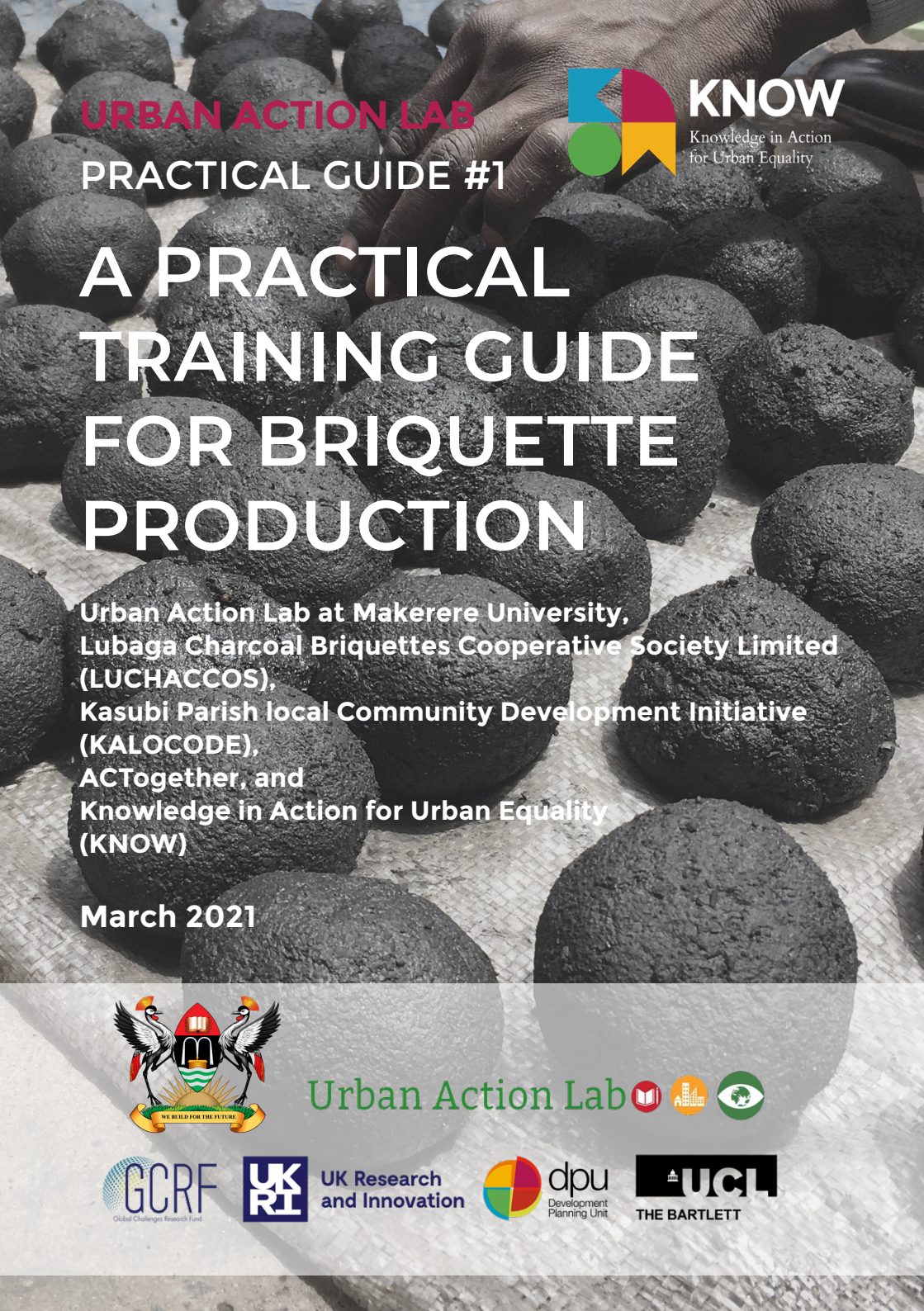

URBAN ACTION LAB

PRACTICAL GUIDE #1

KNOW
Knowledge in Action for Urban Equality

A PRACTICAL TRAINING GUIDE FOR BRIQUETTE PRODUCTION

**Urban Action Lab at Makerere University,
Lubaga Charcoal Briquettes Cooperative Society Limited (LUCHACCOS),
Kasubi Parish local Community Development Initiative (KALOCODE),
ACTogether, and
Knowledge in Action for Urban Equality (KNOW)**

