Market Driven Approach for Selection of Faecal Sludge Treatment Products

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Overview

This document includes the background, explanation, methodology and tools for implementation of the Market Driven Approach for Selection of Faecal Sludge Treatment Products. This method was developed to help fill a great need for practical and reliable approaches that allow engineers to select and design treatment technologies for centralized to semi-centralized treatment of faecal sludge. In the absence of clear legal frameworks for faecal sludge treatment products, identifying the greatest market attractiveness provides a method to help select products of treatment. Once treatment products are identified, then treatment performance goals can be defined for the required level of treatment for safe enduse to ensure protection of public and environmental health. In addition to the greatest potential to generate revenue, this can help ensure the design of adequate treatment, and also operation as plant managers have to meet customer demand. However, this is not a stand-alone approach, it needs to be incorporated into an integrated planning approach to faecal sludge management *(www.sandec.ch/fsm_tools, www.sandec.ch/fsm_book).*

This document includes the following sections:

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: Background of the market driven approach

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: Definitions of terms

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: Overview of time requirements, data collection methods and calculation tool

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: Overview of method and data collection tools

Implementation Guide
: Required steps and activities

Outlook
: Limitations of this approach, and outlook for future research

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1. Introduction

The goal for selecting treatment products based on resource recovery, is to define appropriate levels of treatment based on the desired end-use; generate revenue to offset treatment costs; and help ensure adequate operation of treatment plants, as they are producing a product to meet customer demand.
This market driven approach provides a framework to explore potential markets for faecal sludge treatment products. As markets vary significantly based on the local context, it is essential not to make assumptions based on experiences in other regions. The market driven approach can be applied in any context and region and provides a way to consistently and comparably determine potential market applications for faecal sludge treatment products. This information can then be used as a basis to evaluate appropriate market and business model strategies.
Implementation of this market driven approach requires a certain level of technical knowledge of faecal sludge management. A minimum level of required knowledge is covered in the following chapters from Faecal Sludge Management: Systems Approach for Implementation and Operation, which can be downloaded for free at *www.sandec.ch/fsm_book* (Strande et al. 2014):

- Chapter 1: The Global Situation
- Chapter 5: Overview of Treatment Technologies
- Chapter 10: Enduse of Treatment Products
- Chapter 15: Stakeholder Analysis

However, the market driven approach is not at all meant to be a stand-alone tool, and the results need to be incorporated into a comprehensive city-wide planning approach to faecal sludge management (Strande et al. 2014), including: selection of treatment objectives and resource recovery; quantification and characterization of inlet sludge; design of treatment technologies for resource recovery; and sustainable implementation. Complementing information can also be downloaded from *www.sandec.ch/fsm_tools*

An initial study to compare the markets of different faecal sludge treatment products was conducted in Kampala, Uganda; Dakar, Senegal; and Accra, Ghana (Diener et al. 2014). Based on this experience, experts in economics and business analysis were consulted to further develop this method, including a methodology for data collection that would be more quantitative, and produce comparable results among different cities or regions. The methodology was then implemented in Kampala, Uganda, Bignona, Senegal; and Son La, Bac Ninh and Ba Ria, Vietnam. This document is based on the implementation experience in all six cities.

2 Terminology

Implementation of a market driven approach for selecting faecal sludge treatment products is a new and innovative concept, therefore, included here is a glossary of terms that readers might not be familiar with. Market growth, attractiveness and volume are described in more detail in Section 2.1. The use of consistent terminology is important to ensure understanding and is recommended in reports and other publications based on this method.

Table 1: Definitions of relevant terms

Adjustment factor	A means of estimating the difference in future market attractiveness of a substitute product and a faecal sludge treatment product. An adjustment is necessary, as a substitute product (e.g. commercial synthetic fertilizer) will not have the exact same market attractiveness as a faecal sludge treatment product (e.g. nutrient amended faecal sludge pellets).
Faecal sludge	Faecal sludge comes from onsite sanitation technologies, and has not been transported through a sewer. It is raw or partially digested, a slurry or semisolid, and results from the collection, storage or treatment of combinations of excreta and blackwater, with or without greywater (Strande et al. 2014).
Faecal sludge treatment product	Resulting solid and/or liquid forms that are produced from faecal sludge treatment technologies.
Market attractiveness	An estimate of the potential future market based on both market volume and market growth. For faecal sludge treatment products and substitute products this is illustrated by plotting market volume against market growth.
Market growth	Estimated future growth in sales for all identified substitute products ("product portfolio") for one potential faecal sludge treatment product. Historical growth of products is used to extrapolate future growth.
Market participant	Stakeholders that play a role in the supply chain and use of substitute products and/or faecal sludge treatment products, for example producers, wholesalers, retailers, and customers of products.
Market volume	Multiplication of number of units sold per available substitute product with the given price over a specific period.
Product application	Type of industry, production unit or economic activity where the faecal sludge treatment product could be used and where current substitute products can be identified and assessed.
Product portfolio	The collection of different items a company sells. Each item typically makes different contributions to the company's "revenue generation".
Retailer	Seller of a specific product to the end user. Most commonly not a producer of products. Buys products from producers or wholesalers.
Revenue generation	The manner by which a company sells its goods or services to produce an income.
Substitute product	Product currently sold in the market with potential to be replaced by a faecal sludge treatment product.
Wholesaler	Selling a specific product to "retailer(s)". Can be a producer of products at the same time.

2.1 Market attractiveness

As illustrated in Figure 2, market attractiveness takes into account both the current market volume and the future for potential market growth. While other factors (e.g. price trends or technology) can be considered and are relevant, they have been excluded to reduce complexity and to ensure applicability of the approach for diverse locations and products. As shown in Figure 3, the market attractiveness of faecal sludge treatment products is illustrated by plotting market volume against market growth. Market attractiveness is different from market demand, which is the customer demand of actual existing products. Once faecal sludge treatment products become available, then market demand studies can be implemented to obtain more quantitative results to develop business models and market strategies. In contrast, the market driven approach provides a way to explore potential markets for faecal sludge treatment products, prior to their existence in a market.

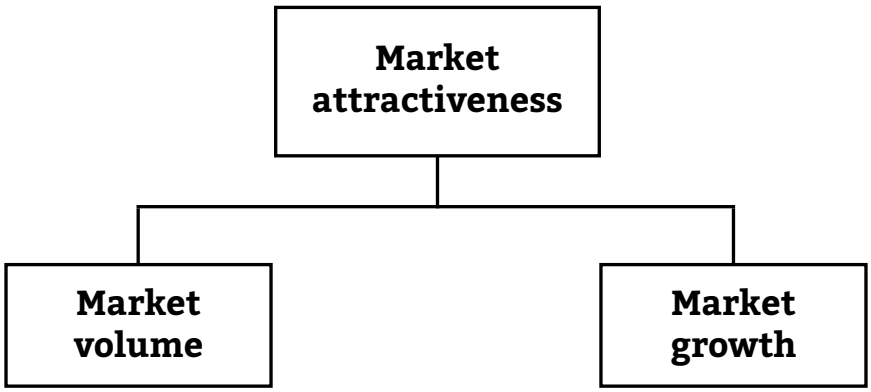


Figure 2: Market attractiveness is comprised of market volume and market growth

One difficulty in determining the market attractiveness of faecal sludge treatment products is that due to a general lack of faecal sludge treatment, the market for treatment products does not yet exist. Hence, to determine the market attractiveness of faecal sludge treatment products, the market dynamics of a proxy (substitute product) that could potentially be replaced is analyzed. For example, for fodder produced from planted drying beds treating faecal sludge, the existing products sold for fodder would be evaluated. This proxy approach provides a way to arrive at reasonable estimates of potential market volumes and future market growth (i.e. market attractiveness) of faecal sludge treatment products.

Within the framework of the market driven approach, market volume is defined as the sum of all available products in a given market. For example, the number of units sold, and price of fodder in a defined geographical area.

Within the framework of the market driven approach, market growth is defined as the growth of the product portfolio over a specified period. The portfolio constitutes all identified substitute products. In a simplified framework lacking more accurate data, the historical growth of a product can be extrapolated to estimate future growth.

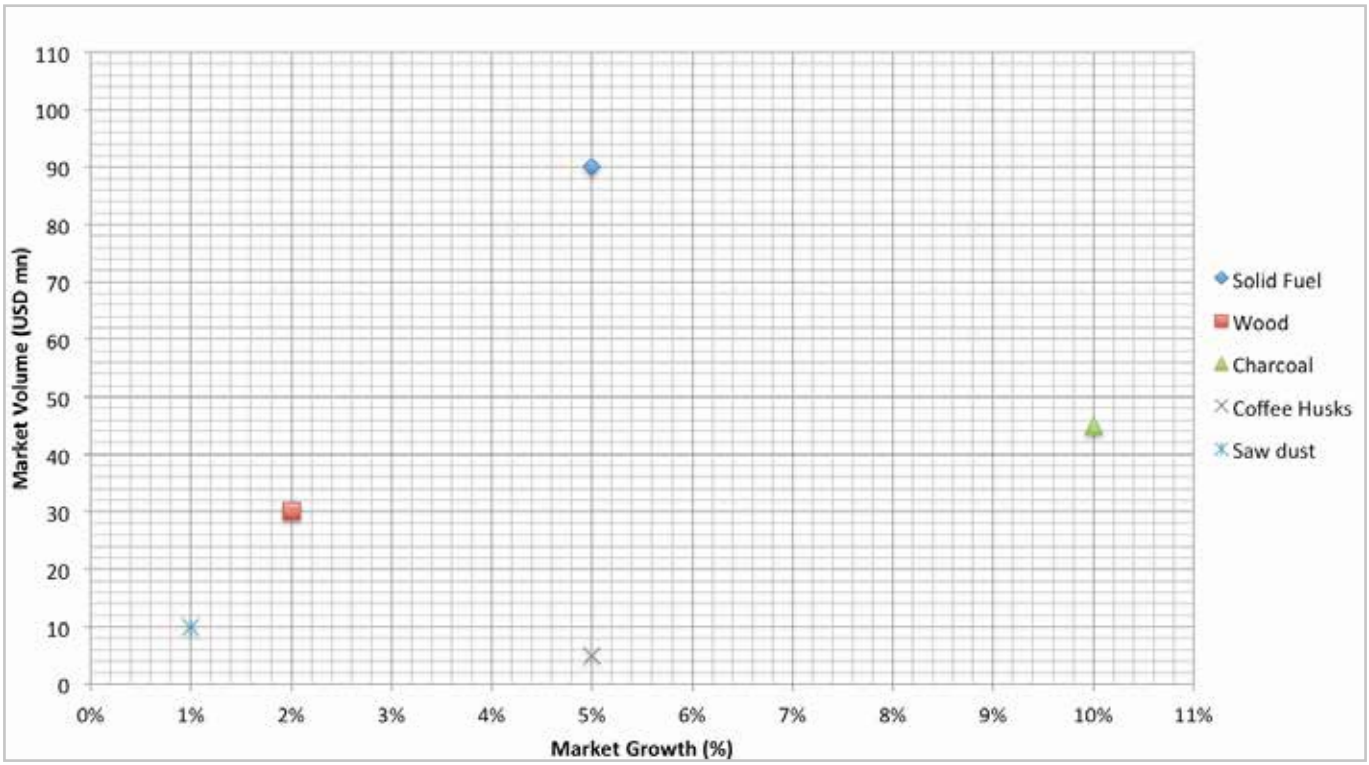


Figure 3: A hypothetical example of plotting market attractiveness for substitute products of solid fuel

3 Framework

3.1 Overview

This section provides an overview of the market driven approach method, time requirements, data collection methods and a data collection tool. The method includes a literature review, interviews, observations and data analysis. Data collection tools include questionnaires for interviews, and important points to observe. Tools need to be adapted and developed for the specific local context. For guidance in this process, a questionnaire from a previous study is presented in the Annex.

