Shit Matters!

Assessing sociocultural barriers and opportunities for upscaling adoption of human faeces derived fertilizers in central Uganda

Therese Hågerup and Elina Persson

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LUCSUS
Lund University Centre for Sustainability Studies

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Submitted May 15, 2018

Supervisor: Sara Gabrielsson, LUCSUS, Lund University

Abstract:

Nutrient recovered faecal sludge is a novel alternative fertilizer product, and is proposed to be promoted in places where improvement in sanitation management is needed, for example in Uganda's capital Kampala. However, Uganda and most of Africa is perceived as a faecofobic area, i.e. where faeces are stigmatized and guarded by taboos, and there is lacking information regarding Ugandan farmers' perception of this type of fertilizer. To understand if promotion of nutrient recovered faecal sludge is viable in this particular sociocultural context, we carried through an exploratory case study. By conducting interviews with farmers currently using this product; focus group discussions with farmers not using it; and facilitating a forecasting scenario workshop we have attempted to assess potential sociocultural barriers towards and opportunities for the adoption of nutrient recovered faecal sludge. Even though human faeces are conceptualized as dirty and the social norm is to not associate oneself with human faeces in central Uganda, practices such as planting banana stands in pit latrine and eating its fruit are common. Attitudes towards the use of nutrient recovered faecal sludge are somewhat varied, but in general farmers are interested in learning more and positive towards the innovation if it can meet their demands of a fertilizer. However, to scale up the use of nutrient recovered faecal sludge, any promotion program must sensibly navigate around the sociocultural barriers in place, in order to become a user-friendly product closing the nutrient loop and simultaneously promoting new ways of sanitation management.

Keywords: nutrient recovered faecal sludge, soil infertility, sociocultural norms, IBM-WASH, diffusion of innovations, Uganda

Word count: 13836

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Finally, we want to express our newfound love with Uganda. A country full with welcoming people, always greeting us with a "Hi Muzungu" wherever we went. It is truly the pearl of Africa.

Table of Contents

List of figures and tables

Figures

Tables

List of Abbreviations

FCS	Forecasting Scenarios
FGD	Focus Groups Discussions
FS	Faecal sludge
FSM	Faecal sludge management
HF	Human faeces (not human waste as it includes urine)
MDG	Millennium Development Goals
NR FS	Nutrient recovered faecal sludge
SDG	Sustainable Development Goals
SMS	Sanitation management systems
SSA	Sub-Saharan Africa
Users	Farmers using NR FS

1 Introduction

Land degradation is a pressing concern in Uganda, where loss of agricultural productivity is one of the main issues (Blaikie & Brookerfield, 1987). Since 80% of the population is depending on small scale agriculture for their survival, this increases food insecurity in the country (GoU, 2013a). Environmental degradation is thought to be the cause of 4-12% loss of GDP in Uganda (Slade and Weitz, 1991; NEMA, 2001), where soil erosion, nutrient loss and changes in crops (annual or perennial) are responsible for 85% of this issue (Olson & Berry, 2003). Chemical fertilizers are highly promoted by the government and international development organizations to overcome the decreasing soil fertility (Andersson, 2015). Despite these efforts, high prices decrease fertilizer accessibility to small-scale farmers, making Uganda one of the least fertilizer consuming nations on a global scale (World Bank, 2013).

Human excreta derived fertilizers have emerged as an alternative way of enriching the soil and enhancing crop yields. For example, by drying faecal sludge, i.e. human faeces (HF) extracted from pit latrines or septic tanks, nutrients can be recovered and treated into a pathogen free fertilizer[1]. While HF is not yet fully recognized as a resource but as waste, it has been proposed that the value creation of making it into a usable product can facilitate improved faecal sludge management (FSM). Furthermore, this provides an incentive to better the infrastructure for storing and collecting faecal sludge (FS), and can thus improve whole sanitation management systems (SMS) - bringing along co-benefits for human and environmental health (Strande, Ronteltap & Brdjanovic, 2014).

The research project “Sanitation Planning for Alternative Nutrient Recovery Systems” (SPANS) is aspiring to increase knowledge on technical and social readiness of alternative nutrient recycling in Kampala, focusing on recovering nutrients in faecal sludge. However, introduction of new soil management practices does in general come with adoption challenges, due to lack of integrating farmers’ acceptance and priorities (Hudson, 1992; Bunch, 1999). Specifically, fertilizers originating from HF comes with challenges related to health issues of pathogens, taboos and cultural norms regarding human excreta, as well as technical barriers (Andersson, 2015). Thereby, to successfully introduce nutrient recovered faecal sludge (NR FS) as a fertilizer, the social readiness amongst farmers is equally important to assess as the technological aspects. On this point Niwagaba (2009)

[1] There are different ways to treat HF into a fertilizer (and into other end products like charcoal for energy, for that matter): vermicomposting, composting, thermal drying, solar drying etc. (see section 2.2 Faecal Sludge).

concludes that "[..] studies are needed to determine the social and cultural acceptability, as well as impediments regarding the use and adoption of the different treatment methods for the faeces" (p.79). Furthermore, Strande et al. (2014) describes the different steps in creating a successful faecal sludge management (FSM), adding that "human dimension of this assessment should not be overlooked" (p. 297) through different participatory methods. Lüthi Morel, Tilley, & Ulrich (2011) writes that it's important to match the proposed sanitation system to the users' preferences, and that the most common reason for past project failures is not making sure that the implemented solution is socio-culturally appropriate. The importance of a participatory approach embedded in the initial project design has also been emphasized by Strande et al. (2014), and Lüthi et al. (2011).