March 2021

WE BUILD FOR THE FUTURE

Urban Action Lab

GCRF Global Challenges Research Fund

UKRI UK Research and Innovation

dpu Development Planning Unit

UCL THE BARTLETT

Forward

Why Briquette production?

Waste is a resource. From a traditional point of view, daily waste has been regarded as worthless, however, from the point of view of resource efficiency, daily wastes can be recovered, recycled, and reused at many points of production and consumption.

There are various types of manual processes, with the advantages of low investment and operation cost and low levels of required skills, which can make use of this resource in an efficient way. Briquetting is one of these means, turning 'waste into treasure'. Briquetting technology is used to densify loose combustible materials into solid composites of different shapes and sizes with the presence of pressure and binding agents. Briquettes present a much more efficient and cost effective energy source for cooking, and in turn, an alternative means of securing a livelihood. They can bring about economic development, employment and reduce the damages on the environment and forests.

The Urban Action Lab, Makerere University

The Knowledge in Action for Urban Equality (KNOW) Kampala City Partners at the Urban Action Lab, are exploring demonstrable strategies for the transformation of waste management in the city at a community-based local-level. The study takes place in densely populated middle–to–low-income neighbourhoods in Kampala, looking at community-led initiatives such as the co-production of fuel briquettes from organic waste as means of developing innovative waste economies.

About this Practical Guide

This Practical Guide is intended for training purposes for groups, organisations and individuals interested in starting up briquettes enterprises as an alternative livelihood strategy. It can be used as an operational manual; as a reference text for those with already existing briquette knowledge; or as an introductory guide for those who are new to the concept and practice of briquette production and enterprises. Although based on case-studies from Kampala, this Guide may also be relevant to other contexts.

Summary

This Practical Guide, is co-created with community briquette making organisations and enterprises involved in the KNOW programme's Kampala micro-economies project. The production of this Practical Guide has been informed by the experiences of local community partners across six settlements within Kampala, including: *Kasubi*, *Bwaise III*, *Bwaise I*, *Namungoona*, *Masanafu* and *Nakulabye*, where community groups have been engaged in the localised production of briquettes.

Those following this Practical Guide will be introduced to the production of briquettes from three different types of material, including:

1. Briquettes from organic waste bonded with clay,
2. Briquettes from organic waste bonded with cassava porridge,
3. Briquettes from organic waste and charcoal dust bonded with either clay or cassava porridge.

This Practical Guide also provides background information on the need for briquettes in Kampala, discusses the socio-economic and environmental benefits of briquettes, and describes step-by-step procedures for their production, marketing and utilisation. It also advises on how community groups can govern themselves and develop briquette enterprises.

In combination with the KNOW Kampala project activities, this Guide aims to contribute to the introduction of low-cost, energy-efficient fuel in Kampala, reducing household expenditure on cooking fuel through a low-cost alternative and, in turn, serving as a pathway to urban equality. By promoting briquette production as a livelihood option for the urban poor in Kampala, the project aims to support the reduction of unemployment, and more broadly, build capacity for innovation in policy and planning, to promote urban equality.

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Contact: Urban Action Lab ual@caes.mak.ac.ug
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1. Introduction

What are briquettes?

Briquettes are a form of solid fuel that can be burned for energy. They are created by compacting loose biomass residue/organic waste bonded with paper or clay and cassava porridge into a solid block that can replace fossil fuels, charcoal and natural firewood for domestic and small-scale commercial cooking. Generally, there are a range of materials that can be used to make briquettes, including agricultural wastes, waste paper, charcoal dust, water and sawdust. This Practical Guide will focus on agricultural wastes and charcoal dust as the main materials for the production of briquettes.

