

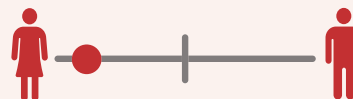
## BUSINESS MODEL 2

# Briquettes from municipal solid waste

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### A. Key characteristics

<b>Model name</b>	Briquettes from municipal solid waste (MSW)
<b>Waste stream</b>	Organic waste – Organic component of MSW and agro-waste (crop residues)
<b>Value-added waste product</b>	Briquettes used as clean cooking/heating fuel
<b>Geography</b>	Region with lack of ease in availability of fuel wood
<b>Scale of production</b>	Small scale (<300 tons per year) and medium scale (300–1,500 tons)
<b>Supporting cases in the book</b>	Kigali, Rwanda; Kampala, Uganda
<b>Objective of entity</b>	Cost-recovery [ ]; for profit [ X ]; social enterprise [ ]
<b>Investment cost range</b>	USD 30,000 to USD 450,000 for medium scale
<b>Organization type</b>	Private or cooperative public-private partnership
<b>Socio-economic impact</b>	Reduction in deforestation and environmental pollution, reduced indoor air pollution resulting in improved health for household and employment generation, improved educational opportunities for girls
<b>Gender equity</b>	Beneficial to women and children using fuel with less indoor air pollution than firewood; time savings for girls in fuel collection which can be used for education.