NR FS is in this study categorized as a novel innovation, as it has only been adopted by a few farmers in Uganda. The diffusion of innovations (DOI) theory, was developed by Rogers in the 1960's, and conceptualizes the different stages in innovation-decision processes. We use DOI to explain different motivational and inhibiting factors to the adoption of NR FS, which can be linked to sociodemographic attributes and generalized for upscaling (Rogers, 1995). This theoretical framework also accounts for sociocultural variables affecting the motivational and inhibiting factors for innovations.

Another framework which has been developed specifically for assessing the adoption of new water, sanitation and hygiene practices in an integrated manner is the Integrated Behavioral Model for Water Sanitation Hygiene (IBM-WASH) (Dreibelbis et al., 2013). Being an integrated model it ascribes weight to the technology itself (new practice), psychosocial factors (individual-level behavior), and contextual determinants (physical and natural environment), during interventions of WASH behaviors (Dreibelbis et al., 2013). It was developed specifically for WASH practices but is relevant for the assessment of adopting NR FS as fertilizer; as they are both navigating through sensitive topics inflicted by these technological, psychosocial and contextual dimensions.

Thereby, the focus of this thesis is to assess the socio-cultural acceptance amongst farmers in the outskirts of Kampala, towards using fertilizers derived from HF on crops for human consumption. Our thesis aspires to meet the need of integrating knowledge on societal readiness of these novel fertilizer options to larger project aims, i.e. promoting NR FS as fertilizer. It can contribute to the SPANS project's and, perhaps more importantly, it aims to give stakeholders in Kampala's sanitation management insights to the acceptance level of alternative nutrient recovery and could play an important role in the future planning of upscaling (personal communication, Jennifer McConville, September, 2017).

1.1 Research objective

The purpose of this study is to, in a Central Ugandan context, and through engaging with farmers, identify and understand the sociocultural barriers towards the adoption of NR FS from Kampala, by applying IBM-WASH framework, and explore the opportunities for upscaling the use of this fertilizer, by applying DOI.

RQ1: What are the sociocultural barriers for adopting NR FS?

RQ2: How can farmers be motivated to use NR FS?

RQ3: How can upscaling of NR FS adoption be facilitated?

1.2 Scope & Limitations

Integrating a successful FSM entails incorporations of all levels in society (micro, meso and macro); municipal authorities, regional & national authorities, private/public businesses, organizations active in sanitation, potential end-users & households (Strande et al., 2014). There is both need for an in-depth understanding in each as well as interdisciplinary corporation across these borders. Thus, it requires an iterative and participatory approach to match the socio-cultural context (Strande et al., 2014; Lüthi et al., 2011). Understanding that FSM is a transdisciplinary field with engagement from many stakeholders; NR FS is not something that can be implemented or studied overnight. Such research thus takes a lot of time. Therefore this thesis is explicitly focusing mainly on the micro level.

Our study is in collaboration with SPANS; assessing the technological readiness of NR FS in Uganda. However, a product is nothing without its user, hence our focus concerns the sociocultural readiness, i.e. attitudes and motivations, of using NR FS in central Uganda. Attitudes and perceptions towards HF depends on their sociocultural contexts, where some would never use excreta for any purposes, and others have a long history of using it in agriculture (Jewitt, 2011). Our scope first and foremost is limited to farmers in the vicinity of Kampala who hold the potential access to this product. Focusing solely on the end-users, we still aspired to investigate what enabling environment there is for subsistence farmers to use NR FS.

Social readiness and barriers can also entail the attitudes and perceptions held by consumers of food produced with human excreta derived fertilizer. Even though conducting consumer assessment is outside the scope of our thesis, we still gained some insights to how adopting NR FS will be received by consumers, given that the majority of Uganda's population are subsistence farmers (GoU, 2013).

1.3 Relevance to Sustainability Science

Sustainability science is a field concerned with how sustainability is affected by the interaction between natural and social systems (Kates, 2011), and to "bridge the natural and social sciences for seeking creative solutions to these complex challenges" (Jerneck et al., 2011, p. 69) Furthermore, it is a field concerned with understanding drivers and inhibitors of change, in order to contribute to sustainability transitions of socio-ecological systems (Kates, 2011). Our thesis aspires to contribute to sustainability science through the exploration of drivers and inhibitors of adopting NR FS. Sustainability science is also a problem solving field (Jerneck et al., 2011), and our thesis aim is in partial to propose key insights of how adoption of NR FS can be up scaled, which would induce improvement of FSM and SMS.