Benefits of briquettes:

1. Using briquettes means using less wood as household fuel. As they are made mostly from locally sourced organic wastes, their use reduces carbon emissions and contributes to environmental sustainability;
2. Briquettes provide possible employment opportunities and therefore a source of alternative income;
3. They burn for a longer period compared to wood fuels, making them more fuel efficient and cheaper for local households;
4. Daily briquette production is a more efficient and effective waste management alternative, helping to keep communities cleaner;
5. Briquettes are cheaper for the producer and the consumer as the raw materials to make them are readily available and much cheaper compared to standard fuels (such as charcoal and wood);
6. Given their size, shape and density, briquettes are easy to store and transport. By compacting biomass waste into briquettes, the volume that can be stored and transported is much greater than common fuels.

2. Market Survey

The aim of conducting a market survey with local communities is to ascertain who may become future users of briquettes. These will be people or groups who previously used charcoal or firewood for cooking. In the first stage of the market survey, participants in homes and businesses like restaurants, should be given samples of briquettes so they can try out, or witness, their use in cooking. This will educate potential future users of briquettes in the community.

Briquettes are mostly targeting two main market groups:

- The mass domestic market, consisting of households that use wood or charcoal for daily cooking;
- Business and institutional consumers, including restaurants, hotels, institutions, etc.

Both of these market groups are driven by consumer decisions, which are normally based on comparing prices between briquettes between briquettes and traditional solid fuels (charcoal and firewood). However, the price of briquettes is not the only incentive for a consumer to purchase briquettes. Things like the burning longevity and heat strength of the briquette are also of importance to the consumer.

Some marketing tools to consider in supporting the sales of briquettes are:

- Buyers of large quantities can receive discounts;
- Briquettes can be exchanged for the delivery of raw materials;
- Pro-environmental conversations can be included in marketing briquettes;
- Open-air cooking demonstrations using briquettes (e.g. in market centres) can be conducted;
- Participation in shows and exhibitions.

Things to keep in mind:

- Briquettes are consumable goods, which means users, or user groups, must trust in their reliable availability;
- The characteristics of briquettes and their marketing should be adapted to the targeted local market. This may be domestic use, business, institutional markets, or premium consumers;
- Briquettes are a competitive good to traditional solid fuels like charcoal and firewood. The price per unit of energy competes with the range of traditional fuels.

3. Briquette production: A Practical Guide

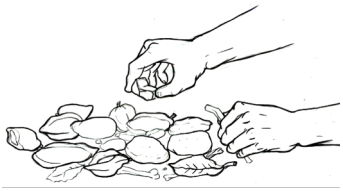
The following tables and illustrations aim to provide a step by step overview of the briquette production process. For those working through each step, a check box (✓) has been provided to confirm when a guideline has been completed.

3.1 SITE		
No.	Guideline & Detail	✓
3.1.1.	Production site: Important decisions and arrangements need to be made before beginning the production process, including, but not limited to::	
A	Selection of a production site/place.	
B	Identification and availability of appropriate raw materials for production.	
C	Sourcing of raw materials.	
3.1.2	Site selection: When selecting a site for briquette production, the ideal location should:	
A	Be within, or near, residential neighbourhoods with access to sources of raw materials such as organic waste and water.	
B	Have a sufficient production space: • An area of at least 5m x 3m for small-scale production; • An area of at least 13m x 7m for larger-scale production; • The production site (large or small) should have space for producing, dying, and storing the briquettes, storage of raw materials and, where possible, space to sell the final product.	
C	The production, sales, and collection sites should all be in a location deemed fit by all the members of the group/organisation producing the briquettes.	