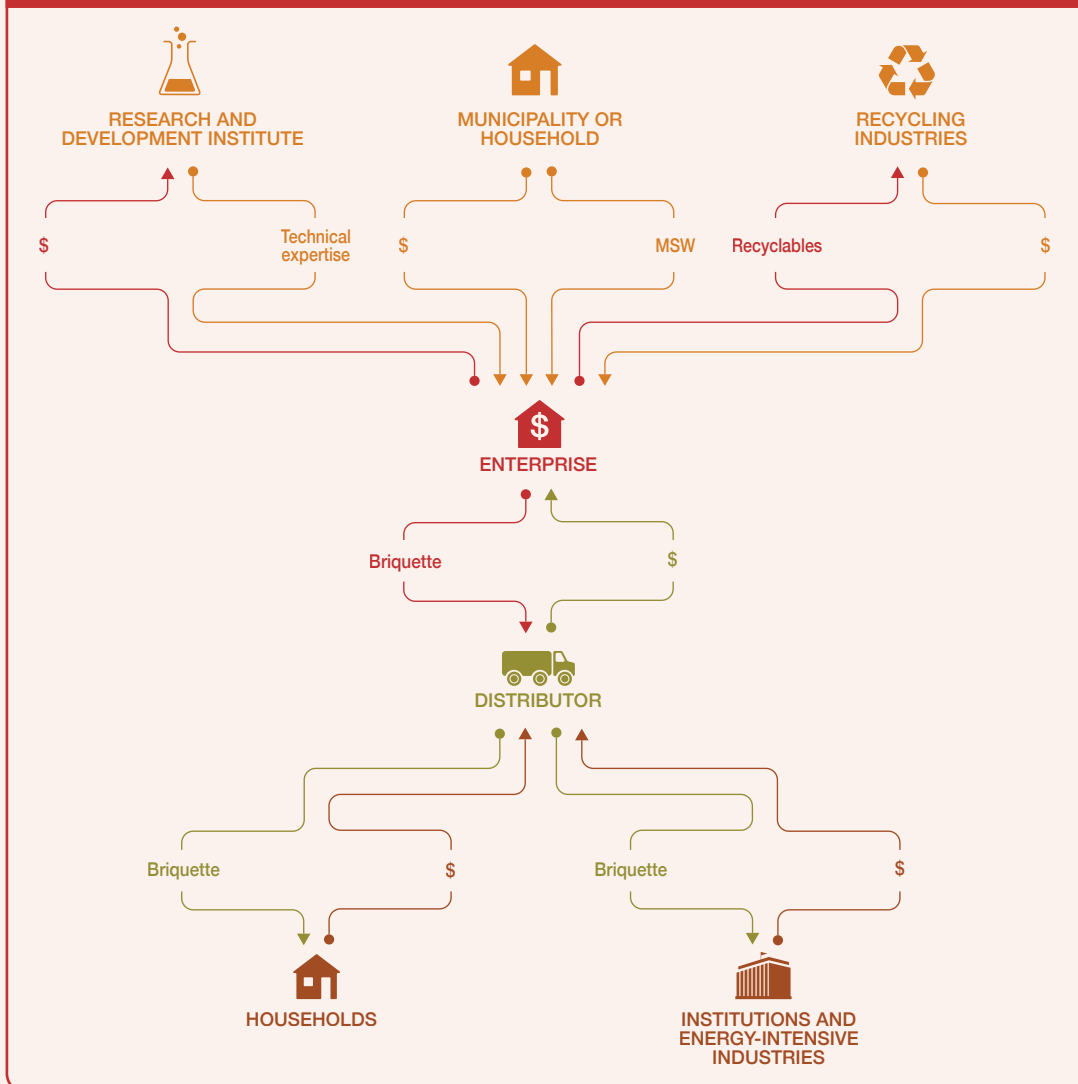


### B. Business value chain

The business model is initiated by either a standalone private enterprise or a cooperative under public-private partnership (PPP) where a private entity partners with the municipality to manage the solid waste generated by the city. The business processes organic component of municipal solid waste (MSW) and convert it into briquettes that can be used as clean fuel. The key stakeholders in the business value chain are the waste suppliers – either household or the municipality, product distributors and end-users of the briquettes (household and businesses) (Figure 24).

The process of briquetting involves reducing moisture content in the organic waste, which is shredded and the biomass is compressed at high temperature and using a binding agent. The organic component in MSW consists of multiple substances with different calorific values. Collaboration with a research institution or in-house research laboratory will help in developing suitable process to produce briquettes with higher calorific value. Another option is to produce charcoal from organic waste by carbonizing/burning it in low-oxygen atmosphere. The resulting charred material is compressed into briquettes.