3.2 Time requirements

Implementation of the market driven approach requires an in-depth field study. Depending on the implementer's level of knowledge, at least two weeks should be allocated to learn the method and attain background information including preliminary secondary data collection and evaluation. Infield work includes the collection of primary data (see Section 3.3 and Box 1). Following completion of fieldwork, additional time needs to allocated for data analysis and producing a report.

3.3 Data collection methods

The methods for data collection include:

Literature review of secondary data

- Recommended sources include: academic and grey literature, government documents (e.g. policies, legislations), national census, field studies (e.g. prepared by non-governmental organizations (NGOs), research institutes, international donors, local authorities).
- Literature can also be obtained as unpublished material during interviews. The literature review should therefore be regarded as an iterative process.

Interviews for the collection of primary data

- Interviews are the primary source of information for the market driven approach.
- A detailed description for identification of interviewees and the design of appropriate questionnaires is provided as part of the methodology (see Section 4).

Field observations

- Field observations are useful for triangulation of secondary and primary data and could furthermore be used for estimations if no data exists.

3.4 Data collection tool

A Microsoft Excel based spreadsheet (tool) was developed, which provides a template for documenting the results obtained from the step-wise implementation of the market driven approach. The tool includes five sheets and all the required information to derive market volume and market growth of substitute products and hence, the market attractiveness of faecal sludge treatment products, which can then be illustrated with a graph.

Box 1: Case study Kampala, Uganda

In Kampala, ten weeks were spent for collection of data in the field by an engineer at the level of master's degree, who was working together with local experts. During this time, on average five interviews were performed per week, resulting in a total of 50 interviews. While the collected information was sufficient to identify the market growth substitute products and subsequently faecal sludge treatment products, it was not enough time to collect all required information for market sizing. It was estimated that an additional three weeks might have been sufficient to collect the additionally required data, which would have allowed to derive more accurate estimations for some substitute products. However, the time for data collection could be reduced with increased expertise and knowledge of local context. Required time will also be influenced by city size, existing local contacts, role of the informal sector and available secondary data.

4 Methodology

4.1 Preparation for implementation

The first step in implementation is to become familiar with the terminology, method for data collection and calculation tool. A thorough understanding is necessary, as even though the methodology follows a step-wise approach, the implementation is an iterative process, and activities are interlinked.
Next, a detailed literature review is performed. Depending on the availability of information, the literature review can offset the required time for primary data collection. Therefore, it is important to document the literature review. The literature review also informs the planning and design of primary data collection tools (e.g. questionnaires for interviews) and identification of gaps that need to be filled during primary data collection. The preliminary literature review includes:

- Policies, l egislation and regulatory frameworks for faecal sludge management and the use of faecal sludge treatment products (e.g. from local authorities).
- Databases containing demographic and economic data (e.g. from the national statistics office).

During implementation, the following literature is also important, and can be obtained during interviews:

- Market and economic information about substitute products that could be replaced by faecal sludge treatment products (presented in Section 5.1: Target Market Analysis).
- Growth rate and revenue of relevant product applications that were identified for substitute products (presented in Section 5.2 Market Stakeholder Analysis).

4.2 Identification of interviewees

Stakeholders need to be identified at different stages during implementation, and interviews can be structured into three types.

Type 1
At the beginning of the process, it is important to identify interviewees that have a more holistic overview of the city context (e.g. from city authorities, universities, trade organizations). A more comprehensive list is provided in Activity 5: Identify market participants.

Type 2
Further into the process, markets need to be identified. Here it is helpful to interview experts in the specific sector (e.g. Ministry of Energy and Environment). See also: Activity 5: Identify market participants.

Type 3
Once the markets are identified, specific market participants need to be interviewed (e.g. the CEO of a company). These market participants are the primary source of information to derive the market volume of substitute products. Wholesalers and producers of substitute products should be interviewed where possible for the most reliable information with least effort, otherwise retailers and customers should be identified.

4.3 Design of questionnaires

To derive market attractiveness, questionnaires need to be developed for Type 3 interviews that include all necessary questions to derive market volume, market growth, and the adjustment factor. An example is provided in the Annex, however, it is necessary to adapt for the local context (see Box 2).

4.4 Performing interviews

After identification of interviewees and the design of questionnaires, interviews should be conducted. A project factsheet can be prepared, which provides the interviewees with background information about the objectives of the study. This can be valuable for creating trust between the interviewer and the interviewee and to provide transparency. Experience has furthermore shown that asking interviewees to recommend other stakeholders in the same field was a successful method for identification of additional interviewees.

Box 2: Kampala case study

A first draft of a questionnaire was developed for one treatment product (i.e. "protein"), and one market for the product (i.e. fish feed producers). Prior to use, a professor at Makerere University was consulted to further refine the questionnaire. This feedback was incorporated to make the questions more relevant to the local context. After a first round of interviews, it was apparent that the questionnaire needed to be further adapted for each target group of stakeholders. For example, the CEO of a large company that is importing fertilizer might be familiar with economic terminology such as "market participants", whereas an independent, small-scale or informal retailer of charcoal may be more familiar with laymen's terminology.

5 Implementation Guide

Presented in Table 2 is an overview of the implementation steps. Each step is outlined under the relevant sheet of the calculation tool spreadsheet, together with the activities that need to be performed and methods of data collection (as described in Section 4.2). Table 2 was designed as an overview, and to be used as a reference guide during implementation.

Table 2: Overview of activities and data collection methods for implementation of the market driven approach

Sheet (Calculation tool)	Activity	Data collection method
(1) Target Market Analysis	(1) Review list of potential faecal sludge treatment products	Secondary data, Type 1 interviews
	(2) Identify potential product application	Secondary data, Type 1 interviews
	(3) Identify substitute products	Secondary data (to some extent), primarily Type 2 and Type 3 interviews
(2) Market Stakeholder Analysis	(4) Define geographic boundaries	Not applicable
	(5) Identify market participants (producers/ customers)	Type 1, Type 2 and Type 3 interviews
(3) Market Sizing	(6) Calculate Market Volume	Primarily Type 3 interviews
(3.1) Adjustment Factor	(7) Assess Adjustment Factor	Type 1, Type 2 and Type 3 interviews
	(8) Calculate Adjusted Market Volume	Not applicable – relevant data already in spreadsheet
(4) Market Attractiveness	(9) Assess Market Growth	Primarily secondary data, Type 1 interviews
	(10) Graph Market Attractiveness	Not applicable – relevant data already in spreadsheet

5.1 Target Market Analysis

Activity 1: Review list of potential faecal sludge treatment products

Presented in Table 3 is a preliminary list of faecal sludge treatment products that have been identified as a starting point. Products are presented by the type of resource recovery they present, what type of product they are, and what form they are in. The list should be reviewed in detail, and other treatment products or product types that are applicable in the local context can be added. If additional faecal sludge treatment products are added, they also need to be entered into the calculation tool: Sheet 2: Target Market Analysis, under the heading "List of faecal sludge treatment products". The correct input cells are highlighted in the screenshot in Figure 4. Modifications of any of the lists in the following activities will all need to be incorporated into the spreadsheet, as outlined below.

Table 3: Potential faecal sludge treatment products and type of resource recovery

Resource	Treatment product	Product type
Energy	Solid fuel	Pellets, briquettes, powder
Energy	Liquid fuel	Biogas
Energy	Electricity	Conversion of biogas; or gasification of solid fuel
Food	Protein	Black soldier flies, fish meal
Food	Animal fodder	Plants from drying beds, dried aquaculture plants
Food	Fish	Grown on effluent from faecal sludge treatment
Material	Building materials	Additive to bricks, road construction
Nutrients	Soil conditioner [1]	Compost, pellets, digestate, black soldier fly residual
Nutrients	Fertilizer [2]	Pellets, powder
Nutrients	Soil conditioner [3]	Untreated sludge, dewatered sludge from drying beds
Water, Nutrients	Reclaimed water	Effluent from faecal sludge treatment

Box 1: Kampala case study

Prior to data collection, the list of potential faecal sludge treatment products was used as a starting point for the collection of secondary data and for interviews with researchers in the field of resource recovery of nutrients, energy and water. Relevant literature about specific resources, such as energy, provided a first indication about product types that are in use for the production of energy (e.g. charcoal). Interviews provided first insights into potential faecal sludge treatment products. The list was then ranked qualitatively according to the perceived relevance of products in Kampala.

