AGRICULTURE PAPER ONE (527/1)

ITEM 1: VALUE ADDITION

This item will be integrated with two other topics: "Financial Services and Money in Agriculture" and "Cooperatives and Self Help Groups". The selected topic from the five Value Addition topics (Value Addition to Meat, Milk, Fruits, Vegetables, and Agrowastes) will be assessed in conjunction with the above two topics.

Part A will require learners to adhere to hygiene standards, use personal protective equipment, and dress code. Learners will also need to identify tools, materials, and equipment used and describe logical and coherent steps for producing the value-added product, including packaging, branding, and marketing.

Part B will task learners to suggest justifiable solutions to challenges presented in the scenario. Examples of value-added products that can be derived from each topic include:

- **Value Addition to Meat:** Sausages, bacon, ham, cured meats, meat pies, and jerky.
- **Value Addition to Milk:** Cheese, yogurt, butter, ice cream, and milk powder.
- **Value Addition to Fruits:** Jams, fruit juices, canned fruits, dried fruits, and fruit leather.
- **Value Addition to Vegetables:** Canned vegetables, frozen vegetables, pickled vegetables, dehydrated vegetables, and vegetable juices.
- **Value Addition to Agrowastes:** Compost, animal feed, biofuels, biogas, and paper products.

YOGHURT

This is a semi solid milk product made by fermentation of milk by good bacteria (probiotics). It can be eaten plain or flavoured with fruits, honey or chocolate etc.

Materials and Equipment

Fresh milk.	Starter culture.	Preservatives.
Flavours.	Stabilizers.	Icebath/cold water.
Stirrer e.g. spoon.	Saucepan.	Heat source.
Aseptic containers.	Refrigerator.	Clean water.
Labels.	Protective gears.	

Procedure

Put on apron, mask, gloves and hairnet for hygiene standards and body safety.
Assemble the materials and equipment for use in making yoghurt.
Clean the saucepan and stirrer to avoid contamination of milk.
Heat fresh milk to 80^{O}C while stirring to prevent milk from scorching and kill the bacteria.
Cool the milk to 46^{O}C in an ice bath or cold water to make milk hospitable for good bacteria.

Inoculate or add starter culture to provide good bacteria into cool milk. Incubate for about 5-8 hours at warm temperatures to spread and promote growth of good bacteria and increase thickness of yoghurt.
Add 1-2 tablespoons of flavours such as strawberry, vanilla, chocolate, toffee, mixed fruits to make yoghurt tasty or sweeter.
Add stabilizer to prevent milk separation and extend shelf life of yoghurt.
Add preservatives and refrigerate to cool and set for some time.
Package yoghurt in clean aseptic containers and label with product name, business name, production date, flavour and ingredients.
Market at local shops, schools, offer samples at community events, use posters, or online platforms like WhatsApp, Tiktok, Facebook.

CHEESE

This is made by coagulating milk using rennin obtained from calves or can be made synthetically. The milk is allowed to sour, heated up to $78^{O}C$ for 20 minutes to harden and then the liquid (whey) is forced out. It can be used for cooking or grafting over salads.

Materials and Equipment

Fresh milk.	Stirrer.	Starter culture.
Rennet enzyme/acid.	Heat source.	Muslin bag.
Salt.	Knife.	Labels.
Saucepan.	Packaging material.	Protective gear.

Procedure

Put on protective clothing for body safety and hygiene standards.
Assemble the materials and equipment for use in making cheese.
Pasteurize fresh milk to a desired temperature to kill the bacteria.
Clean the saucepan to avoid contamination of milk.
Add starter culture into milk to introduce bacteria that convert lactose into lactic acid.
Add rennet enzyme or acid to coagulate milk forming curds and whey.
Cut, stir, cook and wash curds to release whey.
Drain the curds using a sieve or muslin bag to remove moisture.
Add salt and age the cheese to add good taste and flavour.
Cut the cheese into desired form or shape before use to ease packaging.
Package cheese in materials and label with ingredients, health benefits, logo, production date, expiry date, and business contact.
Sell through local shops, schools, markets, offer samples at events or use online platforms.

ICE CREAM

Ice cream is a frozen dessert made from milk or cream, sweeteners (like sugars), and flavourings (vanilla extract, fruit puree, chocolate, fruits, strawberry). It is churned (mixing and agitating) while freezing to incorporate air and prevent ice crystals, giving it a smooth and creamy texture.

Materials and Equipment

Fresh milk.	Heat source.	Saucepans.
Sweeteners.	Flavourings.	Heavy cream.
Refrigerator.	Packaging material.	Labels.
Clean water.	Spoon/stirrer.	Protective gear.

Procedure

Put on apron, hairnet and gloves for body safety and hygiene standards.
Gather the materials and equipment for use in making ice cream.
Clean the saucepan and stirrer to avoid contamination of milk.
Boil milk at a right temperature to kill harmful bacteria. Allow it to cool before use.
Mix milk, cream, and sugar in a saucepan and heat gently until sugar dissolves (don't boil).
Cool the mixture at room temperature and then refrigerate for 2-4 hours.
Add in vanilla extract or other flavourings (e.g. fruit puree, chocolate chips, coffee, strawberry).
Churn/agitate the mixture in an ice cream maker until thick. Alternatively, freeze the mixture in a refrigerator stirring every 30-60 minutes for 4-6 hours.
Pack ice cream in labeled airtight containers with a catchy name, product name, ingredients, flavours, production date, expiry date and business contact.
Refrigerate ice cream in the freezer to extend the shelf life.
Serve it immediately or sell/distribute to the potential customers in schools, trading centres, hotels, local shops, events or use online platform to widen market.

MILK POWDER

This is milk that has been evaporated into dry, shelf-stable powder. It is made by removing nearly all water from fresh milk through different drying methods like **spray drying** (industrial)**, drum** or **sun drying** which helps to preserve milk for long-term storage without refrigeration. It retains most of the nutrients of regular milk including protein, calcium and vitamins. It can be reconstituted by adding water to make a liquid again.