FIGURE 24. VALUE CHAIN OF BRIQUETTES FROM MSW

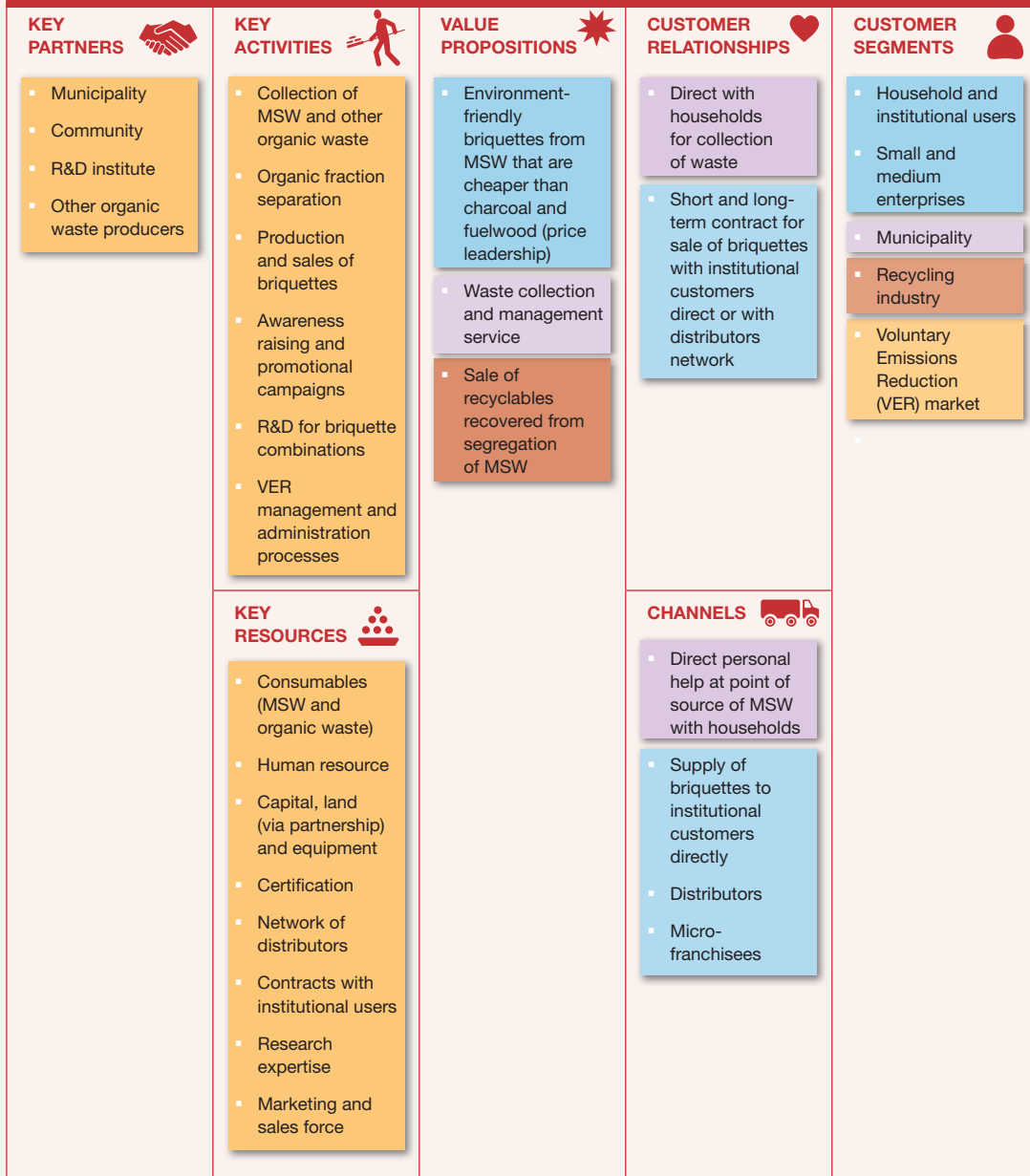






The briquette is used as fuel for cooking and/or thermal energy in small and medium industries and households. Briquettes can also be used as fuel for gasifiers to generate electricity or powering boilers to generate steam. The business model described is focused on using briquette as fuel for cooking and thermal applications only. The process of making briquettes from MSW requires segregation of organic component, which results in recyclables such as plastics, paper and glass that have good resale value.

### C. Business model

The primary value proposition of the business model depends on the entity initiating the business model, which is either a standalone private entity or cooperative. For both the entities, producing high-quality briquettes for households and institutions such as schools and prison and small and medium enterprises who need fuel for cooking and heating is a common value proposition. However, for a PPP, providing waste collection and waste management service is the primary value proposition (Figure 25).

FIGURE 25. BUSINESS MODEL CANVAS – BRIQUETTES FROM MSW



<p><b>COST STRUCTURE</b> </p> <ul style="list-style-type: none"> <li>Investment cost – Land, building, and machinery</li> <li>Operational cost – Transportation – MSW and organic waste, labor, disposal of inorganic waste to landfill, utilities, maintenance, marketing and packaging, training of distributors/micro-franchisees and VER costs</li> </ul>	<p><b>REVENUE STREAMS</b> </p> <ul style="list-style-type: none"> <li>Briquette sales</li> <li>Waste collection and management fees</li> <li>Sale of recyclables</li> <li>VER sales</li> </ul>
<p><b>SOCIAL &amp; ENVIRONMENTAL COSTS</b> </p> <ul style="list-style-type: none"> <li>Potential loss of income for firewood and charcoal traders</li> <li>Potential health risks for workers at production facility</li> <li>Potential environmental risk if the waste is not treated and disposed properly</li> <li>Increased health risks if households switch from gas to briquettes</li> </ul>	<p><b>SOCIAL &amp; ENVIRONMENTAL BENEFITS</b> </p> <ul style="list-style-type: none"> <li>Reduces deforestation and GHG emissions</li> <li>Saves time in the case of time spent in collecting firewood</li> <li>Contribute to improving the educational opportunities among girls who previously missed school to fetch firewood</li> <li>Contributes of improved MSW management</li> <li>Generates income and employment</li> <li>Creates environmental sanitation awareness</li> </ul>

The briquettes are delivered to the customers either through direct sales, network of distributors or micro-franchising<sup>1</sup>. The direct sales involves managing a large human resource base for sales and marketing staff. The business requires developing strategic partnerships with municipality to procure MSW and it would likely require contractual arrangements with the municipality. The business will have to collect MSW from the municipal landfill site or have the municipality garbage trucks deliver MSW to the plant. The business can also organize collection of MSW directly from households at a collection fees.