[1] With different levels of pathogen reduction, based on enduse
[2] Addition of NPK to fulfill nutrient needs of a fertilizer
[3] No pathogen reduction

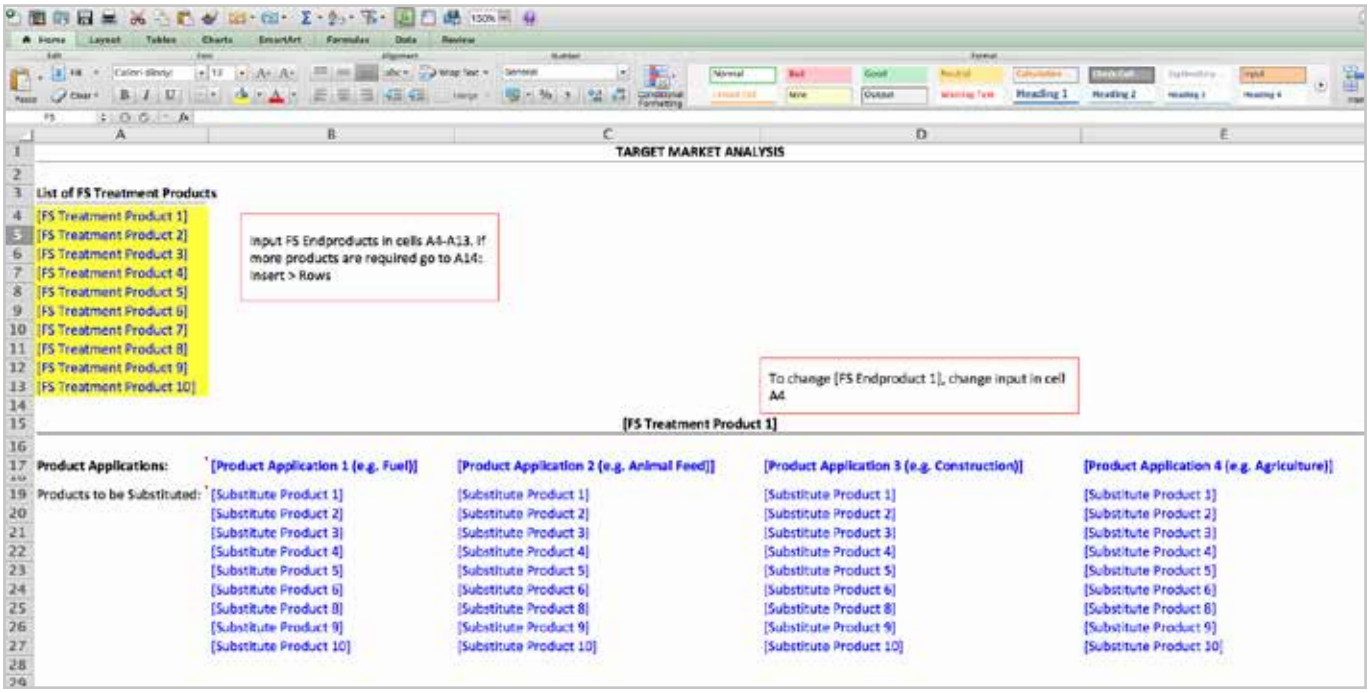


Figure 4: Screenshot of calculation tool: (1) Target Market Analysis with highlighted cells for data entry

Activity 2: Identify potential product application

This activity is performed together with Activity 1. As shown in Table 4, for each faecal sludge treatment product, potential uses of the product are identified. This activity also includes revisiting the secondary literature. Research published in conjunction with the development of the faecal sludge treatment and treatment products provide a good starting point to identify the product applications. Depending on the local context, these applications may vary and need to be re-evaluated.

Additional applications may be identified and added to the list. The findings are entered into the calculation tool, *Sheet 2: Target Market Analysis*, under the heading *"Product Applications"* for each *"FS treatment product"* (see Figure 5).

Box 2: Kampala case study

Product applications for the treatment product "protein" included large-scale commercial fish feed producers, and small-scale producers who produce a "premix" for feed, or collect and distribute agricultural residues for feed. Agriculture was also identified as a product application for the treatment product "soil conditioner" with the current use of cattle manure, chicken manure and wastewater treatment sludge.

Table 4: Product applications of faecal sludge treatment products

Resource	Treatment product	Product application
Energy	Solid fuel	Energy through combustion
Energy	Liquid fuel	Lighting, heat, cooking fuel
Energy	Electricity	Feeding into the grid
Food	Protein	Aquaculture, livestock industry

Food	Animal fodder	Livestock industry
Food	Fish	For human consumption
Material	Building materials	Construction industry
Nutrients	Soil conditioner [4]	Agriculture, horticulture, flower industry
Nutrients	Fertilizer [5]	Agriculture, horticulture, flower industry
Nutrients	Soil conditioner [6]	Forestry
Water, Nutrients	Reclaimed water	Agriculture, horticulture, flower industry

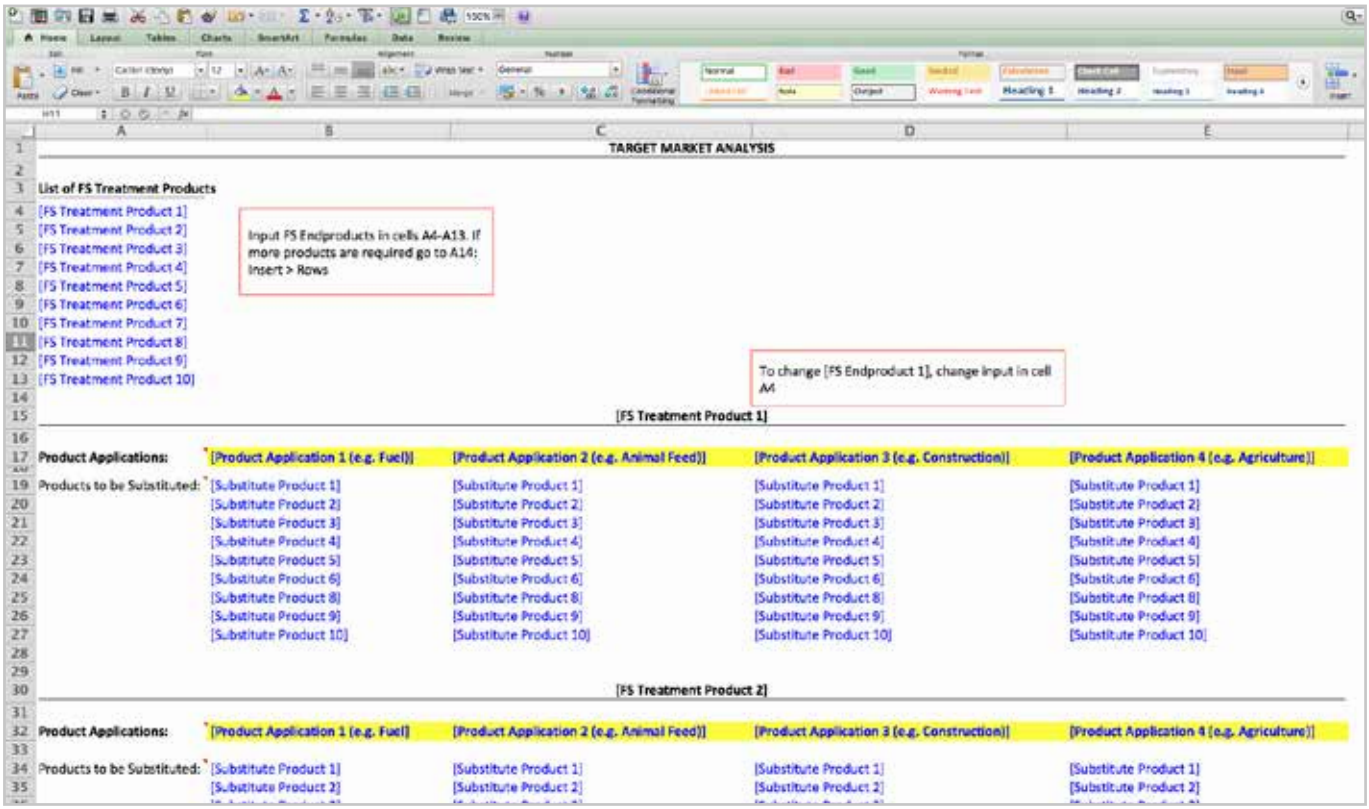


Figure 5: Screenshot of calculation tool: (1) Target Market Analysis with highlighted cells for data entry

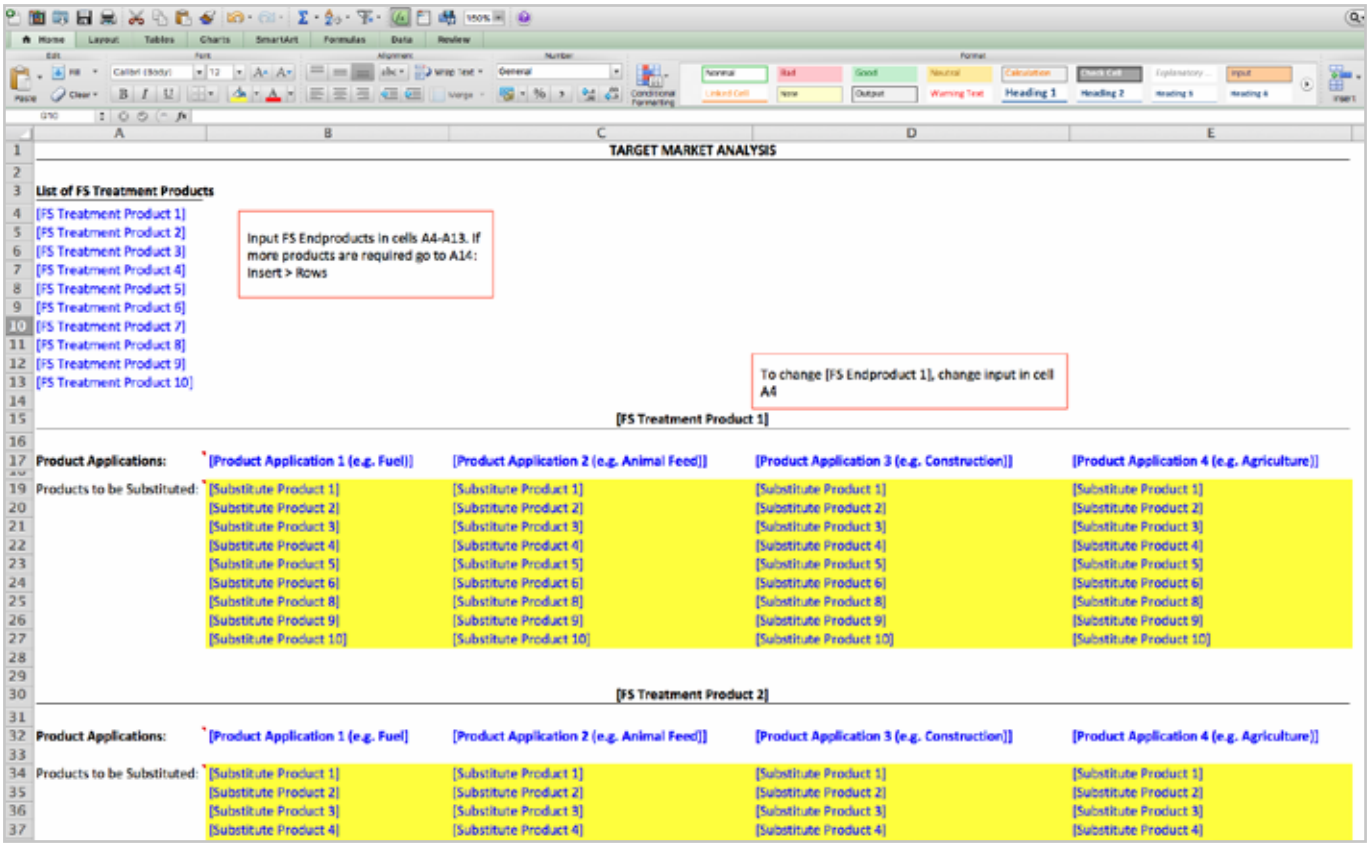
Activity 3: Identify potential substitute products

This activity identifies products that are currently in use by the industries identified in Activity 2. These products are referred to as "substitute products" because they could potentially be replaced by faecal sludge treatment products (e.g. animal feed, fertilizer, charcoal).