Furthermore, the MDGs did not meet their targets for 2015 in halving the amount of people without access to basic sanitation, which has been described as the most lagging of the MDGs (Eliasson, 2014). Access to sanitation has been the primary focus in the past, hence the broader scope of wastewater and excreta management have been overlooked (Anderson et al., 2016). However, Agenda 2030 and the SDGs provides a wider scope for how the problems of managing both wastewater and excreta should be addressed. Stated in Goal 6; sanitation and water are essential to human health, to environmental sustainability and economic prosperity. Improved sanitation would not only have health benefits; one in five children dies in diarrheal diseases, which is more than malaria, aids and measles combined (UNICEF & WHO, 2009), but also have economic benefits, since studies show that the from every 1 USD spent on improved sanitation services there is an economic return of 5-46 USD depending on the service (Hutton, Haller, & Bartram 2007). Although the MDGs and SDGs have helped to reduce open defecation, several attempts to improve sanitation management has ended in "sanitation crises" where appropriate FSM through the entire service chain is lacking. This results in detrimental impacts on both human and environmental health, since the untreated faecal sludge can end up in the surrounding environment, contaminating it and spreading disease which threatens public health (Strande et al., 2014). Thereby, Anderson et al. (2016) proposes that FSM should be the focus of sustainable sanitation and wastewater management systems, and it should be done in a way that "protects human health and ecosystems, promotes social equity and well-being, is financially sustainable and is supported by strong, appropriate institutions" (Anderson et al., 2016, p. 10). They also estimate that improvements in sanitation and wastewater services with the focus on nutrient recovery can influence 14 out of the 17 SDGs positively (Anderson et al., 2016).

Conceptualizing shit as a resource, which can be treated into usable and valuable end products, rather than viewing it as waste that should be disposed of, could function as an incentive for improving FSM and the total sanitation management chain (as better storage and collection is beneficial for FSM) (Diener et al., 2014). As such, with the other benefits mentioned above, this notion could contribute to sustainable development[2].

[2] Defined by the UN as: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987) http://www.un.org/en/ga/president/65/issues/sustdev.shtml.

2. Setting the stage; Situating shit in Uganda, Kampala

2.1 Sanitation in Uganda

Around 800 million people in urban areas worldwide lack access to adequate sanitation, and with the increasing urbanization most African cities will double their population by 2020, posing an increasing pressure on the sanitation management systems (Kwiringira, Atekyereza, Niwagaba, Günther, 2014). Around 2.7 billion people worldwide uses onsite sanitation today, which is expected to grow to 5 billion by 2030 (Strande et al. 2014). In general, onsite sanitation is most common in rural areas, especially in Sub-Sahara (65-100%), however, there is seldom proper sanitation management in place to deal with the FS produced. Kampala, has more than 1.5 million inhabitants in an area of 178 km2. However, the total population is assessed to 2.5 million people when including the daily commuters, which adds to the faeces produced (KSP, 2008; Kulabako, Nalubega, Wozei, & Thunvik 2010). In Kampala, most residents have onsite sanitation; septic tanks or pit latrines[3] (92.5%), whereof pit latrine is the most common faecal sludge containment technology (Schoebitz, Niwagaba & Strande, 2016), while only a small portion is connected to the sewage system (7.5%).

The implementation of water, sanitation and hygiene (WASH) is governed by national policies, laws and regulations. The National Water and Sewerage Corporation Act (NWSC) is responsible for providing water and sewage services in 165 cities in Uganda, including Kampala, and is also responsible for the operation of Lubigi Wastewater and faecal sludge treatment plant in the city (Schoebitz et al., 2016). They keep the costs down for discharging faecal sludge, as an incentive for collection. The Kampala Capital City Authority (KCCA) is also partially responsible for the sanitation systems in Kampala, which involves the non-sewage linked households and communities. The emptying of faeces in private household and communities is mainly done by private businesses (Schoebitz et al., 2016). In some areas it is not possible to operate the trucks because of narrow streets, and gulpers[4] have to be used, often these gulpers are transported to Lubigi by pick-up trucks, but since this is a costly procedure it's often dumped into water sources in the community or by

[3] The different types are: septic tanks: (one or two chambers), septic tank to soak pit, fully lined tank (sealed) to soak pit. Pit latrines: Lined tank with impermeable walls and open bottom, no outlet or overflow, lined pit with semi-permeable walls and open bottom, no outlet or overflow or unlined pit, no outlet or overflow.

[4] A manually-operated pump used for emptying latrine pits when they get full. The Gulper is basically a hand pump that fits on top of a permanent pipe rising out of a latrine pit (https://fems-microbiology.org/wp-content/uploads/2017/11/thegulpertechnologyposter-3.pdf)

digging a hole (Tsinda, Abbott, & Chenoweth, 2015), meaning that the risk for groundwater pollution is significant, especially for the many low-income communities located in valleys (Schoebitz et al., 2016). In the final report of the SFD Promotion Initiative Kampala Uganda, they estimate that 48% of the excreta in Kampala is managed safely. Adding to that, less than 1% of the population in Kampala practice open defecation (Günther Horst, Lüthi, & Mosler, 2011), but all unsanitary facilities (pit-latrines, septic tanks or toilets) "deliver the same negative effects as open defecation" (Kwiringira, et al., 2014, p. 8).

2.2 Faecal sludge management in Kampala

Faecal sludge, (FS) 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., p. I, 2014) which comes from onsite sanitation such as pit latrines, septic tanks or dry toilets. The management chain of faecal sludge (FSM) includes storage, collection transport, treatment and safe use or disposal. Since the FS contains a lot of fluids it has to be dewatered in drying beds or through mechanical dewatering before it goes through further stabilization and treatment; such as co-composting, adding lime or ammonia, thermal or solar drying, vermicomposting or planted drying beds, to eliminate hazardous pathogens (Strande et al., 2014). It can then be used for proteins, fodder and plants, building material, biofuels or in our case: for conditioning the soil, which is a rather novel idea (Strande et al., 2014). At Lubigi, the faecal sludge is emptied into an influent, where the solid waste is manually extracted before it is transferred into a settling/thickening tank and thereafter put in an unplanted drying bed for 8 weeks (depending on the climate) before it's sold as soil conditioner (Own observation at Lubigi, February 5, 2018).