Materials and Equipment

Fresh milk	Milk strainer.	Saucepan.	Spoon/stirrer.
Tray/plate.	Blender/grinder.	Clean water.	Heat source.
Packaging material.	Labels.	Protective gears.	Oven (optional).

Procedure

Put on apron, mask, gloves and hairnet for hygiene standards and body safety.
Assemble the materials and equipment for use in making powdered milk.
Clean the saucepan, tray/plate, blender, strainer to avoid milk contamination.
Filter milk with a milk strainer to remove foreign materials/impurities.
Boil milk in a heavy bottomed saucepan at a low heat while stirring constantly to prevent burning.
Continue simmering until milk thickens into a creamy milk paste.
Spread the thickened milk paste on a clean tray or plate and dry in sunlight or in a low temperature oven (around 60-70^{O}C).
Flip or turn over the paste to ensure uniform drying of both sides.
Once fully dried, break the flakes/paste into small-sized pieces.

Grind the paste using a blender or grinder to turn them into fine powder.
Sift if needed to obtain a fine/smooth texture.
Pack milk powder in airtight containers or sachets to prevent moisture and contamination.
Label with production date and instructions, and store in a cool, dry place ideal for 6-12 months.
Market the milk powder at local shops, households, schools, institutions, bakeries, food processors, health and nutrition shops, hotels, restaurants, cafes or export markets.

NB: Additives like sugar, vanilla are honey powder (optional) can be added for flavoured milk powder.

BUTTER
This is a solid fat made from milk cream. It is made by churning the whole milk using a machine called a **butter churner**. Butter is used in baking, cooking and spread on breads.

Materials and Equipment

Fresh milk.	Butter churner.	Muslin cloth.
Cold water.	Flavours.	Salt.
Refrigerator.	Knife.	Packaging material.
Labels.	Protective gear.	

Procedure
Put on protective clothing for body safety and hygiene standards.
Gather the materials and equipment for use in making butter.
Place milk in containers for 24 hours to allow fat globules collect on surface.
Skim off the cream (butter fat) from milk.
Place a muslin cloth in a churner and then fill it with cream to one-third of its capacity.
Churn the cream in a butter churner until butter fat globules begin to come together.
Add cold water into the churner and churn again.
Drain off the butter milk using a muslin cloth so as to leave only the butter granules.
Wash the butter in cold water to remove milk solids.
Add flavours and salt to improve on the taste and salt which act as a preservative.
Store butter in a refrigerator for 3 weeks to allow it ripen and get its characteristic flavours.
Cut butter into desired pieces and pack in clean containers like small boxes.
Label container with product name, business name, contact, logo, health benefits, production date and expiry date.
Market at local shops, schools, offer samples at community events or pair with bread and fruits, use online platforms.

GHEE
This is made by heating butter to remove milk solids and water leaving behind a concentrated pure fat with a richer flavour than regular butter.

Materials and Equipment

Fresh butter/cream.	Heat source.	Sauce pan.
Fine mesh/cheesecloth.	Stirrer.	Labels.
Packaging materials.	Protective clothing.	

Procedure

Put on hairnet, gloves and apron for hygiene standards and body safety.
Assemble materials and equipment for use in making ghee.
Place butter in a heavy bottomed saucepan.
Melt over medium heat until it begins to foam.
Continue boiling while stirring until the water content evaporates and milk solids separate and turn golden brown. Three layers will separate i.e. foam on top, clear ghee in the middle and milk solids at the bottom.
Strain through a fine-mesh sieve or cheesecloth to remove solids.
Package ghee in glass jars or sachets and label with product name, production date, weight, usage information and business contact.
Market at local shops, schools, offer samples at community events, use posters, or online platforms like WhatsApp, Tiktok, Facebook.

FLAVOURED MILK

Flavoured milk contains added flavours and colours that make it more palatable and give it taste and aroma. Examples of flavours include vanilla extract, strawberry, sweet banana, iced coffee, chocolate, pineapple, mango, cocoa, cinnamon etc.

Materials and Equipment

Fresh milk.	Heat source.	Flavours.
Sweeteners.	Stabilizer.	Blender.
Milk strainer.	Clean water.	Refrigerator.
Packaging materials.	Labels.	Protective gears.

Procedure

Put on apron, gloves, head cover for hygiene standards and body safety.
Assemble materials and equipment for use in making flavoured milk.
Clean the equipment to maintain hygiene standards of flavoured milk.
Pasteurize/boil the fresh milk to kill harmful bacteria.
Cool milk for some time and pour it into the blender.
Add flavours such as strawberry, banana, chocolate, vanilla or coffee to milk.
Add sweeteners or sugar to improve on the taste.
Add stabilizer to prevent milk separation and extend shelf life of flavoured milk.
Blend for 3 minutes to homogenize milk to ensure even distribution of flavours.
Sieve the flavoured milk in a tall glass or container and check for taste, texture and consistency.
Cool and package, flavoured milk in aseptic bottles or containers and label with product name, production date, expiry date, health benefits, ingredients and business contact.
Market at local shops, supermarkets, schools, offer samples at community events, use posters, or online platforms like WhatsApp, Tiktok, Facebook.

SAUSAGES

These are meat products made by grinding or mincing meat usually pork, beef, chicken and blend it with seasonings. The mixture is then stuffed into a casing traditionally made from cleaned animal intestines or synthetic casings.

Materials and Equipment

Meat (beef, chicken or pork).
Seasonings (salt, black pepper, chilli, herbs etc).
Casings (natural and synthetic tubes).
Sausage stuffer.
Heat source.
Binders e.g. flour, bread crumbs (optional).
Protective gears.
Meat knife.
Meat grinder/mincer.
Refrigerator/freezer.
Cutting board.
Containers/sauce pan.
Packaging materials/paper bags.
Labels.