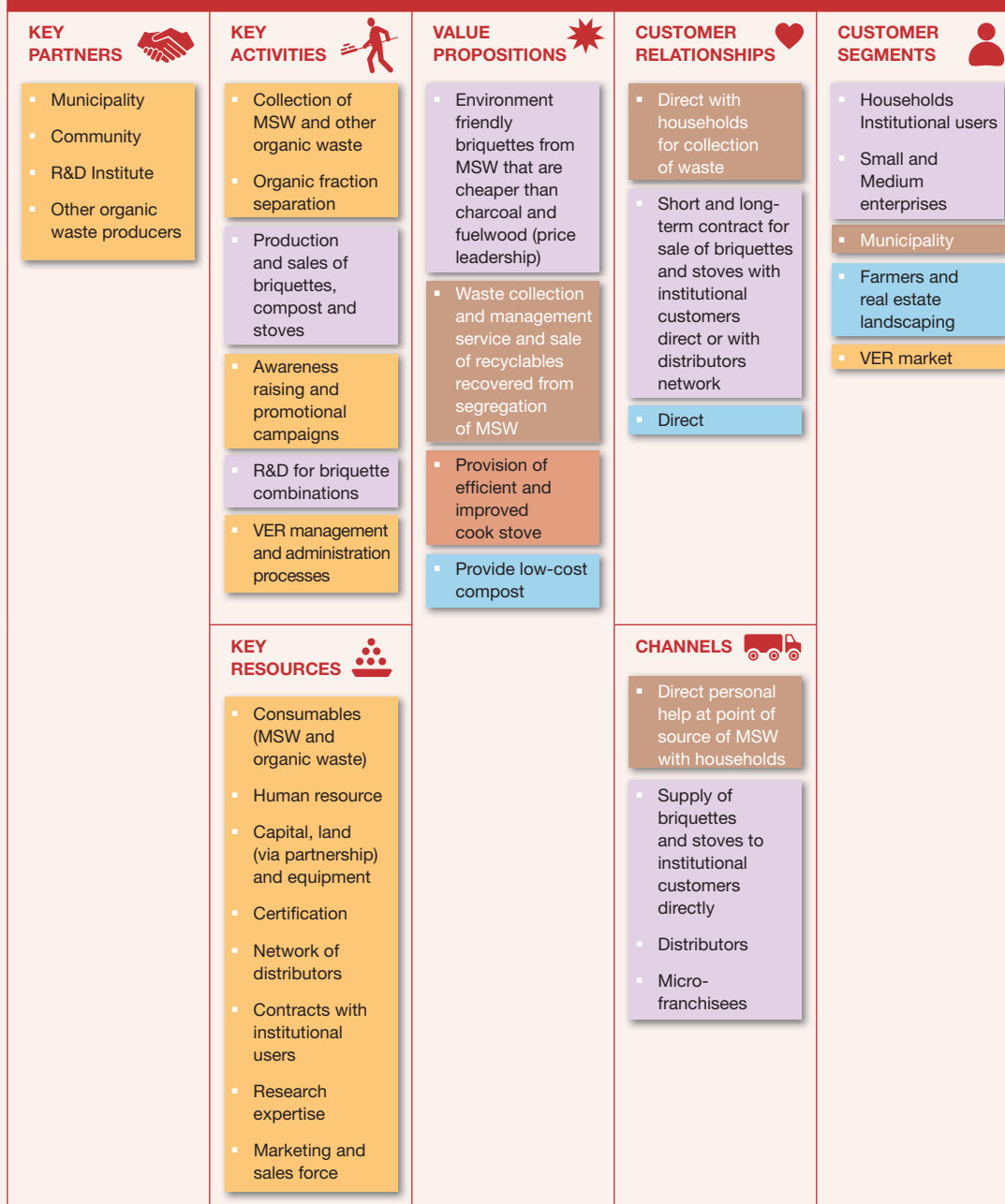
The key activities of the business model are MSW collection and processing, briquette production and sales. Since MSW consists of both organic and inorganic material, the business enterprise must undertake segregation of waste to separate out organic material, which is the key raw material for briquette production. Research and development (R&D) would be a useful activity to ensure high quality and calorific value of the product. However, the cost-benefit of R&D should be assessed and ideally partnership with a research institution would mitigate the risk of need for high-skilled labor.