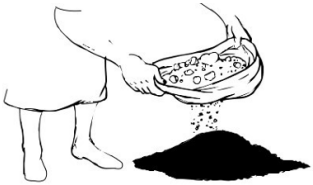
3.2 GENERAL PRODUCTION GUIDELINES		
No.	Guideline & Detail	✓
3.2.1	Community groups/ individual enterprises should take note of these general guidelines before starting the production of briquettes:	
A	Individual groups of producers should: • Not see themselves as competitors, but rather as allies who can assist each other in creating an alternative market to traditional fuels like charcoal or firewood; • Be mindful that competition is tough and that the odds of developing a financially viable individual briquette project are limited, but possible; • Be mindful about the limitations of production which is best suited to local, small-scale urban markets; • Start with small-scale production expecting less return until the market it ready and higher production can be aimed for; • Establish working relationship(s) with residents, households, or market operators around the collection of organic waste including material collection, transportation and storage; • Community-based briquette groups/ enterprises should be designed to be market-driven rather than production driven; • Achieve a minimum level of critical consumption. Large-scale production results in reduced production cost only if the product can be sold in sufficient quantity.	
B	To meet the needs of briquette users, it is important that: • The produced briquettes must have comparable characteristics to charcoal; • They must contain carbonised material or else they will likely be rejected Users should have training/ education about the ways briquettes differ from charcoal; • The briquettes produced must be of very good quality to meet expectations; • Raw materials and production processes should be carefully selected and tailored to a given project's needs and scale.	
C	When selling briquettes • The price must be lower than charcoal as its overall fuel strength and quality will always be less than charcoal/firewood; • Having a good knowledge of the charcoal and firewood markets and prices is useful; • Producers should market beyond the domestic market to reach, for example, agribusinesses, hotels, or schools.	

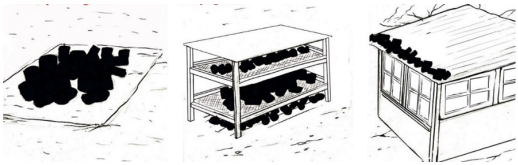
3.3 MATERIALS			
No.	Guideline & Detail	Example image of material	✓
3.3.1	Sourcing raw materials for briquette production		
A	**Organic waste:** Organic waste(s) can be collected from markets, local traders, households, vendors, and branches from invasive trees from the local area. If necessary, community groups can raise awareness in their local areas to sort waste at home into organic and non-organic waste. They can also arrange a fee system for collecting organic waste directly from markets, institutions or households. Organic waste to use include: • Fruits; • Vegetables; • Roots and tubers from legumes and potatoes; • Grains; • Other biodegradable materials; • Tree branches from invasive plants and leaves; • Cut grass. Waste should not include: • Plastics; • Metal; • Wood; • Glass; • Cloth.	 Fruits, vegetables, fish, legumes   Cut grass Branches 	
B	**Charcoal dust** *(this is optional)* Charcoal dust can be sourced from existing charcoal traders or vendors. Charcoal dust can be used as a primary raw material or as subsidiary raw material.		

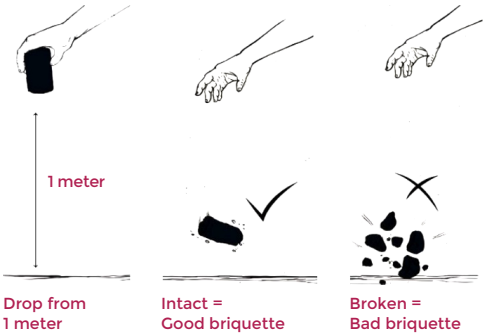
3.3 MATERIALS (continued)			
No.	Guideline & Detail	Example image of material	✓
C	Clay Clay is used as a binder and can generally be sourced from an ant-hill, or a local swamp.		
D	Cassava flour/ porridge Cassava flour/porridge is used as a binder and can be purchased from retail shops or at local markets.		
E	Water Water is used to mix or mould all the raw materials together. Water can be accessed from any water point available to the briquette producers.		

3.4 BRIQUETTE PRODUCTION			
No.	Guideline & Detail	Example image of process	✓
3.4.1	Step-by-step guide to producing briquettes		
A	Collection Waste is collected from households, markets, or food vendors. It then needs to be stored *as pictured*.		
B	Sorting The organic waste needs to be sorted to remove any non-organic materials like pieces of wood, glass, metal, or stones.		