Procedure

Put on apron, hairnet, mask and gloves for body safety and hygiene standards.
Assemble the materials and equipment for use in making sausages.
Clean the meat grinder, cutting boards, meat knives before use to avoid contamination.
Select fresh meat like beef, pork or chicken with a ratio 70% lean meat to 30% fat.
Trim and cut meat into small chunks suitable for grinding.
Freeze/chill meat for about 15-20 minutes to make it firm and easier to mince.
Grind meat using a mincer or food processor to obtain a minced form.
Combine minced meat with spices to add texture and binders (optional) for texture.
Mix thoroughly until the texture becomes sticky to bind the sausage.
Soak casings in water (around 30-40^{O}C) for 30 minutes to soften or slightly expand them.
Fill the casings evenly with minced meat using a sausage stuffer or funnel.
Twist the sausage into desired lengths to avoid air pockets and tie the ends with strings.
Cook or preserve sausage by grilling, frying, boiling, smoking, drying or refrigerate them.
Pack sausages in labeled paper bags and sell to the potential customers.

JERKY/DRIED MEAT

This meat has most of its moisture removed by either sun, oven, or air to preserve it for a long time. Removing moisture stops bacterial growth which keeps the meat safe and shelf stable. Jerky is eaten as snacks or added to stews or sauce for flavour.

Materials and Equipment

Lean cuts of meat (flank, sirloin).
Drying racks or mesh trays.
Packaging material.
Salt (for curing and preservation).
Sugar or honey (adding flavour and browning).
Spices (garlic, ginger, chilli, black pepper powder, soya sauce).
Acids (vinegar or lemon juice to preserve and tenderize meat).
Meat knife.
Cutting boards.
Protective gears.

Procedure
Put on apron, hairnet, mask and gloves for body safety and hygiene standards.
Assemble materials and equipment for use in making jerky/dried meat.
Clean the drying racks, meat knives and cutting boards to avoid contamination.
Select lean meat (meat without fats) from goat, beef or game meat.
Trim off all visible fats as fats spoils meat quickly and shortens shelf life.
Slice meat into thin, uniform strips (about inch thick, 1 inch wide and 4-6 inches long) to ensure uniform drying.
Mix ingredients like salt, vinegar or lemon juice, sugar and spices.
Marinate meat for 6-24 hours in a cool place to add flavor, preserve and tenderize it.
Sundry meat on drying rack/string or meshed trays to protect from insects only in dry weather for 8-16 hours. Alternatively, dry meat in oven at 60-70^{O}C for 4-6 hours.
Test for doneness as dried meat feels leathery and reduced in size and moisture content.
Pack dried meat in labeled airtight containers or vacuum sealed bags to maintain quality identification and increase shelf life and sell to the potential customers.

MEAT PIES
These are small pastries filled with cooked, seasoned meat and sometimes vegetables wrapped in dough and baked or fried until golden brown. Meat pies are perfect for school children, travellers, weeding meetings and community gatherings.

Materials and Equipment
Ingredients (all-purpose flour, baking powder, salt, margarine, cold water, curry powder, vegetable oil, fresh egg).
Fillings (minced meat e.g. beef or chevon, irish potatoes, carrots, onions, pepper).
Baking/wooden tray.
Frying pan.
Rolling pin/chapatti roller.
Fork.
Packaging material/paper bags.
Mixing bowl.
Pastry knife.
Heat source.
Skimmer.
Protective gears.

Procedure
Put on apron, hairnet, mask and gloves for body safety and hygiene standards.
Assemble materials and equipment for use in making meat pies.
Clean the baking tray, mixing bowl, frying pan, fork, skimmer and chapatti roller to maintain hygiene.
Mix 4 cups of flour, 1 tablespoon of baking powder and salt, 250g of margarine, cold water to form a firm dough.
Heat 2 tablespoon of vegetable oil in a frying pan.
Chop onions, garlic, carrots and green pepper into small pieces.
Add chopped onions into vegetable oil and fry until soft.
Add minced meat and cook until browned, then add diced carrots and irish potatoes.
Season with curry powder, salt and pepper powder to add flavour and natural taste.
Add 1 tablespoon flour and ½ cup water to thicken the mixture.
Cook until vegetables are soft and let the mixture cool for some minutes.

Roll the dough on a baking tray, shape and cut it into circles using a bowl.
Place a spoonful of cooked fillings in the centre of each circle and fold it over to form a half-moon shape.
Seal the edges with a fork and brush with the beaten egg.
Fry the meat pies evenly with a skimmer in vegetable oil until golden brown and crispy.
Pack meat pies in well labeled paper bags ready for sale to the potential customers.

BACON

This is a salt-cured meat traditionally made from the belly or back or loin of a pig. It can also come from cuts of beef (belly, brisket), turkey (thigh or breast), lamb (belly or shoulder) or other meats. It has a smoky and crispy texture when cooked.

Materials and Equipment

Meat cuts with fats e.g. belly.
Curing ingredients e.g. salt, sugar, black pepper, garlic powder, chilli etc.
Wood chips/charcoal/firewood. Heat source e.g. smoker or charcoal grill.
Packaging materials e.g. paper bags. Labels. Protective gears.

Procedure

Put on apron, gloves, mask and head cover for body safety and hygiene standards.
Assemble materials and equipment for use in making meat bacon.
Select the fatty meat cuts from belly or brisket or loin for tender result.
Mix salt, sugar, black pepper, garlic powder or chilli to make a cure mixture.
Rub the cure mixture all over the beef and seal it in a bag or container.
Refrigerate for 5-10 days, turning over meat daily to ensure even curing.
Rinse off excess cure under cold water and dry it with paper towels.
Air-dry in the fridge for 12-14 hours to a pellicle (sticky surface for smoke adhesion).
Smoke meat at 90-120^{O}C until internal temperature reaches 65-70^{O}C with wood chips or charcoal to preserve and add flavour.
Chill the smoked bacon in the freezer and then slice it into thin strips for frying or baking.
Pack bacon in labeled containers with curing dates, refrigerate or sell to the potential customers.