The FS itself contains solids concentration such as nutrients, pathogens and heavy metals. Some of the essential nutrients originating from food consumption is excreted in the faeces (Berger, 1960). The organic matter of FS can "increase the soil water holding capacity, build structure, reduce erosion and provide a source of slow released nutrients" (Strande et al., 2014, p. 206). In theory, the FS produced by a human in one year contains enough nutrients to grow the amount of food they require in one year (Strande et al., 2014). Hereafter, we are using fertilizer as a synonym for soil conditioner, as the major difference between the two is the concentration in nutrients (conventional fertilizers generally having nutrients readily available for plant uptake), and that soil conditioners generally brings more benefits to the soil other than nutrients, e.g. increase organic matter and the capacity to retain water (Strande et al., 2014). It is not unorthodox of us to make this word

replacement, as the soil conditioner derived from faecal sludge is comparable to other organic fertilizers, such as animal manure or compost (Diener et al., 2014).

Faecal sludge and wastewater that has been dewatered and further dried into a fertilizer is currently available at Lubigi and Bugolobi (Schoebitz et al., 2016), however Bugolobi is currently under construction (M. Orwiny, personal communication, February 5, 2018; Niwagaba, 2018) meaning that Lubigi is currently the only wastewater treatment plant that handles faecal sludge in Kampala.

2.3 Uganda, the country with fertile grounds?

Agriculture employs nearly 80% of the Ugandan population and contributes to 25% of their GDP as well as 40% of their exports (MAAIF, 2016). Even though he Ugandan soils are renowned for their high fertility, the loss of soil nutrients in Uganda is the highest in Africa; approximately 80 kg of nutrients per hectare and year, due to topsoil erosion and overuse of farmland (Sanchez et al., 1997; in MAAIF, 2016).

Vision 2040, amended by the government of Uganda and their Second Development Plan (NDP II in 2015), anticipate Uganda to become a middle-income country by 2020 and identifies agriculture as one of the priority sectors of investment, with a vision of transforming the sector from subsistence to commercial agriculture (MAAIF, 2016). In order to achieve this, it would require increasing the production and productivity with the use of enhancing technologies, such as fertilizers (MAAIF, 2016). This is a challenge, as Uganda is one of the world's lowest in fertilizer use since the application of fertilizers only replaces 1-1,5 kg of the 80 kg which is lost (in comparison to SSA where the average is 8 kg per hectare) (Stoorvogel & Smaling, 1990; Namazzi, 2008). This means that soil fertility loss is one of the restraints for agricultural growth. The low fertilizer use is due to challenges in the enabling environment (high prices, marketing, trade and tariffs), supply (small lots from far-off places & transport cost) and demand (lack of capacity and knowledge on replenishment). These factors, together with the myth of Uganda's soil being fertile, which is further presented in their national anthem; "Oh Uganda! The land that Feeds us, By sun and fertile soil grown" is inhibiting fertilizers use in the country (MAAIF, 2016).

2.4 Shit! A cultural dilemma

As such, there are a multitude of rationales for promoting NR FS in Uganda. However, as previously mentioned, one has to consider the sociocultural implications for this promotion. Mary Douglas' work in *Purity and Danger* (1966) has served as a theoretical framework for scholars engaged in mapping and understanding shit as a taboo (Jewitt, 2011). Douglas (1966) defines dirt as a matter

considered out of place, and social norms are created by what in a culture is perceived as pollution and taboo. Culture differences of what is accepted behavior varies with the attitude towards shit (Douglas, 1966). In addition, people generally prefer to behave accordingly to their religious, social and magical ideas, where religion and culture often triumph over scientific findings (Tanner, 1995 in Drangert & Nawab, 2011). Building on this, Jewitt (2011) states that "cultural attitudes towards shit is not static over place and time" (p. 5), on the individual's level, perception of disgust can change during a person's lifetime. Loudon (1977) argues that identification and categorization of what is disgusting are shaped socially.

Some cultures are faeceophilic (high acceptance of handling shit), whereas others are faecophobic (low acceptance of handling shit). An example of high acceptance towards handling shit is parts of Vietnam where fertilizing rice fields with fresh HF is a common practice (Hart-Davis, 1997). An example of extremely low acceptance towards handling shit is the Akan people in Ghana, where shit is a taboo in its strictest sense, e.g. it cannot be talked about, resulting in highly inadequate sanitation management system in terms of pollution and pathogen release (Van der Geest, 1998). Other examples of faecophobic cultures are Kenya, India, and South Africa where the task of excreta disposal has fallen on particular ethnic groups which have become stigmatized by the general community due to this (Drangert, 2004).

Despite this, there are historical examples of shit being used as fertilizer which was preceded (and succeeded) by changing attitudes from inhibiting to facilitating. For example, a British town during the mid-19th century tackled the problem of increasing sewage from rapid population growth by transferring human excreta from the town to the rural areas, where it was used as fertilizer (Jewitt, 2011). Given that cultural and individual attitudes are non-static, there is hope for the dismantling and changed behavior regarding the handling of shit.

3 Methodology

3.1 Research Design

Working under the SPANS project's goal to assess the technical and social readiness to alternative nutrient-recovery systems, the objective of this field study is to understand socio-cultural barriers and opportunities among farmers towards using nutrient recovered faecal sludge in Kampala. Even though SPANS has its specific objective, we were free to construct our own study focus and approach.