As a starting point, information can be obtained from literature and online resources, however, it will also require the development of more detailed questionnaires, which could be used to implement interviews of Type 3 as a primary source of data. Experts of specific industries are identified and consulted for input to compile an initial list that can be expanded

[4] With different levels of pathogen reduction, based on enduse
[5] Addition of NPK to fulfill nutrient needs of a fertilizer
[6] No pathogen reduction

and amended as the study progresses (see Box 3). The identified substitute products are entered into the calculation tool, Sheet 2: Target Market Analysis, under the heading *"Substitute Product"* for each *"Product Application"* (see Figure 6).



TARGET MARKET ANALYSIS

List of FS Treatment Products

[FS Treatment Product 1]
[FS Treatment Product 2]
[FS Treatment Product 3]
[FS Treatment Product 4]
[FS Treatment Product 5]
[FS Treatment Product 6]
[FS Treatment Product 7]
[FS Treatment Product 8]
[FS Treatment Product 9]
[FS Treatment Product 10]

Input FS Endproducts in cells A4-A13. If more products are required go to A14: Insert > Rows

To change [FS Endproduct 1], change input in cell A4

[FS Treatment Product 1]

Product Applications:	[Product Application 1 (e.g. Fuel)]	[Product Application 2 (e.g. Animal Feed)]	[Product Application 3 (e.g. Construction)]	[Product Application 4 (e.g. Agriculture)]
Products to be Substituted:	[Substitute Product 1]	[Substitute Product 1]	[Substitute Product 1]	[Substitute Product 1]
	[Substitute Product 2]	[Substitute Product 2]	[Substitute Product 2]	[Substitute Product 2]
	[Substitute Product 3]	[Substitute Product 3]	[Substitute Product 3]	[Substitute Product 3]
	[Substitute Product 4]	[Substitute Product 4]	[Substitute Product 4]	[Substitute Product 4]
	[Substitute Product 5]	[Substitute Product 5]	[Substitute Product 5]	[Substitute Product 5]
	[Substitute Product 6]	[Substitute Product 6]	[Substitute Product 6]	[Substitute Product 6]
	[Substitute Product 8]	[Substitute Product 8]	[Substitute Product 8]	[Substitute Product 8]
	[Substitute Product 9]	[Substitute Product 9]	[Substitute Product 9]	[Substitute Product 9]
	[Substitute Product 10]	[Substitute Product 10]	[Substitute Product 10]	[Substitute Product 10]

[FS Treatment Product 2]

Product Applications:	[Product Application 1 (e.g. Fuel]	[Product Application 2 (e.g. Animal Feed)]	[Product Application 3 (e.g. Construction)]	[Product Application 4 (e.g. Agriculture)]
Products to be Substituted:	[Substitute Product 1]	[Substitute Product 1]	[Substitute Product 1]	[Substitute Product 1]
	[Substitute Product 2]	[Substitute Product 2]	[Substitute Product 2]	[Substitute Product 2]
	[Substitute Product 3]	[Substitute Product 3]	[Substitute Product 3]	[Substitute Product 3]
	[Substitute Product 4]	[Substitute Product 4]	[Substitute Product 4]	[Substitute Product 4]

Figure 6: Screenshot of calculation tool: (1) Target Market Analysis with highlighted cells for data entry

Box 3: Kampala case study

Product applications for the treatment product "solid fuel" included industries using solid fuel for energy or heat, and wholesalers or retailers selling fuel for household use. In the industries that were identified in Kampala, the currently used products were wood, charcoal, sawdust, and agricultural residues like coffee husks (commonly used in Kampala), bagasse, rice husks, rice straw, sunflower hulls, cotton seed hulls, tobacco dust, maize cobs and groundnut shells. These were all identified as substitute products that could be replaced with faecal sludge treatment products. In Kampala, retailers whose customers are households only sell wood and charcoal. Based on secondary literature, wood and charcoal were initially identified as substitute products, however, it was through interviews that additional agricultural residues that are used as a solid fuel were identified as substitute products.

5.2 Market Stakeholder Analysis

Activity 4: Define geographic boundaries

The target market analysis is not limited to geographic boundaries because it is an exploratory study. However, a defined geographic area is useful for the market stakeholder analysis. Depending on the size of the city, it is useful to limit the geographic area for the identification of market participants to city or country boundaries. But, when assessing market dynamics of products, export and import play a significant role. Therefore, geographic boundaries cannot always be clearly defined for each product application that was identified in Activity 2. The choice of boundaries also depends on the anticipated level of detail for the study. If time and resources allow, interviews can be performed all over the country and even beyond, if however, a rapid assessment is necessary, it would be more useful to limit the number and reach of interviews, and potentially conduct interviews by telephone.

Activity 5: Identify market participants

This activity identifies all market participants that are relevant for substitute products, identified in Activity 3. Market participants include producers of products, wholesalers, retailers and customers.
Private companies in addition to industries discovered in Activity 2 (i.e. customers) provide an ideal entry point to identify the producers of substitute products. Once identified, these producers can provide the most comprehensive information on the unit and price of products, which is the information required during market sizing (see Section 5.3) However, customers are also valuable interviewees for obtaining this information, especially where products might be produced and transported from far outside the city, or even imported from different countries. Additionally, these companies may ultimately be the customers of faecal sludge treatment products that could replace the currently used substitute product (e.g. fertilizer, animal feed, charcoal) (see also Box 5).

The identified market participants are entered into the calculation tool, *Sheet 3: Market Stakeholder Analysis*, under the heading *"Market Participant"* for each *"Industry Application"* and *"Substitute Product"* (see Figure 7)

Box 4: Kampala case study

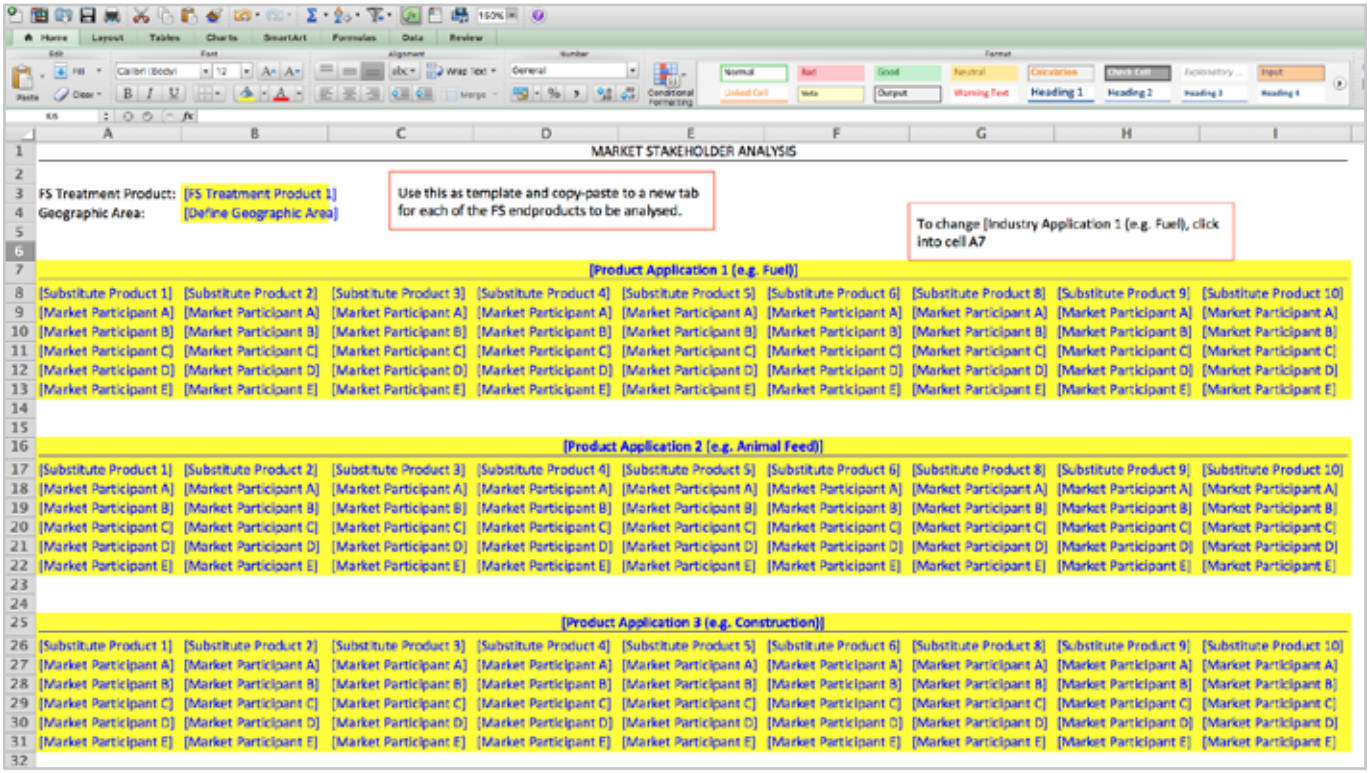
The geographical boundaries were set to the municipal boundaries of Kampala. While animal fodder, such as pasture and commercial feed, are produced outside of these boundaries, wholesalers sell the products within the boundaries to urban animal farmers. The wholesalers were interviewed as market participants, because they provide a potential future entry point for replacing pasture and commercial feed with fodder plants produced from planted drying beds treating faecal sludge.

Box 5: Kampala case study

Relevant information about market participants was gained from associations, such as the Kampala City Traders Association, the Uganda Seed Trade Association and the Kampala District Farmers Association. A relevant governmental institution was the Ministry of Trade, Industry and Cooperatives, while several departments at Makerere University provided useful entry points. Actual market participants for the treatment product "solid fuel", such as Uganda Clays Ltd. and Hima Cement Ltd., which are private companies, also provided further contacts within their respective sector.

Box 6: Kampala case study

In Kampala, the substitute product charcoal is mainly sold in the informal sector. As a consequence, charcoal retailers are not officially registered as a company and often do not have official records about their sales and revenues. These informal businesses are scattered all over the city without documented locations, which makes it difficult to identify them or estimate the scale of operation. Kampala authorities were able to provide estimations about the number of charcoal retailers in the city. However, interviews with informal charcoal businesses can provide useful information about market growth, the substitute product itself, market competition and other qualitative information about the sector.



MARKET STAKEHOLDER ANALYSIS

FS Treatment Product: [FS Treatment Product 1]
Geographic Area: [Define Geographic Area]

Use this as template and copy-paste to a new tab for each of the FS endproducts to be analysed.