HAM

This is a meat product made from hind leg of a hog/pig and preserved through **dry curing** i.e. rubbing salt or sugars and spices directly on meat. Alternatively, the leg can be submerged into a seasoned saltwater solution (brine) i.e. **wet curing**. The brine can also be injected into the muscle for faster penetration i.e. **injection curing**. The preservation process gives it distinct flavour and long shelf life compared to fresh pork.

Materials and Equipment

Salt, water and spices. Refrigerator/freezer.
Hardwoods e.g. guava, mango, eucalyptus. Drum smoker.
Protective gears. Packaging materials.

Procedure
Put on apron, gloves, mask and head cover for body safety and hygiene standards.
Assemble materials and equipment for use in making meat bacon.
Clean the cutting board, meat knife and containers to avoid meat contamination.
Choose a clean, well-marbled hind leg from a health pig and trim off excess and skin if needed.
Dry cure or rub a mixture of salt, sugar and spices directly onto the meat to preserve and flavour. Alternatively, cure meat by wet curing (brining) or injection curing.
Keep ham cool in a freezer (ideally below $4^{O}C$) for 7-14 days to prevent spoilage.
Smoke ham with hardwoods to add flavour and extend the shelf life.
Soak ham for 4-12 hours in clean water to reduce saltiness while changing water every few hours.
Rub with garlic, black pepper, honey, pineapple juice, mustard, rosemary, tarmarind paste or ground cloves to add flavour.
Wrap ham in banana leaves or foil to retain moisture and roast it for 2-3 hours until internal temperature reaches $70\text{-}75^{O}C$.
Pack in well labeled materials for sale to potential customers or serve with matooke, cassava or sweet potato chips for a full meal.

NB: Alternatively, boil ham in a large pot with water, onions, garlic, bay leaves and black pepper and simmer for 1-2 hours.

CANNED MEAT
This is fresh or processed meat sealed in airtight containers usually metal cans and then treated to kill bacteria, yeasts or moulds. Canning makes meat shelf stable for months or even years without refrigeration ideal for rural markets or long distance transport.

Materials and Equipment
Meat (beef, chevon, chicken).
Lids or sealers.
Vinegar or lemon juice.
Ingredients like spices, binders e.g. flour-optional.
Broth.
Protective gears.
Sterilized cans or jars.
Meat knife.
Curing salt.
Cutting board.
Water.
Labels.

Procedure
Put on apron, gloves, mask and head cover for body safety and hygiene standards.
Assemble materials and equipment for use in making corned/canned meat.
Clean the cutting board, meat knife and containers to avoid meat contamination.
Select fresh cuts of beef, chevon, pork or chicken.
Trim off excess fats and connective tissue, or cut meat into cubes or mince to ease processing.
Prepare ingredients spices, or flour to enhance flavour and thicken sauces.
Wash and sterilize the cans thoroughly and prepare the lids and sealing equipment.
Pack meat tightly in sterilized can, often with broth or seasoning if desired to add flavour and preserve meat.

Seal the sterilized can so tightly to prevent spoilage.
Heat the cans to high temperatures to kill microorganisms. This ensures long shelf life and food safety.
Allow the containers to cool naturally for some minutes.
Label the cans with the product information, expiry dates and batch codes.
Store the cans in a cool, dry place away from sunlight until distribution to the market or potential customers.

NB: Broth is made by simmering meat such as beef, chevon, or chicken in water. It can be seasoned with salt, garlic, onions and herbs. It is thin and clear.

SMOKED MEAT
Materials and Equipment: Fresh meat, meat knife, smoker, charcoal or wood chips, spices (salt, garlic, onions, pepper, chilli), wrapping materials, protective gears.

Procedure
Put on personal protective gears for body safety and hygiene standards.
Select the meat cuts of your choice like ribs, brisket, ham, shoulder etc.
Trim off excess fats from the meat and apply marinade (local spices) to add flavour.
Rest the meat for a few hours or overnight in the refrigerator to absorb marinade.
Preheat the smoker to a desired temperature (usually 60-80^{O}C) for hot smoking.
Add charcoal or wood chips depending on your desired smoky flavour.
Place meat on the smoker grates or grill racks and maintain a consistent temperature throughout the smoking process. For added moisture a water pan can be placed inside the smoker.
Turn the meat regularly and ensure it is uniformly smoked or done.
Remove the meat from the smoker and rest it for 15-30 minutes to allow juices to redistribute ensuring tenderness.
Slice the smoked meat as desired and serve with your favourite dishes.

FRUIT JUICE
Manual Extraction and Processing of Fruit Juice
Materials and Equipment

Fresh ripe fruits.	Manual hand press juicer.	Strainer/muslin cloth.
Clean water.	Large bowl/container.	Heat source.
Preservatives.	Knife.	Airtight bottles.
Sauce pan.	Labels.	Bottle caps/lids.
Protective gears.		

Procedure
Wear appropriate attire such as clean gloves, apron and hairnet or cap and closed shoes for body safety and protect juice from contamination.
Assemble the materials and equipment for use in extraction of fruit juice.
Select clean, fresh, ripe and undamaged fruits for processing.
Wash the fruits thoroughly to remove dirt and pesticides.

Peel/remove the skin, seeds or hard cores depending on the fruit.
Cut fruits into small pieces for easier handling or juicing.
Hand press the fruits with a hand presser or squeeze them manually in a cloth strainer or muslin bag by hand.
Strain juice repeatedly to remove the pulp using a muslin cloth to obtain clear juice.
Heat or pasteurize juice to kill bacteria and extend the shelf life.
Add natural preservatives such as lemon juice, honey to slow spoilage.
Pack juice in labeled clean airtight bottles with product name, ingredients, contact and refrigerate immediately to maintain freshness and for longer shelf life.
Market and sell juice to the potential buyers or provide samples to the supermarkets.