3.4 BRIQUETTE PRODUCTION (continued)			
No.	Guideline & Detail	Example image / definition	✓
C	Drying of the waste Before carbonising or burning the waste, it needs to be sun-dried to remove any moisture, *as pictured.*		
D	Carbonisation The process of carbonising or burning can be done in a carbonising drum or in an underground hole*	*'Carbonisation', is the process of heating the dried raw materials (biomass) in the absence, or with limited supply of, oxygen to produce a carbon rich solid residue called 'char'. Carbonisation releases the biomass volatile compounds resulting in a light-weight combustible fuel.* There are two recommended methods explained below:	
⚠	*Warning! The following important safety measures must be considered before carbonising/burning. Always wear thick gloves, long sleeves, trousers, closed shoes and overalls. To avoid breathing in any smoke emitted during carbonizing, always wear a mask and protective glasses to avoid any smoke entering the eyes. If in close proximity of others, ensure they know burning is taking place before it begins.*		
D (*i*)	Carbonisation method 1: Using a carbonising drum Put the dried material in the carbonizing drum raised on 3 stones. Light a fire underneath using a match box or lighting stick. Keep turning the material until it is completely burned to ash. When the smoke reduces and flames are generated, wait for a few minutes and then put the lid on the drum. Remove the stones underneath (or remove the drum from the stones) and leave the closed drum for around 20 minutes, before checking the material. After 20 minutes, the material inside should be like small pieces of charcoal ('the char'). If the material has not formed into char, then replace the lid and allow longer to burn. However, be careful not to leave it too long or it will turn into ash. Remove the char from the drum and immediately sprinkle water to stop the burning.		
D (*ii*)	Carbonisation method 2: Open burning This method can be used if access to a carbonizing drum is not available. The ground, on which the dried material is to be burnt, should be clean.. The material should be placed on the bare ground and a fire lit. Just like in the carbonizing drum, keep turning the material to make sure it all burns. The burning process should last for about 10 minutes depending on the quantity of material being burnt. Keep checking and turning the material to avoid it becoming ash. The burnt product should be small black particles called 'char'. When these form, stop the burning process by sprinkling water on the burning material.		

3.4 BRIQUETTE PRODUCTION (continued)			
No.	Guideline & Detail	Example image / definition	✓
E	**Crushing** Crushing of the char dust into powder can be done using a mortar and pestle. An automatic crushing machine can also be used if the group has access to one.		
F	**Sieving** The char has to be sieved to remove any larger particles using a metallic sieve or a sack with sufficient holes.	 Sack with holes for sieving	
G	**Mixing** The dry and the wet ingredients need to be mixed together. Char can sometimes be mixed and bonded with either cassava porridge or clay *(see right)*.	The char is the main ingredient that is mixed with a binding material. This is preferably clay or cassava porridge. For every 2 basins of char, add: • *1 kg of cassava flour binder* *This binder is similar to a wet porridge or 'bakwafu';* • *Or use ½ kg of clay as a binder.*	
		 Sorting dry and wet ingredients  Organised ingredients to be mixed  Manually mixing ingredients	