There is lacking information regarding peoples' and farmers' perception about fertilizer derived from faecal sludge in the context of Uganda, which calls for an exploratory approach (Streb, 2010). Thus, this research was designed as an exploratory case study for generating knowledge, rather than testing theory (Bryman, 2012). What usually characterizes an exploratory case study design is "the absence of preliminary propositions and hypotheses" (Streb, 2010, p.3). It is also common to alter and adapt the research protocol, accordingly to the case as it unfolds (Streb, 2010). With a feminist constructionist ontology (i.e. the 'real' is internally constructed), we explore how the perception of NR FS is socially constructed (Bryman, 2012). Our epistemological orientation is of an interpretivist stance in regards to understanding human behavior e.g. interpreting the constructions of the actors studied (Schwandt, 1994), in opposition to causally explaining it (positivist stance). By adding a feminist approach to constructivist ontology, which include "power and gender differences as integral elements in the process of construction" (Locher & Prügl, 2001, p. 111), we explored this issue through separating women and men in different groups. Thus, we added two comparative components to the study, one; by exploring conventional and organic farmers' acceptance towards NR FS, and two; due to the gender differentiated rights and responsibilities that exists in their everyday life (Esuruku, 2010) the differences in opinion and adaptability amongst women versus men. Keeping in mind that the knowledge produced is in relation to the social context (i.e. strong objectivity) (Harding, 1991).

As such, this research design led us to use various qualitative methods usually applied in social science for data collection, which generally has a low structure and standardization but high flexibility (Mikkelsen, 2005). We adopted data triangulation, i.e. using more than one data source, to validate and complement our data as one single method could entail weaknesses and blind spots (Flick, 2009). Triangulation was further useful as the results from one method helped in the

development of our subsequent data collection (Greene, Caracelli, & Graham, 1989; Bryman, 2012). Thereby, the process has been dynamic, iterative, and based on inductive reasoning; going back and forth between data and theory (Bryman, 2012), as each step generated new knowledge for the continued development of the data collection.

3.2 Methods and data collection strategy

Initially, to enhance our understanding of the field and to explore which theories and methods has been applied in previous research (Bryman, 2012), a literature review of the topic was performed, followed by an empirical data collection - where knowledge was gained through experience and interaction with the participants around Kampala during two months. The data was collected through four steps of qualitative methods (see figure 1); semi-structured interviews with key-informants knowledgeable in the field and the specific context (see step 1), semi-structured interviews with farmers buying and using NR FS to explore the influencing factors behind this decision (see step 2), Focus Groups Discussions (FGD) with two units of farmers (inorganic and organic) to explore and the describe the socio-cultural underpinnings shaping the acceptance for the use of NR FS as fertilizers (see step 3) and finally a participatory exercise; forecasting scenario, to better understand and discuss pathways forward for upscaling NR FS (see step 4). The four steps was a sequential procedure, building on each other, meaning that the information generated in step 1 fed into step 2 etc., which is common when mixing methods (Creswell, 2009). However, the findings from step 2-4 feeds into answering all three RQs, since the different methods gave accounts on more than just one specific RQ.