CANNED FRUITS

Here, prepared fruits are sealed in airtight containers (cans or glass jars) and heated to high temperatures to destroy microorganisms that cause spoilage. Canning extends shelf life and maintains flavour, texture and nutritional value of the fruits.

Materials and Equipment

Fresh fruits.	Clean water.	Knife.
Canning jars.	Lids.	Rings.
Chopping board.	Heat source.	Syrup.
Labels.	Protective gears.	

Procedure

Put on appropriate protective attires for body safety and hygiene standards.
Select fresh, ripe, high quality fruits free from bruises.
Wash and prepare fruits by peeling, slicing and de-seeding.
Sterilize the canning jars, lids and rings in boiling water.
Pack fruits into sterilized jars and add syrup, juice or water.
Seal the jars with rings and lids and process in boiling water bath or pressure canner.
Cool the containers and store in a dark, cool place.
Label with production date and fruit type before sale to potential customers.

FRUIT JAMS

These are sweet, thick spreads made by cooking crushing fruit (s) with sugar and acid until the mixture gels or thickens. This extends shelf life, concentrates flavour and creates a spreadable product on breads, cake fills etc. Common fruits used in fruit jam making are mangoes, strawberries, pineapples, oranges, apples, guavas, grapes and mixed fruit blends.

Materials and Equipment

Fresh ripe fruits.	Chopping board.	Clean water.
Lemon juice.	Sugar.	Knife.
Saucepan.	Sterilized jars.	Heat source.
Spoon/stirrer.	Labels.	Protective gears.

Procedure
Put on appropriate protective attires for body safety and hygiene standards.
Select fresh, ripe, clean fruits like mangoes, pineapple and oranges for mixed jams.
Wash fruits thoroughly to remove dirt and pesticides.
Peel and remove seeds from fruits if necessary.
Chop fruits into small pieces or blend into a puree (smooth, thick paste from crushed fruits).
Place fruit in a heavy pan, add sugar to adjust taste and fruit sweetness.
Add lemon juice to preserve jam for long-term storage and to add tangy flavour.
Cook on medium heat until sugar dissolves and thickens and reaches gel stage (for about 10-20 minutes).
Stir with a spoon while cooking to prevent burning.
Pour hot jam into sterilized jars and seal it tightly with lids.
Label the jars with fruit type, ingredients and production date, and store in a cool, dry place.
Sell fruit jam at the local markets and online platforms, provide samples to supermarkets.

FRUIT LEATHER
This a chewy sweet snack made by drying fruit puree into thin, flexible sheets on a flat surface. When dried, the fruit is pulled from the surface and rolled. They are made from strawberries, mangoes, pineapple, banana, papaya, apples, pears etc.

Materials and Equipment

Fresh ripe fruits.	Chopping board.	Knife.
Clean water.	Trays.	Protective gears.
Blender.	Honey/lemon juice (optional).	Labels.
Parchment paper/silicone sheets.	Solar dryer/oven/dehydrator.	Packaging materials.

Procedure
Put on appropriate protective attires for body safety and hygiene standards.
Select fresh, ripe, clean fruits free from damages/bruises.
Wash fruits thoroughly in clean water to remove dirt and pesticides.
Peel and remove seeds if necessary depending on the fruit.
Chop the fruit into small pieces or blend into a smooth puree.
Add honey or sugar (optional) to improve taste and flavour.
Add lemon juice (optional) to preserve colour and add acidity.
Spread puree evenly about 3-5 mm thick on trays lined with parchment paper or silicone sheets.
Use a solar dryer, oven or dehydrator to dry the puree for 6-12 hours until the surface is dry but flexible.
Rotate trays occasionally for even drying.
Once cooled, peel off the sheet or paper and cut into strips or shapes.
Pack fruit leather and store in airtight containers away from sunlight and moisture.
Label packages with fruit type, ingredients and expiry date.
Offer sample strips at local shops or markets to attract buyers.

DRIED FRUITS

Here, water content of the fruits is removed to extend shelf life and preserve their nutrients. It is commonly done on fruits like mangoes, oranges, apples, pears and apricots through natural sun drying and dehydration.

Materials and Equipment

Fresh ripe fruits.	Clean water.	Lemon juice.
Drying tray.	Netting/cheesecloth.	Labels.
Airtight containers.	Protective gears.	

Procedure

Put on appropriate protective attires for body safety and hygiene standards.
Choose high quality mature fruits free from damages.
Wash, peel and slice fruits evenly for uniform drying.
Pretreat with lemon juice or blanching to preserve colour.
Spread fruit slices on the drying trays or racks.
Cover the trays with netting to protect from insects.
Place the trays under direct sun light for 2-5 days (or use an oven or a dehydrator until they reach desired dryness).
Turn the fruits occasionally to ensure even drying.
Monitor and protect the fruits from humidity or rain.
Once fully dried, allow them to cool and store in airtight containers in a cool, dry place.
Label the containers with fruit type and production date before sale to potential customers.

CANNED VEGETABLES

Here, prepared vegetables are sealed in airtight containers (cans or glass jars) and heated to high temperatures kill the bacteria and enzymes that can cause spoilage. Commonly canned vegetables include tomatoes, carrots, green beans, peas, peppers, pumpkin, squash, beets, spinach, cucumber etc.

Materials and Equipment

Fresh vegetables.	Clean water.	Glass jars/cans.
Lids.	Knife.	Heat source.
Saucepan.	Skimmer.	Protective gears.

Procedure

Put on personal protective attire for hygiene standards and body safety.
Choose fresh, clean, high quality vegetables.
Wash, peel and slice them into uniform pieces.
Sterilize the jars, lids and rings in boiling water.
Blanch to preserve the texture, colour and flavour.
Pack them into hot sterilized glass jars or cans.
Gently press down the vegetables on sides of the jar to remove air bubbles.
Seal the jars and then heat-process to kill microorganisms.
Cool the containers and store in a cool dark place.