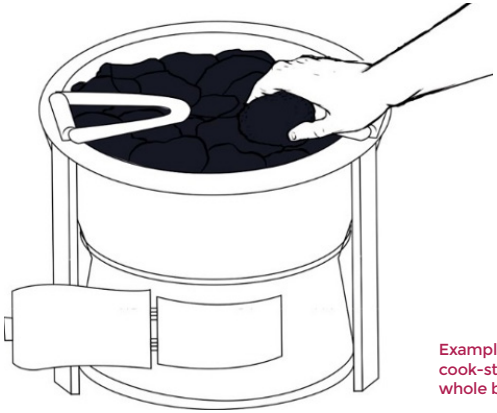
3.4 BRIQUETTE PRODUCTION (continued)			
No.	Guideline & Detail	Example image / definition	✓
H	**Consistency** Squeeze the mixture to see if it sticks together. This can be checked by the group members during production.	 Squeeze the mixture If it holds, it's good If it's lose, add some char or charcoal dust	
I	**Moulding** Moulding and pressing can be done my hand, or by using a briquette press machine.	Moulding methods • *Briquette press machine:* *Put the mixed material in the briquette press machine. Press 2 or 3 times, then remove.* • *(Or) Using hands:* *Put the desired amount of mixed material in hands and mould it into a ball shape. Repeat the process until all the mixed material is moulded into briquette balls.*	
	Pictured: Briquette machine press. This machine press can be obtained at a local market, or fabricated. Alternatively briquettes can be moulded by hand pressing.	 Machine press Hand press	
J	**Drying** After moulding, put the formed briquettes in the sun to dry for 1-5 days (weather dependent). Dry the briquettes in a shaded area (*examples right*) to avoid cracking.	Drying location options  In the shade on the ground On a frame drying rack On a shady rooftop	

3.4 BRIQUETTE PRODUCTION (continued)			
No.	Guideline & Detail	Example image / definition	✓
K	**Testing** Testing the durability of the briquettes is important to know if they are suitable for use and sale. The durability of the briquettes is tested after they have dried by dropping the briquette from one meter distance to the ground.	How to test: *The briquette should be dropped 1 meter from the ground.* • *If the briquette remains intact, it is good, durable, and suitable for use.* • *If it breaks into pieces, the briquette is not good and should not be used.*  	

Above: Diagram of the briquette-making process (Image by Urban Action Lab/KNOW, 2020)

4. Using briquettes for cooking at home

Briquettes are used in cook-stoves (*as illustrated below*). They can be used as a whole, or broken into smaller pieces, depending on what fits well into the cook-stove available. Note that breaking briquettes into small pieces will reduce their burning period.



Example illustration of cook-stove filled with whole briquettes

Important things for users to consider when cooking with briquettes:

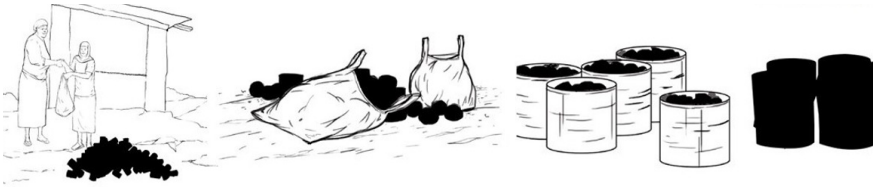
- Lighting briquettes takes longer than charcoal;
- Briquettes burn faster than charcoal and wood, so it is necessary to light the briquettes in the cook-stove after the food has been cleaned and prepared. This will ensure briquette fuel is not lost during preparation;
- Likewise, it is important to have extra briquettes by the stove if the fuel is completed before cooking is complete;
- Do not use wet briquettes.

Note:
It is recommended that group members first use the briquettes at home for at least two weeks before attempting to sell them, in order to become familiar with the way they perform in terms of burning longevity, heat, and other properties.

5. Business development

Packaging and pricing:

- The price of the briquettes is normally low and should be based on local costs in order to target local customers.
- Briquettes can be packaged into tins, metal buckets, sacks or bags. Customers can bring their own bagss or take briquettes unpacked as individual pieces *(as illustrated below)*.



Customer brings own bag | In bags or sacks | In tins or containers | Individual pieces

Business plan:

Community group members must meet and brainstorm ideas on the following:

- Types of briquettes to be produced;
- Source of raw materials;
- Potential customers;
- Location for production, sale, and exposure;
- How the business will be run, describing production procedures, packaging, and pricing depending on the market, location, and selling points;
- A strategy for awareness-raising campaigns such as media targeting different customer types;
- A budget on costs, targeted profit, and time period.

Group governance and leadership:

Before forming a working group, important decisions have to be made:

- What will the group name be?
- What are the mission, vision, goal, and objectives for the briquette project?
- How will group meetings be conducted and when?
- What will the criteria be for leadership election within the group? Leaders should be decided by all group members inclusively and transparently
- What rules and regulations should govern group relationships, such as sharing roles and benefits? What consequences should exist for group members who fail to honour obligations? Group members need to carry out their role diligently and be clear about the role of others in the group.