Key capital costs are building and machinery and primary operational costs are transportation, labor, utilities, marketing and packaging. Briquette sales and waste collection and management fees are the key revenue source. A briquette enterprise is potentially eligible for carbon offset depending on the type of fuel replaced and the baseline used to calculate benefits from reduced greenhouse gas emission and hence there is potential for increasing revenue from sale of carbon. Depending on the scale of MSW processed and managed, the briquette enterprise could apply for Clean Development Mechanism (CDM). However, due to associated transaction costs, a preferred route would be to apply for carbon offset on Voluntary Emission Reductions (VERs). MSW consists of inorganic waste such as plastics, paper and glass that has high resale value and sale of recyclables is another revenue source for the business model.

## D. Alternative scenarios

The business model can incorporate two additional value propositions in addition to briquette production from MSW: a) produce low cost compost, a by-product from briquette production and b) vertical integration of business by manufacturing and selling improved cook stoves and ovens (Figure 26).

**FIGURE 26. BUSINESS MODEL CANVAS – BRIQUETTES FROM MSW ALTERNATIVE SCENARIO**



<p><b>COST STRUCTURE</b> </p> <ul style="list-style-type: none"> <li>Investment cost – Land, building and machinery</li> <li>Operational cost – Transportation – MSW and organic waste, labor, disposal of inorganic waste to landfill, utilities, maintenance, marketing and packaging, training of distributors/micro-franchisees and VER costs</li> </ul>	<p><b>REVENUE STREAMS</b> </p> <ul style="list-style-type: none"> <li>Briquette sales</li> <li>Sales of improved cook stoves</li> <li>Compost sales</li> <li>Waste collection and management fees and sale of recyclables</li> <li>VER sales</li> </ul>
<p><b>SOCIAL &amp; ENVIRONMENTAL COSTS</b> </p> <ul style="list-style-type: none"> <li>Potential loss of income for firewood and charcoal traders</li> <li>Potential health risks for workers at production facility</li> <li>Potential environmental risk if the waste is not treated and disposed properly</li> <li>Increased health risks if households switch from gas to briquettes</li> </ul>	<p><b>SOCIAL &amp; ENVIRONMENTAL BENEFITS</b> </p> <ul style="list-style-type: none"> <li>Reduces deforestation and GHG emissions</li> <li>Reduce indoor air pollution by substituting wood with cleaner burning fuel &amp; improved cook stoves that gives out less smoke</li> <li>Saves time in the case of time spent in collecting firewood</li> <li>Contribute to improving the educational opportunities among girls who previously missed school to fetch firewood</li> <li>Generates income and employment</li> <li>Creates environmental sanitation awareness</li> </ul>

### **Scenario I: Compost production**

Production of briquettes results in generation of organic residual waste which can be used to produce compost. The compost can be either sold to the farmers or landscapers. The additional key activity required for this value proposition is production of compost and related costs incurred. The sales and distribution process will be similar to sales of briquettes.

### **Scenario II: Manufacturing of improved cook stoves**

The business model offers scope for vertical integration since the enterprise into briquette production could potentially manufacture improved cook stoves and ovens that use the briquettes made by the enterprise as fuel for cooking or heating. The sales of stoves could potentially stabilize sale of briquettes as it entices users to not switch to a competing/substituting product. The improved cook stoves have high social benefits for households especially to women and children through reduced indoor air pollution. In addition, with improved cooking efficiency and reduced fuel consumption household incurs savings. The business model does not require significant alteration to its distribution process. The additional key activity required is for the manufacturing of improved cook stoves which has related capital and operational costs incurred by the enterprise. Similar to briquette production, R&D is a required activity to design the cook stoves and oven that meet the customer's requirements. The product also requires specific marketing, certification from independent organization and awareness campaign.

## **E. Potential risks and mitigation**

**Market risks:** The key customer segment for briquettes are households that do not have access to fossil fuels and are dependent upon firewood and charcoal for cooking. Market risks are high as the

willingness to pay is significantly lower among households using firewood for cooking. The business should target diverse customer base to mitigate these risks. It is preferred for the business to target household, institutions and small and medium enterprise as customers. The business could get into long-term bulk contractual arrangement with institutional customers and have assured sales.