FROZEN VEGETABLES

Freezing is a popular method of preserving vegetables helping then to retain nutrients such as vitamins and minerals, flavour and texture and stored for several months.

Materials and Equipment

Fresh vegetables.	Knife.	Clean water.
Heat source.	Saucepan.	Ice/cold water.
Freezer bags/airtight containers.	Freezer.	Protective gears.

Procedure

Put on personal protective gears for hygiene standards and body safety.
Wash, peel and cut vegetables into desired size.
Blanch them to preserve quality.
Cool rapidly in ice water.
Drain and pack frozen vegetables into airtight containers.
Label the containers and store in a freezer at -18^{O}C or below.

DEHYDRATED VEGETABLES

Here, fresh vegetables are prepared, blanched and placed in a special equipment like food dehydrators, ovens or microwave to remove moisture more efficiently. They are then cooled, sealed in airtight containers to prevent rehydration and stored in a cool dark place. They are then rehydrated in water to make them tender when required for use.
NB: Dehydrators extracts high percentage of water compared to traditional drying methods.

Materials and Equipment

Fresh vegetables.	Clean water.	Knife.
Saucepan.	Heat source.	Cold water.
Skimmer.	Electric dehydrator or oven.	Labels.
Airtight containers.	Protective gears.	

Procedure

Put on personal protective attires for hygiene standards and body safety.
Choose fresh, ripe vegetables such as sweet potatoes, carrots, tomatoes, okra, onions etc.
Wash them thoroughly to dirt and microbes.
Peel if needed (e.g. carrots, sweet potatoes) and slice them uniformly to dry faster and evenly.
Boil water and dip vegetables for 1-3 minutes to preserve colour, texture and nutrients.
Immediately cool in cold water, drain them before dehydrating.
Dehydrate the blanched vegetables for 6-12 hours in oven or electric dehydrator for faster dehydration. The period of dehydration depends on vegetable type, thickness and humidity.
Check for doneness, vegetables should be crispy or leathery without moisture remains.
Store dehydrated vegetables in labeled airtight containers or vacuum sealed bags in a cool, dry, dark place.
Sell dehydrated vegetables in local markets, schools or online platforms like Jumia.

VEGETABLE JUICE

Vegetable juice is extracted from fresh vegetables often consumed for its nutritional benefits and refreshing taste. It can be made from a single vegetable like carrots or a blend of several vegetables such as spinach, carrots, beetroot and cucumber. Many people also mix in fruits like pineapple, apples or lemons to improve taste, flavour and balance acidity.

Materials and Equipment

Fresh vegetables.	Clean water.	Knife.
Heat source.	Chopping board.	Blender/juicer
Strainer/muslin cloth.	Clean bottles.	Large bowl /container.
Freezer.	Labels.	Protective gears.

Procedure

Put on appropriate protective attire for hygiene standards and body safety.
Select fresh, clean vegetables such as carrots, beetroots, cucumber and pineapples or apples (optional) to add taste and flavour.
Wash thoroughly in clean water to remove dirt and pesticides.
Peel and chop into small pieces for easier blending or juicing.
Add chopped vegetables with water into the blender to process/blend until smooth.
Strain/sieve with a muslin cloth to remove pulp and fibers from the juice.
Add pineapple juice or mint (optional) to add extra flavour and sweetness.
Pasteurize juice to 70-90^{O}C for 1-2 minutes (optional) to kill microbes and extend shelf life.
Package juice in clean bottles with labels showing ingredients and health benefits.
Refrigerate juice to preserve freshness, prevent spoilage and extend shelf life.
Offer juice samples at local shops or markets and online platforms like Jumia, WhatsApp.

BRIQUETTES

These are compressed blocks of combustible material used as fuel. Briquettes are made in different shapes and size from various organic waste materials such as charcoal dust, sawdust, waste papers, agricultural wastes (rice husks, wheat straw groundnut shells, sugarcane bagasse), wood chips, chopped leaves, cassava flour, wheat flour, clay etc.

CHARCOAL BRIQUETTES

Materials and Equipment

Charcoal/charcoal dust	Crusher/grinder.
Binder (clay, soil or starch).	Briquette press.
Water.	Buckets.
Protective attires.	Packaging materials.

Procedure

Put on protective attires such as gumboots, overall and mask for body safety.
Assemble the equipment and materials for use in processing charcoal briquettes.
Crush the charcoal into small pieces to form charcoal dust and put them in bucket.

Add binders such as starch or other additives like clay or cow dung to hold briquettes together and improve the burning efficiency.
Mix the materials thoroughly until the mixture is homogenous.
Add some water just enough into the materials until they are wet to obtain a paste.
Place the charcoal mixture/paste into the briquette press and then compress it to proper consistence or roll the paste between palms to make wet circular briquettes.
Dry the briquettes in the dryer or under sunshine until water evaporates.
Turn the briquettes regularly to ensure uniform drying.
Pack the finished briquettes in labeled polythene sacks and store under a leak proof shelter ready for use.

PAPER BRIQUETTES
Materials and Equipment

Waste papers.	Sawdust.	Rice husks.	Starch.
Briquette press.	Container.	Razor blade.	Protective attires.
Water.			

Procedure
Put on personal protective equipment/attire for body safety.
Assemble the equipment and materials for use in processing paper briquettes.
Cut or tear the waste papers into very small pieces and place them in a container.
Soak the papers in the container for at least 24 hours until it becomes pulp or soft.
Blend or mash the soaked papers into a porridge-like paste.
Add binders such as sawdust, starch, rice husks or other organic materials.
Place the material into briquette press to compress it into compact shapes.
Press/squeeze the briquettes to remove excess moisture.
Set the briquettes in the sun or a well-ventilated area until completely dry.
Once dry, the briquettes are packed in polythene sacks and are ready for storage or use as fuel.