APPENDIX 1

Table indicating current market prices of materials (UGX), as of January 2021.

Current market prices of core materials *(Use as guide only. Prices may vary)*				
No.	Required material	Unit cost	No. of units	Total cost (UGX)
1.	Organic waste	0	5 sacks	0
2.	Binder (Cassava flour)	1500	1kg	1500
3	Water	200	10 Litres	200
4	Clay	400	0.5 kg	400
5	Rent	*This is dependent on the place and the landlord*		

APPENDIX 2

Urban Action Lab handout in Swahili and English to explain the briquette production and enterprises process for training purposes and workshops.

Kulakulanya E'kyettunzi kyo wenyigire mu byenfuna mu kibuga

Starting a business to integrate into the urban economy

• Emitendera gyo kutandikawo bizinesi entonotono

1. Brain storm Ideas
2. Put together a business plan
3. Financing the business
4. Determine legal business structure
5. Registering the Company
6. Build your team
7. Brand Yourself and advertise
8. Grow Your Business
   - Moving from Micro to Macro
   - License your product
   - Diversify
   - Target other markets
   - Merge with or acquire another business
   - Expand Globally
   - Expand to the internet
9. Personal Ethics
10. Your Personal Expenses
11. Customers
12. Have Passion for Your Work

1. Kubaganya ebirowoozo ku ki ekisobola okufuka e'kyettunzi
2. Kola entekateeka ya bizinesi yo
3. Noonya ssente ezitandika bizinesi yo
4. Salawo oba nga bizinesi onogiwandisa oba egya kukola nga ezifuna empola
5. Wandisa bizinesi yo mu bitongole byona ebivunanyizibwa
6. Kungaanya timu yo gyo'kola nayo
7. Tuuma ekyettuzni kyo erinya eritunda
8. Kulakulanya bizinesi yo
   - Kola eby'ettunzi nga bingi bimatize akatale
   - Funa layisensi yo'mulimu gwo
   - Bizinesi etera okuba nebirala ebigikwatanganya nga nabyo bya ttunzi
   - Noonya akatale akagazi
   - Bwoba nga obazemu, gatta bizinesi yo n'abalala abakola omulimu gwegumu
   - Gaziiya akatale mu nsi yona
   - Kozesa n'omukkutu mugata bantu
9. Tunilira nyo empisa zo eri bizinesi eno
10. W'ekkanye nyo ensasaanya yo nga omuntu n'ebizinesi nayo nga muntu
11. Budabuda nyo ba kasitoma bo
12. Yagala nyo ate weyagalire nyo mu kyokola

About KNOW

Achieving sustainable development requires putting a stop to the growing rates of inequality around the world. Knowledge in Action for Urban Equality (KNOW) asks how citizens can be involved in delivering equality in the cities of the future. KNOW is a 4-year research and capacity-building programme (2017-2021) that seeks to promote urban equality in selected cities in Latin America, Africa, and Asia. Led by Prof Caren Levy of The Bartlett Development Planning Unit, it brings together an interdisciplinary international team of 13 partners in the UK, Asia, Latin America, and Africa (including the Urban Action Lab, Makerere University, Kampala), to develop innovative long-term programmes of knowledge co-production for urban equality among governments, communities, business, and academia. It is a unique gathering of places, people and their knowledge, innovation, and ingenuity. Knowledge in Action for Urban Equality is funded by UKRI through the Global Challenges Research Fund GROW Call, and led by The Bartlett Development Planning Unit, UCL. Grant Ref: ES/P011225/1. For more information please visit www.urban-know.com/kampala

Acknowledgements

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Cover image: Hand-made briquettes, Image by D. Heymann, 2019.
Back cover image: Daala ku Daala Prosper Saving Group making briquettes, with members of the KNOW team, Image by C. Yap, 2019.

Funding partners