**Competition risks:** The briquette product has strong competition risks from competing products like charcoal, wood, kerosene and LPG. Fuels choice typically depends on consumer preference, price, convenience and at times social status associated in using certain types of fuels like Liquefied Petroleum Gas (LPG). Ideally, briquette should be targeted to customer segment that uses firewood and charcoal because briquettes can be more competitive and efficient. This customer segment has lower competition risks in the urban areas due to scarcity of firewood. However, in the rural areas in developing countries the competition risks for households as customers is high due to free availability of firewood from nearby plantations and forest.

Improved cook stoves and compost have competition risks as there are multiple suppliers of different types of stoves and compost in the market. Stove sales can potentially stabilize briquette market as it lowers chance of customers switching to competing products.







**Technology performance risks:** The technology used is either mechanical compressing with or without the binding agent or pyrolysis and mechanical compressing. The technology has been widely used commercially and is proven. It doesn't require high skills for operating it and doesn't have complications towards repair and maintenance of equipment.

**Political and regulatory risks:** In most developing countries, fuel for cooking for household is a social issue and the governments provide subsidy for fuels such as kerosene and LPG. Such fuels are also more reliable and convenient to use. If these competing products are priced lower or even slightly higher than briquettes, it can pose significant risks to the business. Diversifying customer base and including energy intensive small and medium enterprise as primary customers can considerably negate this risk. Increasing government support through financial incentives and policies that promote renewable energy reduces this risk considerably in the long term.

**Social-equity-related risks:** The model is considered to have more advantages to women as culturally in developing countries women collect fuel wood and do the cooking at household. The model provides employment opportunities in the enterprise producing briquettes. The users of briquettes are low-income households who are using other unhealthy and inefficient or more costly fuels.

**Safety, environmental and health risks:** The safety and health risks to human arises when processing any type of waste. The risks are even higher when processing MSW. Labor in such enterprises should be provided with appropriate gloves, masks and other appropriate tools to handle the waste to ensure their safety. The risk of environment pollution is high if leachate from MSW is untreated and seeps into groundwater or other natural water bodies. Organic waste when left in open begins to decay and releases methane, which is more damaging to the environment than carbon dioxide. The waste processing technologies are not without problems and pose a number of environmental and health risks if appropriate measures are not taken (Table 11). There is a potential risk for those households where less harmful cooking fuels such as LPG, kerosene or electricity are replaced by biomass briquettes. The risk is lower where also safer cooking stoves will be introduced (Winkler et al., 2017).

**TABLE 11. POTENTIAL HEALTH AND ENVIRONMENTAL RISK AND SUGGESTED MITIGATION MEASURES FOR BUSINESS MODEL 2**

Risk group	Exposure route					Remarks
	Direct contact	Air	Insects	Water/Soil	Food	
Worker						Health risk for households might increase or decrease depending on the quality of the used fuel. Exposure to sharp objects in MSW, air and noise pollution possible. Fly control measures for MSW and leakage control for composting are required.
Farmer/User						
Community						
Consumer						
Mitigation measures		  				
Key <span style="display: inline-block; width: 15px; height: 15px; border: 1px solid black; margin-right: 5px;"></span> NOT APPLICABLE <span style="display: inline-block; width: 15px; height: 15px; background-color: #f08080; margin-right: 5px;"></span> LOW RISK <span style="display: inline-block; width: 15px; height: 15px; background-color: #800000; margin-right: 5px;"></span> MEDIUM RISK <span style="display: inline-block; width: 15px; height: 15px; background-color: #000000; margin-right: 5px;"></span> HIGH RISK						