BIOGAS PRODUCTION
Materials and Equipment

Biogas digester.	Animal dung and urine.	Food wastes.
Crop residues.	Waste water.	Protective attires.

Procedure
Put on personal protective equipment for body safety.
Assemble the tools and materials for use in making biogas.
Dig a pit depending on the size of the biogas digester tank.
Set up an airtight biogas digester system with all its components.
Gather organic wastes such as animal droppings, urine, food wastes, crop residues etc.
Mix organic wastes like cow dung with waste water or urine (about a 1:1 ratio) to create a semi-liquid mixture called slurry. Combine food wastes, cow dung and crop residues for high yield.
Pour the slurry into the digester through the slurry inlet/mixing tank.
Cover the inlet tank to protect it from rain and keep it from drying up.

The anaerobic bacteria will breakdown the mixture during the process of fermentation to release methane gas called biogas which is trapped in the gas holder.
Store gas in the flexible gas bag/tank or cylinder and install a pressure valve and gas tap for use or channel the biogas through pipes to the stoves, generators or heating systems for use.

HANDMADE PAPERS

These are papers crafted manually using natural materials. Waste materials used in making handmade papers include old newspapers, office papers, cardboards, cotton, banana fibers, sugarcane bagasse, wheat straw, maize husks, rice husks, binder such as starch etc.

Materials and Equipment

Mould and deckle.
Agrowastes (banana fiber or sugarcane bagasse).
Blender.
Razor blade.
Piece of cloth or sponge.
Scrap/waste papers.
Clean water.
Large container/basin.
Pair of scissors.
Protective gears.

Procedure

Put on personal protective equipment/gear/attire for body safety.
Assemble the materials and equipment for use in making handmade papers.
Cut/tear scrap papers or agro wastes (banana fiber or sugarcane bagasse) into small pieces.
Soak the pieces in water for overnight to soften them more.
Blend or mash the soaked materials in until they form a smooth and fibrous slurry.
Transfer the slurry/pulp into a large container/basin and mix it thoroughly.
Dip a wooden frame (mould and deckle) horizontally into the pulp in the container.
Shake the wooden frame lightly in pulp until it spreads evenly to create a thin layer.
Lift the wooden frame out of the pulp in the container to drain out water.
Drain the remaining water with a piece of cloth or sponge.
Carefully transfer the wet sheet onto a flat surface and allow it air dry completely.
Once dry, peel off the paper and trim the edges as needed ready for use.

COMPOST

This is made from a wide range of plant and animal materials, including discarded vegetable residues, weeds, kitchen refuse, animal excreta, straw or crop remains etc. These are put together and made to decompose either in compost pits or heaps until ready for application or use in the field.

Materials and Equipment

Fresh materials.
Agricultural lime.
Water.
Tape measure.
Farm Yard Manure.
Top soil.
Hand hoe.
Spade.
Phosphate fertilizer.
Dry stick.
Watering can
Protective gear.

Procedure
Put on protective equipment such as gumboots, overall and gloves for body safety.
Assemble materials and equipment to be used in preparation of compost manure.
Dig five pits each measuring 120 cm x 120 cm x 60 cm.
Fill pit 1 with fresh materials such as grass, maize stalks and kitchen refuse.
A layer of well decomposed farm yard manure is then added to provide micro organisms which initiate decomposition process.
Phosphatic fertilizers are added to increase the nutrient composition of the material.
Cover the materials with a layer of top soil and agricultural lime to supply more micro organisms as well as to neutralize the pH in the pit.
Repeat the process until the pit is full.
Drive a strong dry stick in the centre of the materials to monitor temperatures.
The pit is kept moist in the dry season by sprinkling water over it to control over heating that would destroy micro organisms as well as lead to nutrient loss.
After 3 to 4 weeks, transfer the material from pit 1 to pit 2.
Continue transferring the materials at an interval of 3 to 4 weeks until they reach pit 5.
In pit 5 the materials stays there for another 3 to 4 weeks from where the well decomposed organic material is removed, cooled and then taken to the field for application.

ANIMAL FEEDS
MINERAL SUPPLEMENTS/MINERAL BLOCKS
Materials and Equipment

Dry clay.	Anthill soil.	Dry bones,
rock salt powder.	Heat source.	Mortar and pestle.
Mould bowl.	Clean edible oil.	Protective gears.

Procedure
Put on protective gears such as gloves, gumboots and overall for body safety.
Burn the bones in a sauce pan to drive out remaining moisture.
Grind the bones in the mortar using a pestle to powder form.
Pound dry clay soil and anthill soil to fine powder form.
Mix 1 part of dry clay, 1 part of anthill soil with 4 parts of bone powder and 2 parts of rock salt powder in the container.
Add reasonable amount of water to the mixture to make a homogeneous paste.
Ensure that all ingredients are covered with water.
Oil the walls of the mould bowl to ease the removal of the paste after setting.
Pour the homogeneous paste into a mould bowl of any desired size and shape.
Gently compact the paste in the mould bowls and leave them in the sun for about 2 days.
Remove the blocks from the bowls and dry them in a well sheltered place for 1-2 weeks depending on the weather. Create a hole in the middle of the wet paste to allow aeration.
Feed the animals on mineral blocks and observe the productivity over some time.

OTHER VALUE-ADDED PRODUCTS
IRISH POTATO CHIPS
These are thick-cut, deep-fried irish potato slices eaten as snack or side dish. They are soft inside and slightly crispy outside. They are served hot with salt, or alongside fish, grilled meat or sausages.

Materials and Equipment

Fresh irish potatoes.	Sharp knife.	Vegetable cooking oil.
Clean water.	Cutting board.	Frying pan.
Slotted spoon/tongs.	Clean bowls.	Heat source.
Charcoal.	Packaging materials.	Labels.
Seasonings (Salt, tomato sauce, chilli powder).		Protective gear.