To change [Industry Application 1 (e.g. Fuel), click into cell A7

[Product Application 1 (e.g. Fuel)]								
[Substitute Product 1]	[Substitute Product 2]	[Substitute Product 3]	[Substitute Product 4]	[Substitute Product 5]	[Substitute Product 6]	[Substitute Product 8]	[Substitute Product 9]	[Substitute Product 10]
[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]
[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]
[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]
[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]
[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]

[Product Application 2 (e.g. Animal Feed)]								
[Substitute Product 1]	[Substitute Product 2]	[Substitute Product 3]	[Substitute Product 4]	[Substitute Product 5]	[Substitute Product 6]	[Substitute Product 8]	[Substitute Product 9]	[Substitute Product 10]
[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]
[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]
[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]
[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]
[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]

[Product Application 3 (e.g. Construction)]								
[Substitute Product 1]	[Substitute Product 2]	[Substitute Product 3]	[Substitute Product 4]	[Substitute Product 5]	[Substitute Product 6]	[Substitute Product 8]	[Substitute Product 9]	[Substitute Product 10]
[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]	[Market Participant A]
[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]	[Market Participant B]
[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]	[Market Participant C]
[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]	[Market Participant D]
[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]	[Market Participant E]

Figure 7: Screenshot of calculation tool: (2) Market Stakeholder Analysis with highlighted cells data entry

5.3 Market Sizing

Activity 6: Calculate Market Volume

Market sizing is an iterative step, where information collected through secondary data, interviews and observations from all previous activities is entered into the calculation tool to derive the market volume of each identified substitute product. This step is iterative, because information on the produced number of units and prices per substitute product may become available at any stage of the implementation.

It is suggested to implement at least two interviews per identified substitute product, ideally with producers, to derive the most accurate numbers. Interviews with retailers can also reveal the necessary information, however, retailers may be widely spread over the study area and often operate in the informal sector (see Box 4).

Depending on the substitute product, it may be helpful to interview customers in some cases. For example, coffee husks are often used in industries as a fuel, however, coffee husks themselves are a by-product of coffee farms and one industry might be supplied by several farmers. It is therefore recommended to interview the company itself on number and price instead of the industry. Charcoal on the contrary could be produced far out of the city in the rural areas of a country, where forestry exists and charcoal is directly produced to reduce volume and weight for transport into the city. In this case, it is recommended to interview several retailers that distribute the charcoal within the city. To cross-check information, even customers (e.g. households) could be interviewed on the unit of required charcoal and respective prices.

The market volume of a substitute product is calculated by multiplying the number of units produced by the price the product is sold for. Based on the fact that treatment technologies might not yet exist, it is possible that some of this data may not be available. Relevant literature can provide ways to estimate and close these gaps. If no data can be collected (e.g. if a retailer will not provide the number of units sold), estimations have to be made, and assumptions need to be clearly documented.

Once the number of units produced by each market participant, and the price per unit has been established, the information is entered into the calculation tool, *Sheet 4: Market Sizing* (see Figure 8).

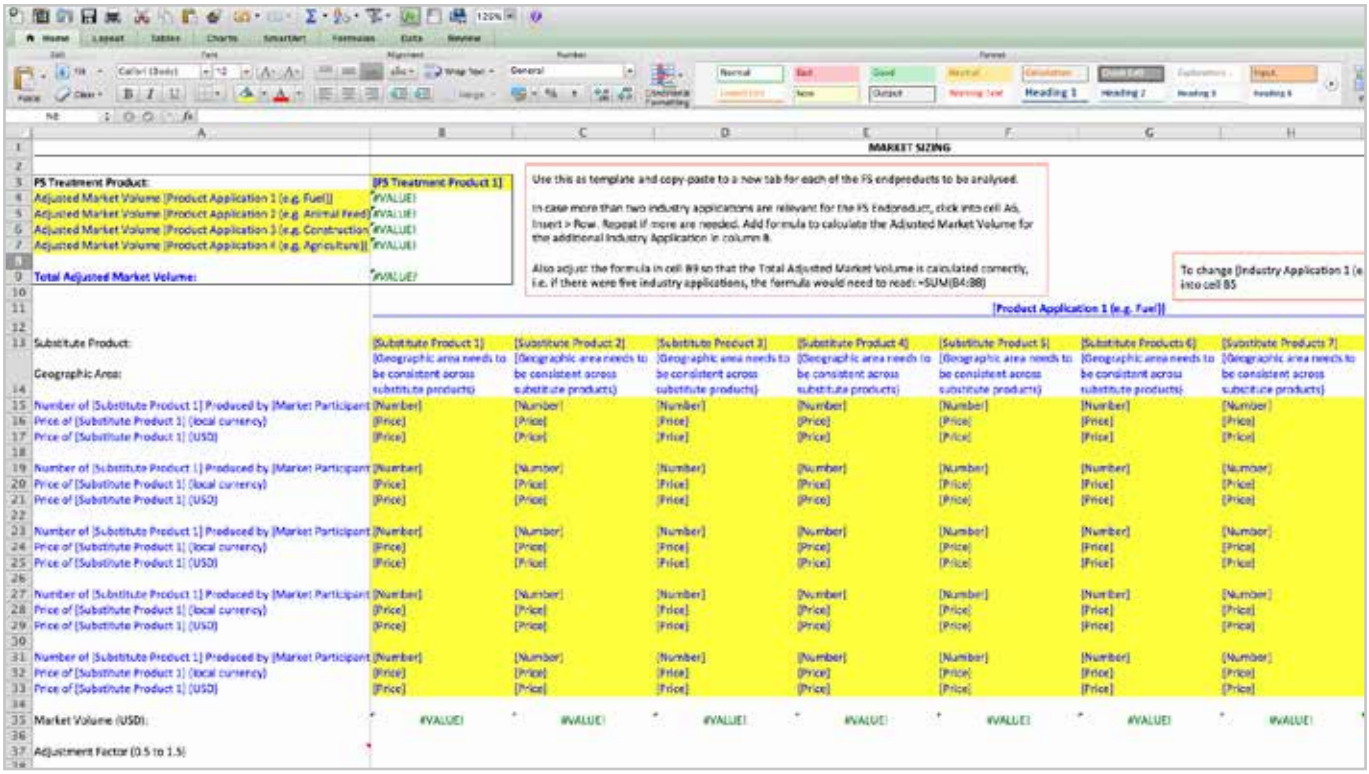


Figure 8: Screenshot of calculation tool: (3) Market Sizing with highlighted cells for data entry

Activity 7: Assess Adjustment Factor

In Activity 6 the market volume of the substitute products is calculated, but before calculating the market volume of the faecal sludge treatment product, the adjustment factor needs to be determined.

The adjustment factor accounts for the market difference in reality between the substitute product and the faecal sludge treatment product. For example, in order to directly replace coffee husks that are currently used as a fuel in the cement industry, the faecal sludge treatment product (e.g. dewatered faecal sludge) has to have the same input quality as the currently used coffee husks. This includes fuel value (e.g. calorific value), form (e.g. ease of use), and intangible factors such as cultural acceptance. If the treatment product cannot be used in exactly the same way, then industrial processes may have to be adapted (e.g. method to feed fuel to boiler).

The adjustment factor is based on qualitative information and the estimation of a future scenario is purely hypothetical. However, this assessment is necessary to identify potential constraints of faecal sludge treatment products. For the final product to be applicable in a given industry and for developing market strategies, the adjustment factor can be used as an explorative tool.

A list of drivers to consider in calculating the adjustment factor is presented in Table 5. However, this is not meant as a comprehensive guideline, and should be adapted for products, markets and the local context (see Box 5). Each driver needs to be assessed individually by using information obtained from interviewing market participants. A questionnaire could

Figure 9: Scores for the adjustment factor related to negative and positive influence on market volume of faecal sludge treatment products

also be developed specifically for the adjustment factor and a targeted faecal sludge treatment product. While this adds another activity to the overall implementation, a more comprehensive knowledge about the potential use of faecal sludge treatment products could be developed.

By ranking each driver from Table 5 and as shown in Figure 9 with a score from 1 (highly negative influence) to 5 (highly positive influence), an adjustment factor between 0.5 and 1.5 is calculated. For example, if the producer of a substitute product needs to invest large amounts of capital to acquire new machinery to utliize the faecal sludge treatment product, the influence on the market volume based on this driver could be ranked as negative (score 2) or highly negative (score 1). These rankings for all drivers are entered in the calculation tool in *Sheet 3.1: Adjustment Factor* (see Figure 10). The tool then automatically calculates the resulting adjustment factor based on the sum of each individual ranking and the addition of "9" before dividing by "36". For this formula to be applicable, it is required that a ranking for each driver is provided.

- An adjustment factor between 0.5 and < 1 indicates that the market volume of the faecal sludge treatment product is lower than the market volume of the substitute product.
- An adjustment factor of 1 indicates that the market volume of the faecal sludge treatment product is equal to the market volume of the substitute product.
- An adjustment factor between > 1 and 1.5 suggests that the market volume of the faecal sludge treatment product is greater than then the market volume of the substitute product.

The result of the adjustment factor for each substitute product and faecal sludge treatment is then entered into *Sheet 3: Market Sizing* in the specific row for the adjustment factor (see Figure 11)

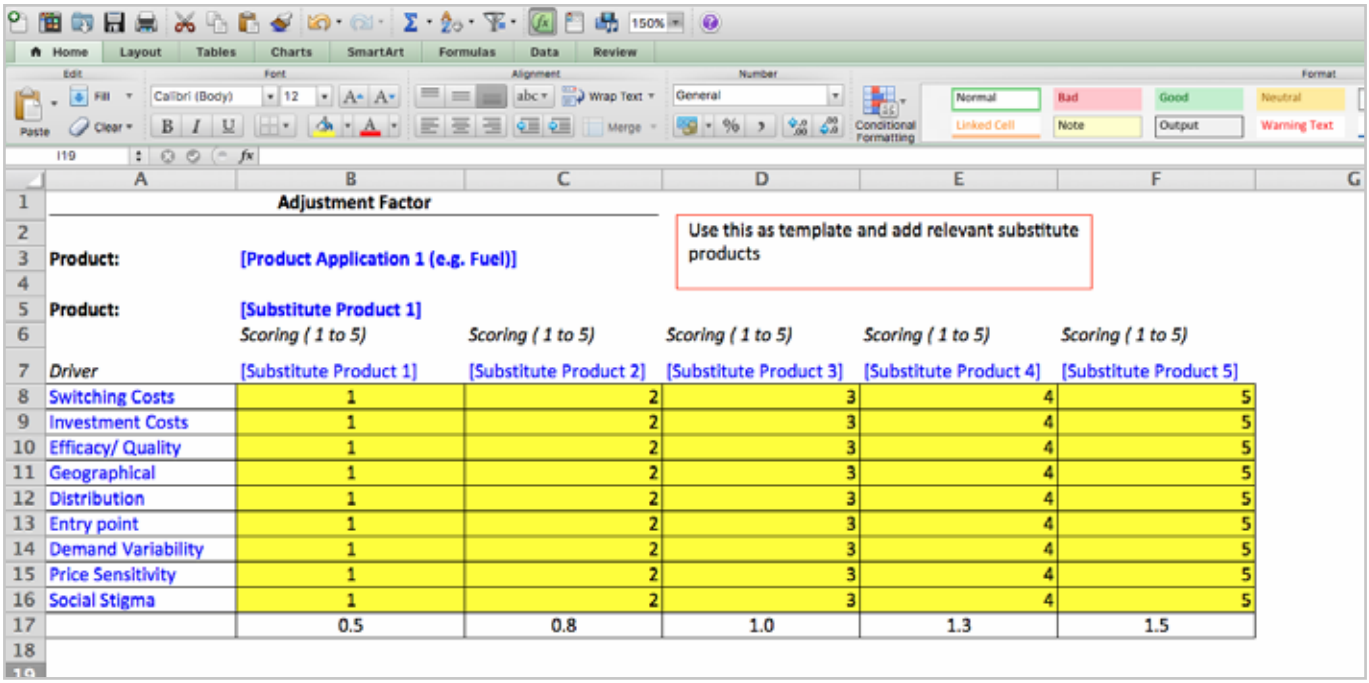
Table 5: Parameters that are considered to have an influence on the market volume of faecal sludge treatment products in comparison to substitute products