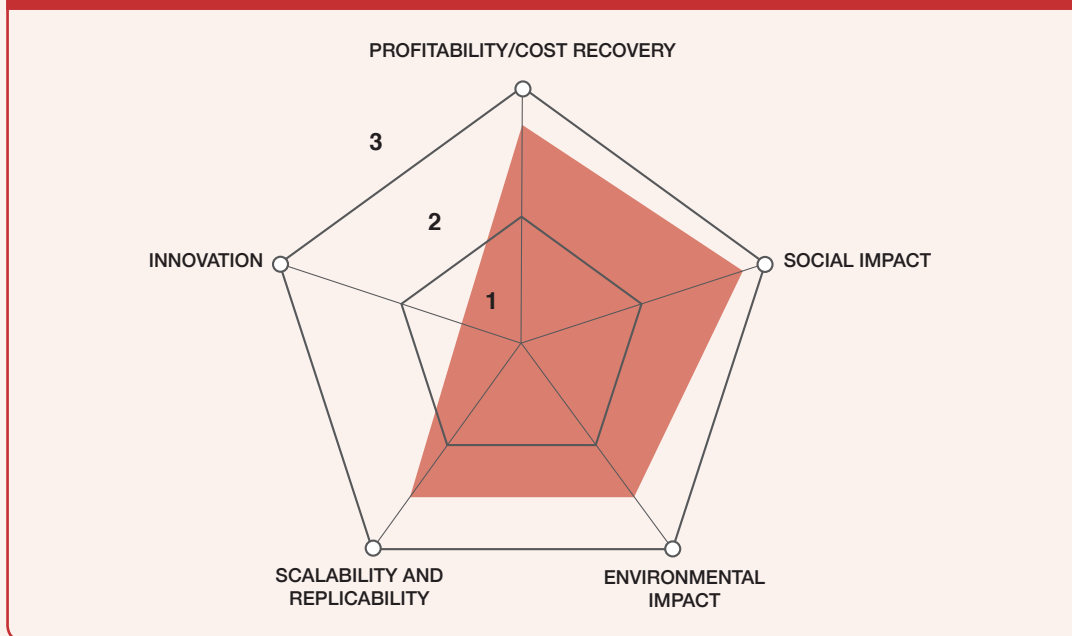
## F. Business performance

This business model is rated high on social impact followed by profitability (Figure 27). The business model provides high number of jobs especially when it is involved in the collection of waste from households. The business model has strong revenue sources from sale of briquette and waste collection and management fees, building on a diverse customer base. It has potential for additional revenue sources from sale of stoves, compost and VERs. The environmental impact is specifically high for regions with deforestation and proper treatment of MSW improves the local health of the environment.

The business model has high potential for replication in developing countries as there are not any strong factors such as new technology, special policies and regulations, institutional capacity, waste availability and so on that can limit replication potential of the business model. The business model has can be scaled horizontally and has potential for vertical scaling by expanding into the business of manufacturing of improved stoves. The business model is straightforward with no sophisticated or innovative financing and technology requirements; however, it requires special partnership arrangement with the municipality for waste collection and management.



FIGURE 27. RANKING RESULTS FOR BRIQUETTES FROM MSW BUSINESS MODEL



### References and further readings

Winkler, M.S., Fuhrmann, S., Pham-Duc, P. et al. 2017. Assessing potential health impacts of waste recovery and reuse business models in Hanoi, Vietnam. *International Journal of Public Health* 62 (Suppl 1): 7–16.

### Note

1 Micro-franchising borrows the traditional franchising concept with scaled-down business concepts found in successful franchise organizations. It operates as a micro-enterprise following proven marketing and operational concepts with systematic replication. The concept is predominant in delivering services to the poor along the lines of microfinance and microcredit. Micro-franchise entrepreneur has similarities to an agriculture extension worker and typically such an entrepreneur sells multiple product like seeds, fertilizers, water filters, Fast Moving Consumer Goods (FMCG) etc.



# **4. BUSINESS MODELS FOR IN-HOUSE BIOGAS PRODUCTION FOR ENERGY SAVINGS**

## Introduction

Energy recovery from fecal sludge or kitchen waste through the installation of biogas systems provides opportunities for domestic, institutional and industrial sectors to save on energy costs by using biogas produced onsite for cooking, power generation and lighting. While household biogas installations are very common, experience in institutional biogas systems is limited and is gradually gaining traction in developing countries in Asia and Africa. The consensus is that the larger onsite biogas units that are run by institutions such as schools, hospitals and prisons to manage their waste have proved to have higher viability than the small-scale household bio-digesters.

There are a number of examples where energy recovery from fecal sludge and kitchen waste through the installation of biogas systems has been a success in institutions such as schools, hospitals, prisons and other institutions consisting of large number of residents (**Business model 3: Biogas from fecal sludge at community level** and **Business model 4: Biogas from kitchen waste**).

The business cases presented under these business models are from India, Nepal, the Philippines, Rwanda and Kenya. These businesses were selected as they present a unique example of successful partnership of local authorities, non-governmental organizations and communities.