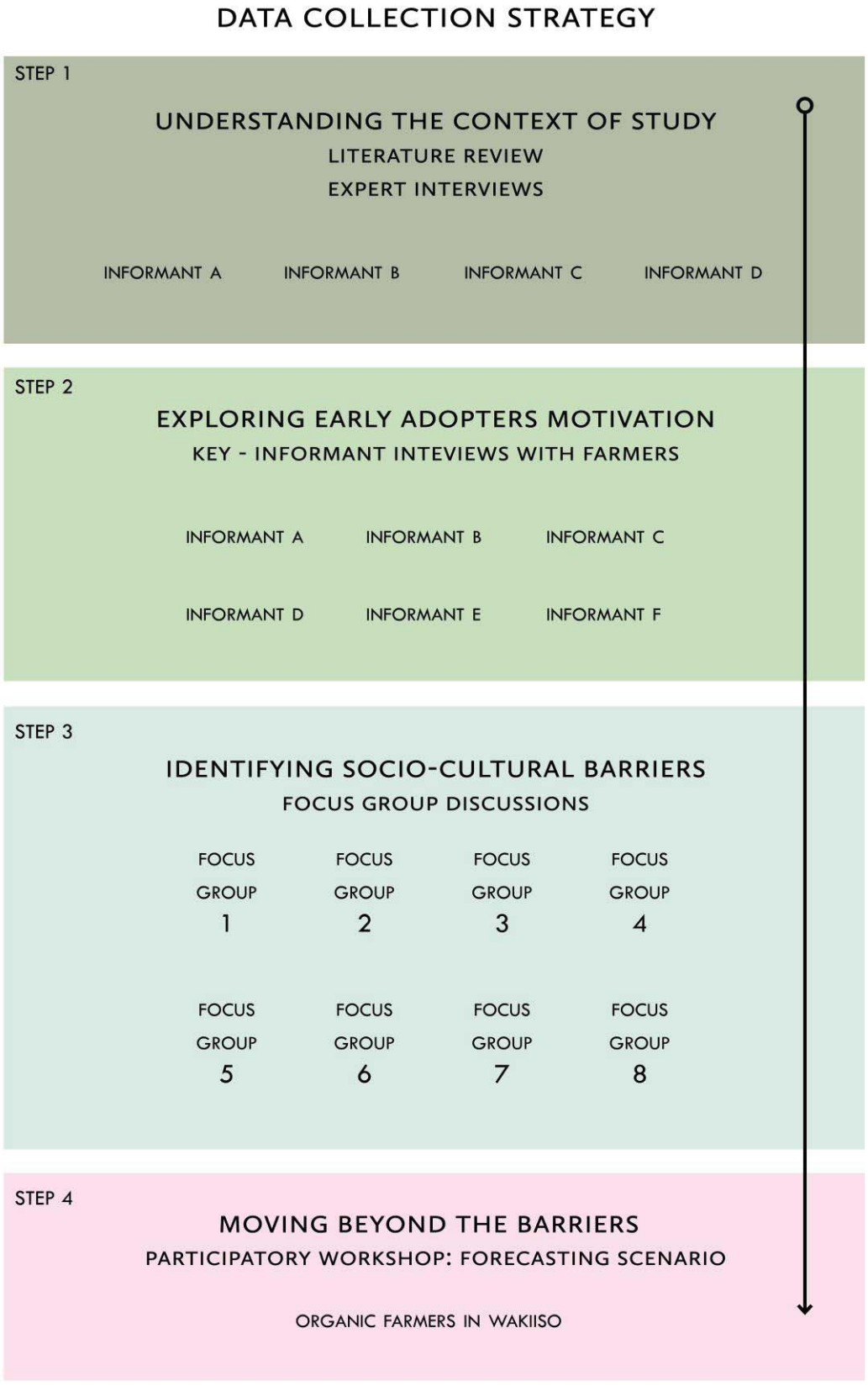

Figure 1. Data collection strategy, own illustration made in InDesign.

3.2.1 Step 1 - Semi-structured interviews with key informants

Our first step (see figure 2) aspired to provide insights regarding the feasibility of offering NR FS as fertilizer, in terms of social and cultural barriers and opportunities. In order for the interviewees viewpoints to be more openly expressed (Flick, 2009), four semi-structured interviews were designed and conducted. The interviewees were selected purposively, since they all had a connection to the study: Charles Niwagaba, Professor at Makerere University and involved in SPANS; Onesmus Semalulu at National Agricultural Research Organization which has done research on using urine as fertilizer; Jane Nalunga, head of programs at National Organic Agricultural Movement of Uganda, which already was connected to SPANS and introduced us to the organic farmers in Wakiiso; and Martin Orwiny, head engineer at Lubigi wastewater treatment plant where the NR FS is treated. Drawing on Slocum's (2003) account on using 'expert panels' in projects as a participatory tool for the production of "visions and/or recommendations for future possibilities and needs for the topic under analysis" (p.87), the purpose of hearing experts, i.e. key-informants, in this field study was to let their statements guide us on how to create a fundamental understanding of the social and cultural context we were about to engage in, and proceed with the next steps.

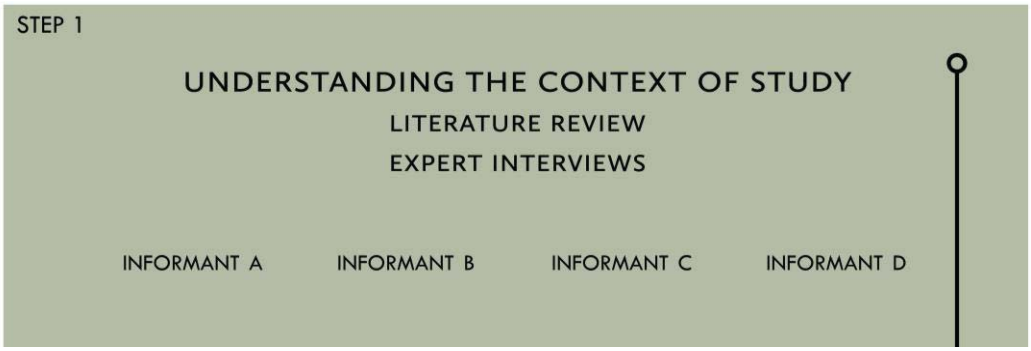

Figure 2. Data collection step one, own illustration.

3.2.2 Step 2 - Semi-structured interviews with users of NR FS

To gain insights from current users of NR FS, we conducted six semi-structured interviews (see figure 4); four farmers (see figure 3) and a headmaster at a school. By engaging with these "early adopters" (see theory section 4.2), we aspired to provide key insights regarding motivations for adopting this product. Semi-structured interviews as a tool has the advantage of being more in-depth than structured interviews (Bryman, 2012), and allowed the users to emphasize, elaborate on and introduce topics they found to be relevant (Krueger, Donner & Maack, 2001), which we see fits with the exploratory nature of our study. The interview protocol of 21 questions (see appendix A) was designed to explore the users' perception on reuse of HF, whether and how this had changed since

they first were introduced to the idea, and (if so) what had influenced this change and motivated the decision to start using NR FS.

Figure 3. Interviewing farmers using nutrient recovered faecal sludge.

Mr. Orwiny at Lubigi provided us with a list of customers buying their NR FS. The selection of whom to contact for interviews was based on their location and their use, i.e. selective sampling, to keep the sampling close to Kampala and to get a broad understanding of the factors influencing the decision to use NR FS in relation to purpose of use. The interviews were held at five different locations in the rural surroundings of Kampala, assuming that the socio-cultural context would be similar. One farmer was interviewed over the phone. The sixth interview was conducted with the headmaster of a school which had used NR FS for tree planting on their compound. After the sixth interview we reached theoretical saturation, i.e. no new information gained (Krueger et al., 2001).