Driver	Description
Switching Costs	Costs incurred by switching from the substitute product to a faecal sludge treatment product • Costs related to train employees on the use of the new product • Costs for adjusting the labeling of the products to a new raw material. *For example:* *Does the industry need to implement training, labeling or other measures if the substitute product is replaced?*
Investment Costs	Costs incurred to use faecal sludge treatment product *For example:* *Does the producer need to invest capital to acquire new machinery to produce the faecal sludge treatment product?*
Efficacy/ Quality	Efficacy/ quality of substitute product vs. faecal sludge treatment product. *For example:* *What is the quality (e.g. lower fuel value) of the faecal sludge treatment product compared to the substitute product?*

Geographical	Difficulty to reach potential customers. *For example:* *Are potential customers accessible from the production site (proximity, road access)?*
Distribution	Difficulty of product distribution? Direct supply, wholesalers, retailers, market place? *For example:* *Is the transportation of the faecal sludge treatment product more costly than that of the substitute product?*
Entry point	Difficulty to access relevant customers. Are there existing relationships that can be leveraged to gain access to the relevant people at potential clients? *For example:* *Is there an existing market/place where the faecal sludge treatment product can be sold?*
Demand Variability	Is constant demand guaranteed or do potential customers only require the products during certain period (e.g. peak times). High variability results in high weighting factor. *For example:* *Is the demand (buying) for the faecal sludge treatment product constant throughout the year or is there a given seasonality?*
Price Sensitivity	Impact on buying interest at variable prices. Needs to take into account price of substitute products vs. price of faecal sludge treatment products. *For example:* *If the price of the product changes a little, how does the demand change with it (big change/ small change)? If the price of a faecal treatment product is much higher than that of the substitute product, will people still buy it? (Regardless of social stigma and other parameters)*
Social Stigma	Social stigma attached with using a product based on faecal sludge. *For example:* *Do the potential users of the faecal sludge treatment product have reservations about using the product (e.g. for cooking)?*

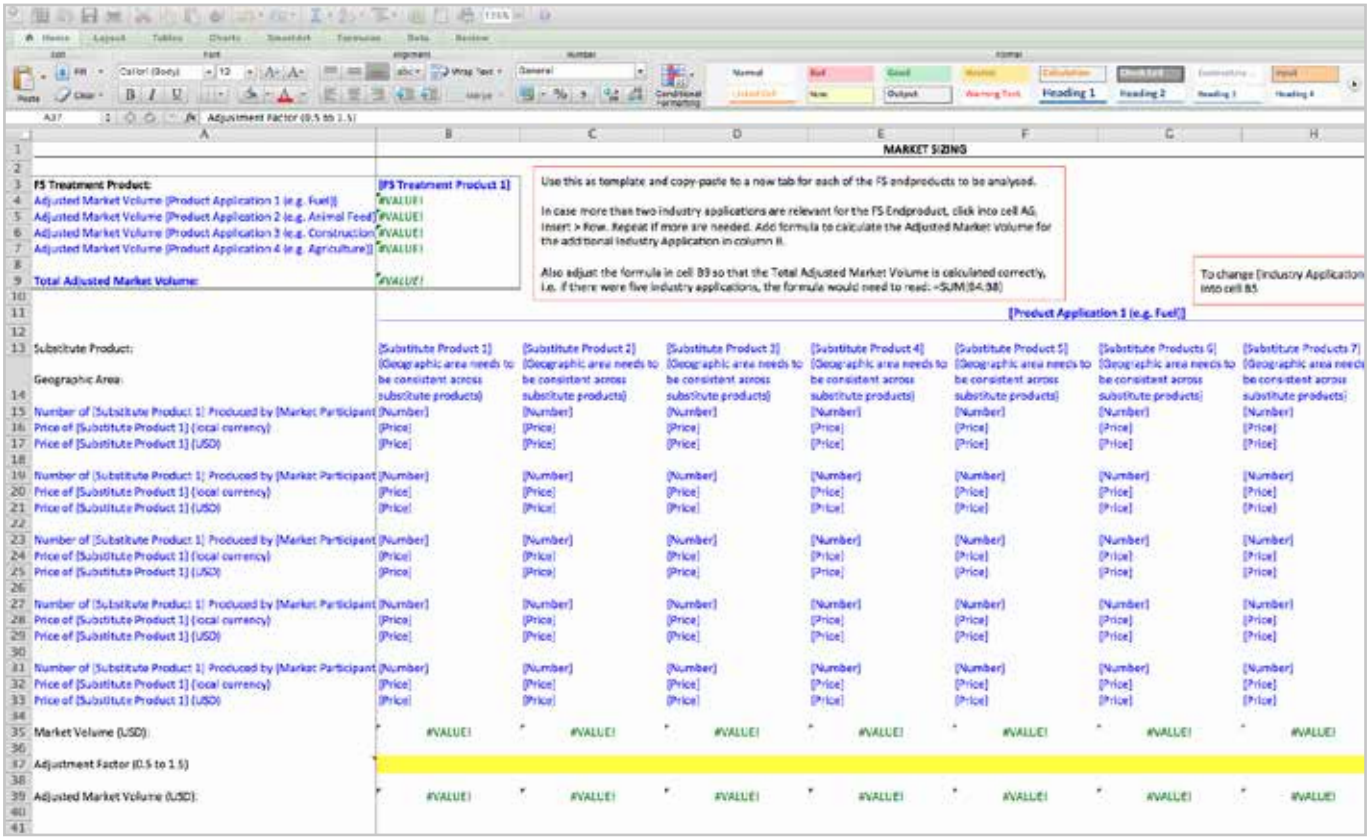
Box 7: Vietnam case study

In Vietnam, a different approach was taken to estimate the adjustment factor. The implementer was not able to obtain useful information on the drivers in Table 5. Instead, the interest of interviewees to consider replacing a current product (substitute product) with a faecal sludge treatment product was assessed and used as an estimation for the adjustment factor. Three aspects defined this interest: (1) the willingness to use faecal sludge treatment product in their process, (2) the price they would pay (smaller or equal to the substitute product), and (3) the support by the local authorities for the application of this faecal sludge treatment product for resource recovery. For example, brick production industries in Vietnam were interested in replacing charcoal with a faecal sludge treatment product at the same price as the substitute product. Retailer of charcoal briquettes were not interested in replacing charcoal with a faecal sludge treatment product and the adjustment factor was set 0.5. If there was a willingness to apply a faecal sludge treatment product, but the product would be bought at a cheaper price, the adjustment factor was set to 0.7



	A	B	C	D	E	F
1		**Adjustment Factor**				
2						
3	**Product:**	[Product Application 1 (e.g. Fuel)]		Use this as template and add relevant substitute products		
4						
5	**Product:**	[Substitute Product 1]				
6		*Scoring (1 to 5)*	*Scoring (1 to 5)*	*Scoring (1 to 5)*	*Scoring (1 to 5)*	*Scoring (1 to 5)*
7	*Driver*	[Substitute Product 1]	[Substitute Product 2]	[Substitute Product 3]	[Substitute Product 4]	[Substitute Product 5]
8	Switching Costs	1	2	3	4	5
9	Investment Costs	1	2	3	4	5
10	Efficacy/ Quality	1	2	3	4	5
11	Geographical	1	2	3	4	5
12	Distribution	1	2	3	4	5
13	Entry point	1	2	3	4	5
14	Demand Variability	1	2	3	4	5
15	Price Sensitivity	1	2	3	4	5
16	Social Stigma	1	2	3	4	5
17		0.5	0.8	1.0	1.3	1.5
18						

Figure 10: Screenshot of calculation tool: (3.1) Adjustment Factor with highlighted cells for data entry



	A	B	C	D	E	F	G	H
1				**MARKET SIZING**				
2								
3	**FS Treatment Product:**	[FS Treatment Product 1]	Use this as template and copy-paste to a new tab for each of the FS endproducts to be analysed.					
4	Adjusted Market Volume [Product Application 1 (e.g. Fuel)]	#VALUE!						
5	Adjusted Market Volume [Product Application 2 (e.g. Animal Feed)]	#VALUE!	In case more than two industry applications are relevant for the FS Endproduct, click into cell A5, insert > Row. Repeat if more are needed. Add formula to calculate the Adjusted Market Volume for the additional industry Application in column B.					
6	Adjusted Market Volume [Product Application 3 (e.g. Construction)]	#VALUE!						
7	Adjusted Market Volume [Product Application 4 (e.g. Agriculture)]	#VALUE!	Also adjust the formula in cell B9 so that the Total Adjusted Market Volume is calculated correctly, i.e. if there were five industry applications, the formula would need to read: =SUM(B4:B8)				To change Industry Application into cell B5	
8								
9	**Total Adjusted Market Volume:**	#VALUE!						
10								
11				[Product Application 1 (e.g. Fuel)]				
12								
13	Substitute Product:	[Substitute Product 1] (Geographic area needs to be consistent across substitute products)	[Substitute Product 2] (Geographic area needs to be consistent across substitute products)	[Substitute Product 3] (Geographic area needs to be consistent across substitute products)	[Substitute Product 4] (Geographic area needs to be consistent across substitute products)	[Substitute Product 5] (Geographic area needs to be consistent across substitute products)	[Substitute Products 6] (Geographic area needs to be consistent across substitute products)	[Substitute Products 7] (Geographic area needs to be consistent across substitute products)
14	Geographic Area:							
15	Number of [Substitute Product 1] Produced by [Market Participant]	[Number]	[Number]	[Number]	[Number]	[Number]	[Number]	[Number]
16	Price of [Substitute Product 1] (local currency)	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]
17	Price of [Substitute Product 1] (USD)	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]
18								
19	Number of [Substitute Product 1] Produced by [Market Participant]	[Number]	[Number]	[Number]	[Number]	[Number]	[Number]	[Number]
20	Price of [Substitute Product 1] (local currency)	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]
21	Price of [Substitute Product 1] (USD)	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]
22								
23	Number of [Substitute Product 1] Produced by [Market Participant]	[Number]	[Number]	[Number]	[Number]	[Number]	[Number]	[Number]
24	Price of [Substitute Product 1] (local currency)	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]
25	Price of [Substitute Product 1] (USD)	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]
26								
27	Number of [Substitute Product 1] Produced by [Market Participant]	[Number]	[Number]	[Number]	[Number]	[Number]	[Number]	[Number]
28	Price of [Substitute Product 1] (local currency)	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]
29	Price of [Substitute Product 1] (USD)	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]
30								
31	Number of [Substitute Product 1] Produced by [Market Participant]	[Number]	[Number]	[Number]	[Number]	[Number]	[Number]	[Number]
32	Price of [Substitute Product 1] (local currency)	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]
33	Price of [Substitute Product 1] (USD)	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]	[Price]
34								
35	Market Volume (USD):	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
36								
37	Adjustment Factor (0.5 to 1.5)							
38								
39	Adjusted Market Volume (USD):	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
40								
41								

Figure 11: Screenshot of calculation tool: (3) Target Market Sizing with highlighted cells for data entry

Activity 8: Calculate Adjusted Market Volume

The adjusted market volume is automatically calculated in *Sheet 3: Market Sizing* of the calculation tool by multiplying the number of units by the price per unit. The resulting number will then form the first parameter necessary to illustrate market attractiveness of the faecal sludge treatment product in Activity 10.