Procedure
Put on appropriate attire like apron, hairnet and gloves for safety and hygiene standards.
Assemble the materials and equipment for use in making irish potato chips.
Wash irish potato tubers thoroughly with clean water to remove soil or dirt materials.
Peel fresh potatoes with a sharp knife to remove the outer skin and eyes.
Slice into thick cuts with a knife or a mandoline slicer into thin cuts for even frying.
Soak slices in cold water for 10-30 minutes to remove excess starch.
Drain and dry thoroughly with paper napkins to remove water.
Prepare the heat source for deep frying the sliced potatoes.
Deep fry slices in batches for 3-5 minutes while turning until golden brown and crispy.
Remove ready chips from hot oil with a slotted spoon and drain on perforated container.
Season with salt, chilli powder, cheese, garlic or add tomato sauce to add taste.
Let potato chips cool completely before packaging.
Package in silver plates or branded bags with clear attractive labels bearing business name, ingredients, nutritional benefits and contact information.
Offer free samples at community events, partner with schools or local shops and use online platforms like WhatsApp, Jumia, Facebook and Tiktok.

FRIED CASSAVA
This is a delicious dish made from cassava roots, peeled, boiled until tender and then deep-fried until golden brown and crispy. It is often served as a snack or appetizer.

Materials and Equipment

Fresh cassava roots.	Sharp knife.	Vegetable cooking oil.
Clean water.	Heat source.	Charcoal.
Slotted spoon/skimmer.	Frying pan.	Clean bucket/container.
Seasonings (Salt, chilli powder, tomato sauce, tomatoes, onions).		
Packaging materials.	Labels.	Protective attire.

Procedure
Wear appropriate protective attire such as apron, head cover and gloves for hygiene standards and body safety.
Assemble the materials and equipment for use in making fried cassava.

Wash cassava roots thoroughly with clean water to remove soil or dirt materials.
Peel the cassava roots to remove the thick brown stick to expose white flesh inside.
Cut/slice the white flesh into uniform thick sticks/pieces for even cooking.
Wash the sliced cassava sticks again with clean water to remove excess starch.
Prepare the heat source for boiling or deep frying cassava.
Boil cassava pieces in salted water in salted water for 15-30 minutes until soft/tender.
Drain tender cassava pieces and cool them slightly for a few minutes.
Slice each piece lengthwise and remove the tough inner string.
Deep fry cassava in hot oil in batches, turn over and over until golden brown and crispy.
Remove fried cassava from hot oil and collect it in a perforated container to drain oil.
Sprinkle with salt, chilli powder or add tomato sauce, avocado, sliced onions or tomatoes to add taste and flavour.
Package in materials like silver plates or branded bags with clear attractive labels bearing business name, ingredients, nutritional benefits and contact information.
Offer free samples at events, partner with schools or local shops and use online platforms like WhatsApp, Jumia, Facebook and Tiktok.

POTATO/YAM CRISPS

Crisps are thin slices of potatoes, yams or plantain that are fried or baked until crunchy and seasoned with various flavours like salt, chilli, cheese and onion.

Materials and Equipment

Fresh irish potato/yam.	Sharp knife.	Vegetable oil.
Slotted spoon/skimmer.	Frying pan.	Clean water.
Seasoning (salt, cheese, chilli and onion).		Heat source.
Packaging material.	Labels.	Protective gears.

Procedure

Put on appropriate attire like apron, hairnet and gloves for safety and hygiene standards.
Assemble the materials and equipment for use in making potato/yam crisps.
Clean the fresh potatoes/yams to remove dirt and debris.
Peel them manually with a sharp knife to expose the flesh inside.
Slice into very thin, uniform pieces (about 1-2 mm) to ensure even frying for crispness.
Soak slices in cold water for 10-30 minutes to remove excess starch.
Drain and dry thoroughly with paper napkins to remove water.
Prepare the heat source for deep frying the sliced potatoes/yams.
Deep fry slices in batches for 3-5 minutes while turning until golden brown and crunchy.
Remove crisps from hot oil with a slotted spoon and drain on perforated container.
Sprinkle with salt, chilli powder, cheese, garlic or add tomato sauce to add taste.
Let potato/yam crisps cool completely after deep frying before packaging.
Package in plastic bags with clear attractive labels bearing logo, ingredients, nutritional benefits, expiry date and contact information.
Store finished packs in a cool, dry place away from sunlight to maintain crisps crunchy.
Offer free samples at community events, partner with schools or local shops and use online platforms like WhatsApp, Jumia, Facebook and Tiktok.

CASSAVA FLOUR

This is a fine white powder made by grinding dried clean cassava. Dried cassava can be processed into flour by either manually (use of simple hand tools like mortar and pestle) or mechanically by use of a hammer mill depending on the scale of production and available technology. Let us look at manual processing of dried cassava.

Materials and Equipment

Fresh cassava roots.	Sharp knife.	Clean water.
Solar dryer.	Mortar and pestle/blender.	Fine mesh strainer.
Polythene sacks.	Labels.	Protective gear.

Procedure

Put on appropriate protective equipment for hygiene standards and body safety.
Assemble the materials and equipment for use in making cassava flour.
Wash freshly harvested cassava roots with clean water to remove soil and debris.
Peel the cassava using a knife to remove the outer skin exposing the white flesh.
Slice the peeled cassava into small uniform pieces to ensure faster drying and grinding.
Dry the chopped cassava in a solar dryer or using open air drying to remove moisture.
Grind with mortar and pestle/manual grinder/blender into a fine powder.
Sift with fine mesh strainer to remove lumps and ensure a fine/smooth uniform texture.
Package in polythene sacks, label with the logo, contact, production and expiry date.
Store in a cool dry store/place to prevent spoilage and maintain quality.
Sell at local markets, supermarkets, partner with schools, share product photos and videos on social media platforms like Facebook, WhatsApp to increase sales.