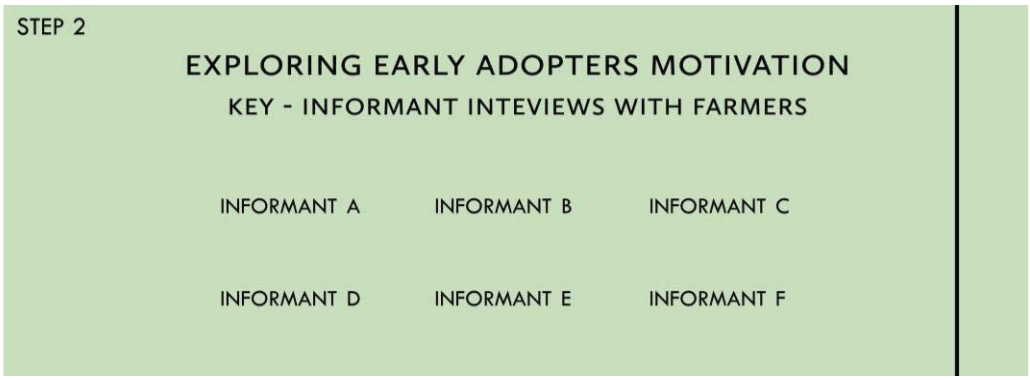

Figure 4. Data collection step 2, own illustration.

3.2.3 Step 3 - Focus Group Discussions with organic and inorganic farmers

Our purpose of conducting FGDs was to explore the attitudes and its origins of using fertilizers derived from HF in this context. In general, FGDs is an appropriate tool for understanding knowledge and experiences (Kitzinger, 1995; Wellings, Branigan & Mitchell, 2000) as well as people's feelings and thought about an issue (Krueger et al., 2001). Slocum (2003) also argues that FGDs is an appropriate tool for understanding societal norms, exploring and creating innovative ideas and when the researcher is interested in the participants' reasoning behind their expressed perceptions. The structure and strategy for the FGDs were influenced by Slocum's guidelines (2003), in order to enhance coherence throughout the process. Thirteen questions (see appendix B) were developed based on the results from the user and expert interviews. The majority of the questions were developed to gather information directly linked to our study objective, from general to specific-oriented questions (Krueger et al., 2001), to explore the participants previous experience with HF for agricultural purposes, their perception and attitude towards using HF as a fertilizer and attempting to assess the origins of these feelings and thoughts.

Figure 5. Picture of Focus group session in Wakiiso, Kampala with males practicing organic farming.

Selection of location and contact persons was done together with above mentioned local key informants and based on purposive sampling (Bryman, 2012), and the group participants were selected based on snowball sampling (mobilized by the contact person in location) (Bryman, 2012). The target participants for the focus group discussions were smallholder farmers, as they constitutes the vast majority of the Ugandan population (GoU, 2013). In total, eight focus groups with 60 participants (25 men and 35 women) were held in two different locations: four in Wakiiso (see figure 5) and four in Kayunga. The number of participants in all of the focus groups varied between a minimum of four participants and a maximum ten. Each FGD took between one to two hours (see figure 6).

A factor separating the two units were organic (Wakiiso) and conventional (Kayunga) farming practices, as we wanted to assess if there were any difference in attitudes among organic and non-organic farmers since earlier studies show that farmers which practice long-term agriculture are more likely to adopt systematic thinking (Menozzi, Fioravanzi & Donati, 2015). Since the main discussion topic, using HF as fertilizer, is sensitive, it is advisable to have gender separated groups

(Mikkelsen, 2005). Thus, to reduce tensions and enable a safe environment, assuming it would render more detailed accounts where the participants could speak as freely as possible about the topic, we chose to split up the groups in all female and all male. In Wakiiso, three all-female groups were held and one all male[5]. In Kayunga it was two of each gender. Furthermore, when conducting female FGDs we were accompanied by two female translators, and for the male FGDs two male translators assisted us, as they were held in Luganda.

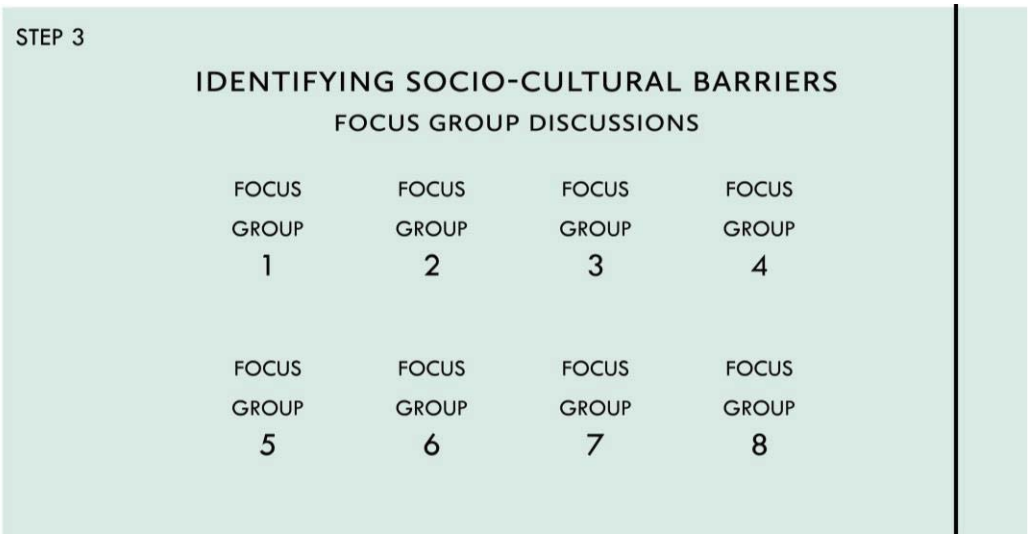

Figure 6. Data collection step 3, own illustration.