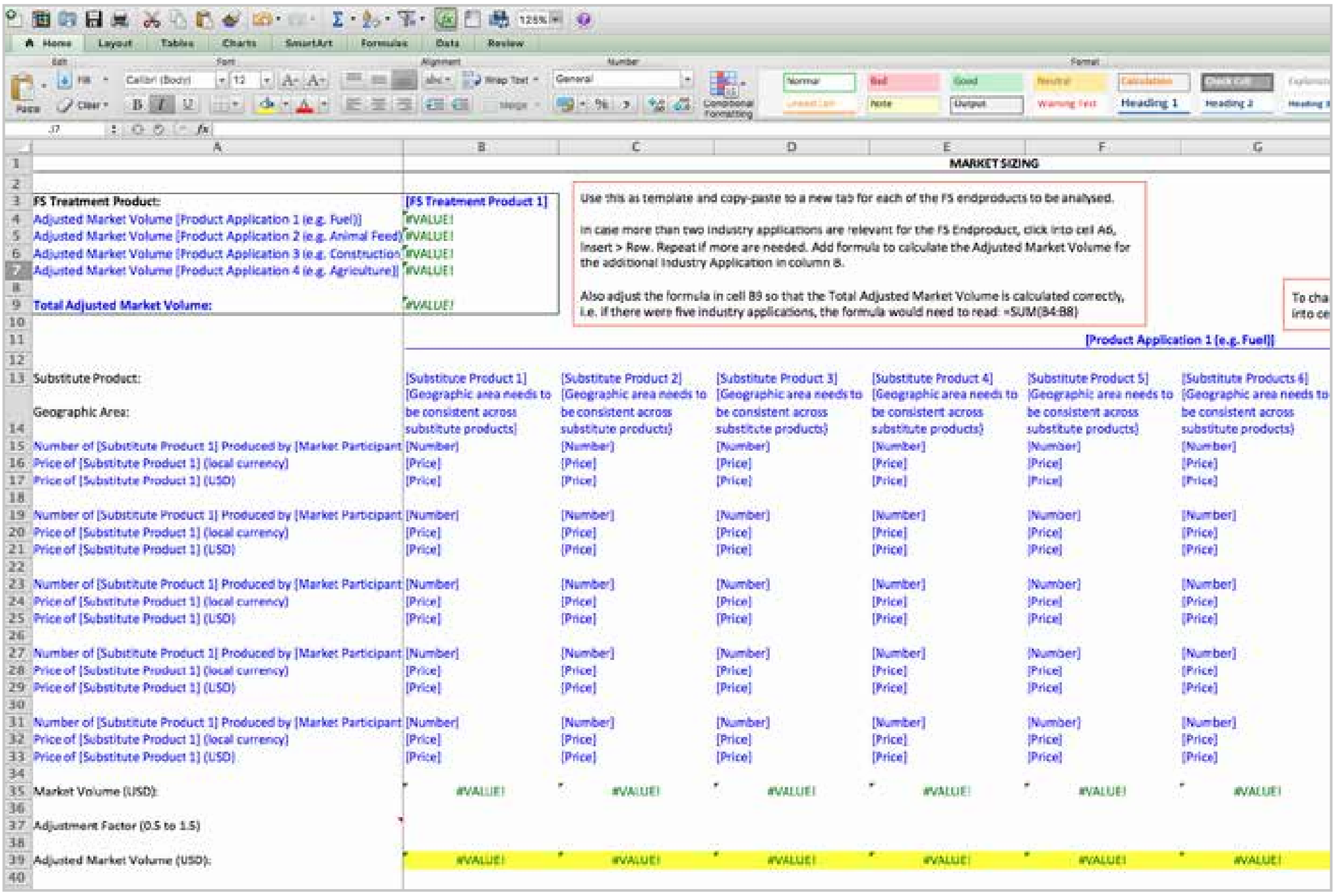


Figure 12: Screenshot of calculation tool: (3) Target Market Sizing with highlighted cells for spreadsheet calculation

Box 8: Vietnam case study

The market volume of charcoal in cement production in Son La, Vietnam, was calculated at around 12 million USD/year. However, the market participant Mai Son Cement Enterprise, which is the only cement producer in the Son La province, had reservations about the applicability of using faecal sludge treatment products as a solid fuel for combustion. Based on this bias, even if the faecal sludge treatment product could be shown to have the same fuel potential, the industry was not interested in replacing the currently used charcoal. An adjustment factor of 0.5 was applied and resulted in an adjusted market volume of around 6 million USD/year.

5.4 Market Attractiveness

Activity 9: Assess Market Growth

Assessing the market growth of a specific substitute product or industry is intended to estimate the potential for increasing demand of the product in the future. Similar to assessing the market volume, market growth is approached by analyzing the industry growth rates of the substitute products (or industry if applicable) and applies the data to the faecal sludge treatment product as a proxy (see Box 6).

For each faecal sludge treatment product, the product applications and substitute products have been identified in the Section 5.1: Target Market Analysis. Required information on market growth can be provided by the same interviews that were conducted as part of this analysis as well as from Section 5.3: Market Sizing.

Furthermore, the initial literature review, as well as primary and secondary data collected during interviews, provides valuable information about market growth (e.g. historical, demographical, sector performance data). The collected data gives an overview of the historical developments of the assessed substitute products and product applications, and its expected future growth.

The identified market growth for each product application, faecal sludge treatment product and substitute product is then entered into Sheet 4: Market Attractiveness (see Figure 13)

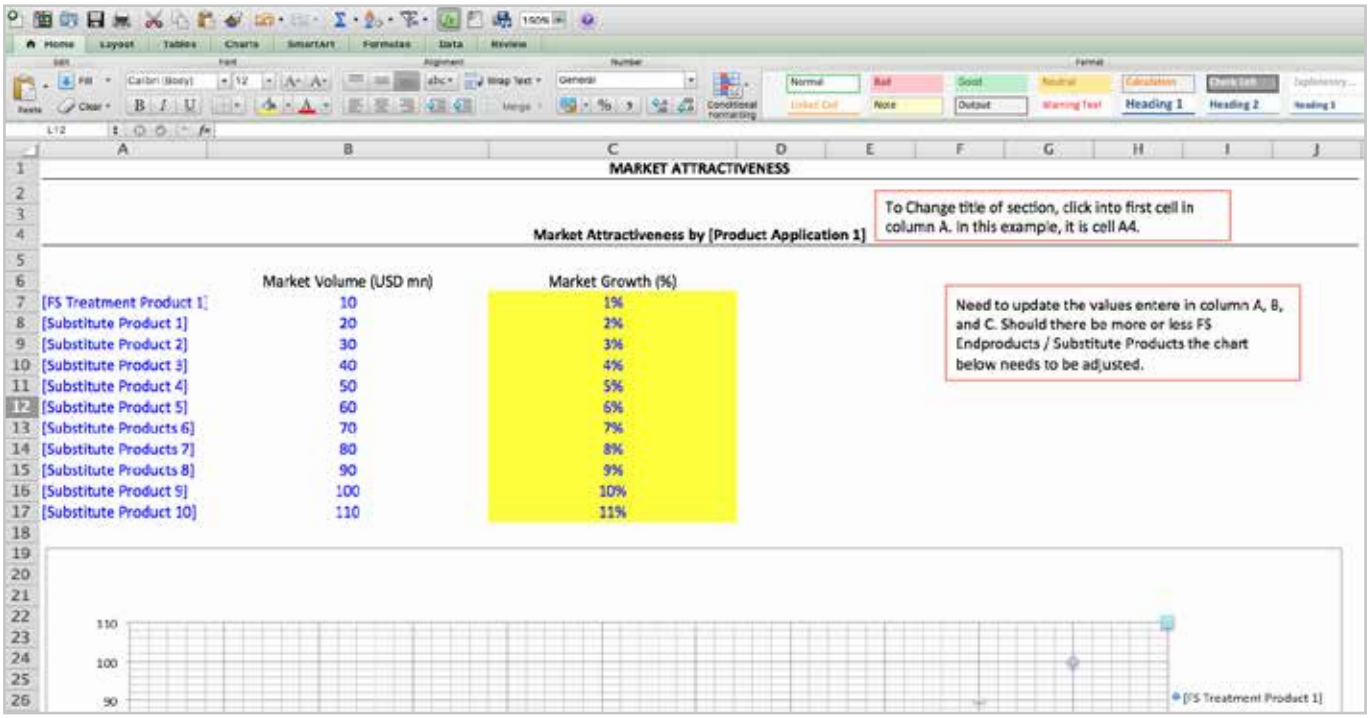


Figure 13: Screenshot of calculation tool: (4) Market Attractiveness with highlighted cells for data entry

Box 9: Kampala case study

In Kampala, agriculture was identified as a product application for fertilizer. To assess the market growth of fertilizer, growth aspects of the agricultural sector in Kampala and throughout Uganda were considered. This included trends on Gross Domestic Product (GDP), GDP per capita, population increase, urbanization, age demographics, number of farmers, revenues in the agricultural sector, and an estimation from government literature about the growth rate over the past years. Based on interviews and literature, it was revealed that the market for synthetic fertilizer has two distinct seasons in Uganda. Additionally, farmers in and around Kampala do not use synthetic fertilizer. Therefore, fertilizer appears to have little to low market growth and therefore low market attractiveness for fertilizer as a faecal sludge treatment product. However, farmers in Kampala are mostly operate on a small-scale and primarily use cow and chicken manure to fertilize. If, however, the boundaries of the assessment would be extended to the whole of Uganda, including large-scale farmers, it could be expected that market volume and growth for fertilizer would be much higher. This again shows the importance of definition of boundaries for the market driven approach.

