced
- 1 Large onion – small dice
- 2 Tbsps oil
- Salt to taste

METHOD:

1. Turn on the rice cooker and set to cook mode.
2. Add in the oil and onions then sauté until translucent.
3. Add the spinach and salt, cook until just wilted. This takes about five minutes.
4. Serve!

Scones:



INGREDIENTS:

- 1 cup milk
- 2 tsps instant yeast
- 2 Tbsps granulated sugar
- 1 large egg
- ¼ cup vegetable oil
- 1 tsp salt
- 3 cups all-purpose wheat flour

METHOD:

1. Add all the ingredients into a bowl and knead for 10 minutes until the dough becomes smooth.
2. Lightly apply oil on the dough on all sides and cover the bowl with a cling wrap or kitchen towel and leave to rise to double its size in a warm place for about an hour.
3. Once double in size knock out the air and divide into 7 to 9 balls.
4. Oil the pot for the rice cooker and place the ball inside it. Cover with the lid and set the rice cooker to keep warm function.
5. Once the balls have doubled in size and are touching each other, turn the rice cooker to cook function. It will stay on for about 3 minutes and then switch back to keep warm function. After about 7 minutes, turn it back to cook mode. Repeat this process 3 to 5 times and then remove the scones. They will be cooked through. Cook them longer if you desire a darker brown colour at the bottom.

INDUCTION COOKER RECIPES:

Wimbi Porridge:

INGREDIENTS:

- 3 Tbsps wimbi flour
- 2 cups of water plus extra ½ cup water
- Sugar to taste
- ½ tsp Citric acid (optional)

METHOD:

1. Mix the wimbi flour with 1.2 cup of water ensuring no lumps remain
2. Pour the 2 cups of oil in a sufuria and place it on the induction stove. Turn on the milk setting.
3. Once it boils, add in the wimbi and water mixture while stirring continuously with a mwiko (wooden ladle) to prevent formation of lumps.
4. The milk setting will stop the vigorous boil and mellow down to a simmer which will let your porridge cook properly. Add sugar and citric acid if using. Cook on this simmering mode for about 5 minutes.
5. Serve and enjoy!

Ground Nut Sauce:

INGREDIENTS:

- ¼ cup smooth peanut butter
- ¼ cup freshly squeezed lemon juice
- Salt to taste
- 4 Cups water

METHOD:

1. Start by adding 1 cup of water and peanut butter to your pan and turn on the induction cooker to the hot pot setting. Turn it to medium heat. Use a whisk to break ensure it all blends and melts properly.
2. Add the rest of the water and lemon juice then reduce the heat to the lowest possible then cook while continuously stirring for the next 30 minutes. This sauce splatters a lot, be very careful not to burn yourself. If at any point it becomes too thick and starts sticking to the bottom and scorching, add more water.
3. It's ready once the oil separates and floats to the top. Best served with sweet potatoes, Enjoy!

Appendix B

1. https://www.merriam-webster.com/dictionary/typology#:~:text=1,things%20in%20the%20Old%20Testament
2. https://artsandculture.google.com/story/the-language-of-kenya-the-nilotic-bantu-and-cushitic-language-groups/2AJCwOhG6x7aIQ
3. https://kilimo.go.ke/wp-content/uploads/2021/01/KENYA-FOOD-RECIPES-2018.pdf
4. Nuvoni Centre for Innovation Research, Nuvoni_KNeCS Baseline Study, 2023.