Activity 10: Graph Market Attractiveness

The last activity is graphing the market attractiveness of a faecal sludge treatment product. All the required values (i.e. market volume and market growth) have already been determined and entered into the calculation tool. A template is available in Sheet 4: Market Attractiveness of the calculation tool (see Figure 14). Once the data is plotted in a chart, interpretation is relatively straightforward. The larger the market volume and the higher the growth rate, the higher the market attractiveness and vice versa. In most cases, however, the situation will not be as clear-cut and will need to be analyzed further in conjunction with the envisaged business model around the faecal sludge treatment product to determine the best market strategy (see Box 10).

Box 10: Kampala case study

Solid fuel for the production of energy and protein for the production of fish feed had the greatest market attractiveness. The next steps for these products would include a supply assessment of faecal sludge as the input material, a technology assessment to select the most appropriate treatment technology, a financial assessment to develop a sustainable business model, and an environmental and health impact assessment, depending on existing regulations.

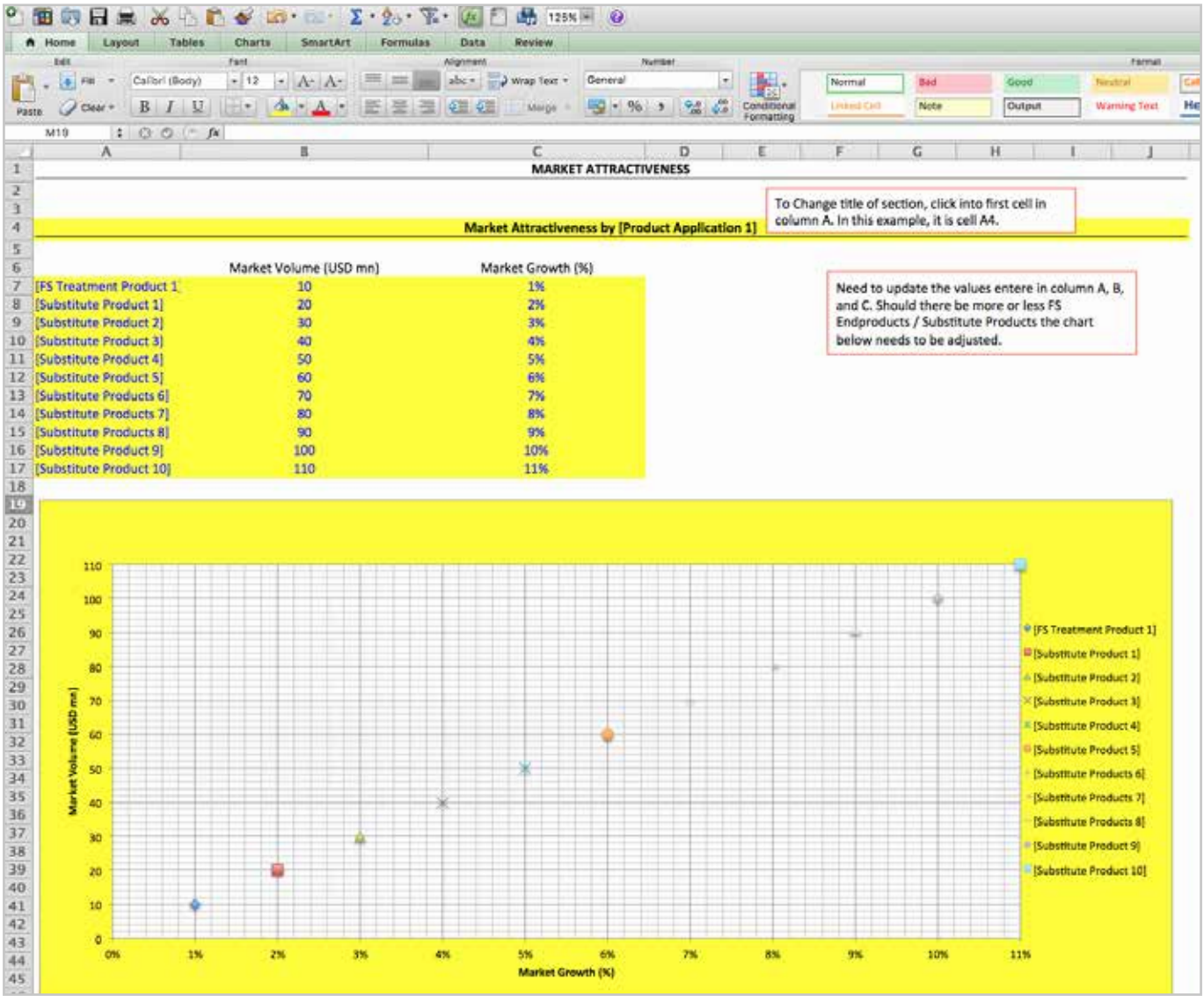


Figure 14: Screenshot of calculation tool: (4) Market Attractiveness with highlighted cells for data entry and graphic

6 Limitations

The market driven approach methodology presented here provides a means to estimate the market attractiveness of faecal sludge treatment products prior to their existence in a market. The method is not intended to be more comprehensive than that in terms of faecal sludge management, and so must be incorporated in an integrated engineering approach that includes collection and transport, quantification and characterization, and selection and design of treatment technologies. Technical decisions also have to be made within the framework of an integrated approach including planning and operations and maintenance, as laid out in Strande et. al (2014). Because the method is focused on future use of products, it also relies on two key assumptions: (1) unlimited supply and availability of untreated faecal sludge; and (2) ability to produce the faecal sludge treatment products in the required quality and quantity. Validation of these assumptions is also an important aspect in determining treatment technologies. Although this method is quantitative, it also relies on subjective and/or qualitative inputs. It is therefore important to triangulate and validate information as thoroughly as possible.

It was difficult to determine the most accurate method for estimating an Adjustment Factor, and this should continue to be improved upon with future implementations. The challenge lies in the identification of common drivers that are applicable across products, markets and geographies, which in reality may or may not be possible. A different approach could be to identify a set of questions and tools that can help in determining a robust set of drivers that take into account the respective market dynamics of each faecal sludge treatment product and the respective substitute products. This may be more relevant than trying to force a common set of 'theoretical' drivers across products and markets.

Market volume and market growth are critical points in the assessment of the viability of a faecal sludge treatment product, however the organization producing the goods plays an equally important role. Its ability to compete in a market environment will depend on various internal and external factors that should be analyzed in detail to provide, in conjunction with the analysis of market volume and growth, a reasonable accurate picture of the market opportunity.

7 Acknowledgements

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9 Annex

Questionnaire for assessing the market attractiveness of faecal sludge treatment products

Market-Driven Approach for Selection of Faecal Sludge Treatment Products

Treatment product: Protein

Target group: Protein distributers, feed producers (fish, chicken)

Name interviewer: _____

Name interviewee: _____

Company name: _____

Function interviewee: _____

Date: _____ Start time: _____ End time: _____

Location: _____

District: _____

Introduction

1. Could you tell me about yourself?
    a. For how long have you been with the company for long?
    b. What is your background?

2. When did you start your business? Could you give me an overview of your business?
    a. How many employees do you have?
    b. How many are fulltime and how many are temporary?
    c. How many customers do you have?

Products

3. a) Can you give me an overview of your products?

Product category	Quantity of units produced	Quantity of units sold	Average selling price per unit (USh.)	When do you sell this product? (seasonal or year-round)

b) Is your production constant (Seasonality in production)? Yes [ ] No [ ]

Production

c) If not, how and why does your production vary throughout the year?

J F M A M J J A S O N D

d) How has your production developed over the last 5 years? (Compared to 5 years ago, how much are you producing more now?)

e) How has the selling price developed over the last 5 years?

f) Have you seen much innovation over the last 5 years?

g) Are currently producing at maximum capacity? Yes [ ] No [ ]

h) If no, at what level are you currently producing?

i) How often do you give price discounts? (And between what range?)

4. a) What is the feed composed of?

Ingredient	% dry weight	Origin of ingredient	Purchasing price (USh.)
Protein			

b) In what form do you buy the protein? (For example, pellets or powder)

c) What equipment do you require to process your input material? Is the equipment dependent on the type of input material you process?

d) Where do you source your equipment? (Supplier, country, costs)

e) Are your input materials available year-round? Yes [ ] No [ ]

f) If no, when are they available?

g) Are all of your input materials available when necessary? (Are they congruent with customer demand? For example, are you able to produce as much as you need in periods when customer demand is high?) Yes [ ] No [ ]

h) If no, which ones not and why?

i) By what mode of transport is the input material transported to you? (For example, truck, bus, boat, etc.)

j) Are you satisfied with your current resources and suppliers? Give the reason why (not).

k) What are the key criteria when selecting a supplier for input material? Do you have any risk management in place to avoid too much dependency on one supplier?

5. a) Can you give me an overview of your supply chain? (For example, where do you source your input materials from, who manages the logistics from your suppliers to your production site and from your production site to the customer? Do you work with distributors or do you have your own sales force to market the products directly to the end customer?)

Input material	Origin (supplier, country)	Quantity per annum (kg)

b) Could you provide me with an overview of your top 10 clients? (How big is your client base and how has it evolved over time? How many customers are regulars?)

Name	Type of customer	City, country
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

d) What is your average order (both in monetary and volume terms)? Do order vary in size a lot? (For example, does everyone buy the same order size or are there large differences?)

e) By what mode of transport is the product transported?

f) Are you able to reach all your potential customers? If not, what are the challenges you are facing? Do you think there are industries where your products could become relevant in the future? (For example, do you think it is difficult to reach certain customer segments, or do you like the way it is going now? Are you experiencing any difficulties at the moment).

g) Can you give me an overview of the demand for the protein throughout the year (demand variability)?

Demand

J F M A M J J A S O N D

<u>Industry sector</u>

6. a) Can you give me an overview of the industry?

b) What does the competitive landscape looks like? Who are they?

c) How has the sector performed over the last 5 years? (Decline/growth of customer amounts, competition, price fluctuations)

d) What are the key drivers for growth in your industry sector? (For example, (urban) population growth, income growth, etc.)

7. What opportunities do you see over the next 3-5 years?

8. What are the challenges you see in the next 3-5 years?

General questions

9. a) Do you know what faecal sludge is? Yes [ ] No [ ]

   b) Can you explain what you think it is?

   c) *[Explain the application of BSF on faecal sludge]* Would you use protein in you product that is made from larvae that bred on faecal sludge? Wat is your reason for this answer?

   d) *[Explain the application of effluent of faecal sludge treatment for fish breeding]* Would you use fishmeal in you product that is made from fish that are bred with use of faecal sludge? Wat is your reason for this answer?

10. Do you have suggestions who else I should talk to about this industry?

Thank you for you time!

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