3.2.4 Step 4 - Participatory exercise: Forecasting scenario

In order to visualize how to overcome the barriers indicated in the FGDs (step 3), we used a scenario tool to explore the possibilities to move beyond these. Scenarios are often useful when there is a high probability for change (Slocum, 2003), which was implied in the interviews with farmers who uses FS as fertilizer (step 2) and the FGD (step 3) (see figure 1). We wanted to imagine how to get to a future, where this is considered common practice through a forecasting scenario (FCS) (see figure 7). In other words, the participants imagined themselves in the future, using NR FS, and explored through a set of questions how they got there, meaning there were some elements of "role play" in place; opening up their imagination and analytic thinking (Slocum, 2003). Some components of the

[5] We piloted one focus group in Wakiiso with an all-male group. The data from this session cannot, unfortunately, be used for the general analysis due to the structure of the facilitation. The facilitator took over the discussion and did not act neutral about the topic. However, it was a good experience which we used to revise the facilitation structure to go back and forth between ourselves and the facilitator for the subsequent focus group discussions.

participatory exercise "World Cafe"[6] was also incorporated in the FCS, meaning that we divided the participants into smaller groups, with the intention to cross-fertilize ideas for sharing in the larger group at the end of the exercise which is an important aspect of a "World Café" (Slocum, 2003). When nesting one method within another method in this way, it can provide insights for different levels of analysis (Tashakkori & Teddlie, 2010). Furthermore, FCSs, allow people to generate other ways of relating to the concept, as well as "becoming agents of change, rather than being driven by change - and to create trends, rather than being the victim of trends" (Slocum, 2003, p. 129). This method is also a technique for enabling participants to understand the possibility to build alternative futures - which could generate future action (Slocum, 2003).

The FCS was held in Wakiiso with 18 participants who had been part of our FGDs two weeks earlier. The participants were divided into three groups, mixed males and females[7], with one facilitator each, who were fluent in Luganda. The FCS started with an introduction together with a drawing over a closed food-loop system (see appendix C) to show the potential and the rationale of recycling nutrients, followed by a set of questions; initially to explore what have been said in the earlier FGD to refresh their memory, before going into the future scenario for them to imagine themselves in and to set the stage (see appendix C). We also added some topics, to see how the outcomes of the scenario could influence other factors like sustainability, health and soil degradation. These variables were identified through literature and dialogue with key informants, as factors influenced by a closed FSM system. The exercise lasted around 1.5 hours and the facilitators took notes in English which was used as material for analysis.

Figure 7. Data collection step 4, own illustration.

[6] World café is a participatory tool where the purpose is to rotate the participants in the group to cross-fertilize ideas and thoughts (Slocum, 2003).

[7] We first propose to hold gender separated groups, but the women instantly protested and said that they did not want to be treated differently from men :)

3.3 Data Analysis

The data collected from step 1 was analyzed to identify trends in the key information accounts on the case specifics relating to current practice, the status-quo of NR FS, and the possible sociocultural aspects which have implications for adopting and talking about HF derived fertilizer. This was the base we then used to develop the subsequent data collection. For the data collected in step 2-4 we did open-ended qualitative coding of the transcription in NVivo Plus 11 (see appendix E), using either the theoretical framework DOI (see section 4.2) or IBM-WASH (see section 4.1) in order to have structured themes to analyze our data to, and to explain our findings. We also used descriptive analysis for the attributes of our study units, such as age, gender, current practices etc.

To assess sociocultural barriers and identifying variables for adoption of NR FS from user interviews and the FCS, we used the themes from DOI: prior conditions, knowledge, persuasion, decision, implementation, and confirmation (Rogers, 1995) (see section 4.2). When analyzing the FGDs, we used the IBM-WASH model (Dreibelbis et al., 2013) to assess the sociocultural peculiarities which could pose as barriers towards an adoption of NR FS as a fertilizer. The model consists of three dimensions: contextual, psychosocial, and technological, and five different levels: habitual, individual, interpersonal/household, community, societal/structural (Dreibelbis et al., 2013) (see section 4.1). When coding in NVivo Plus 11, we created a hierarchy of these aspects by making the three dimensions into parent nodes, and the levels as child nodes to categorize the meta data (see appendix E).

3.4 Data Limitations

One user interview (step 2) was held in Luganda, and translated into English by the neighboring farmer, who also participated as an interviewee. This might limit the credibility of the results, as the translator was not trained or had previous experience of translating for research purposes. However, even though the farmer preferred to speak in Luganda, he still knew English well enough to understand us, and could have corrected the translator in case of misinterpretation. With this being stated, we still have to emphasize that the analysis of the FGDs and FCS reflects our interpretation of the transcribed records translated by a third party person, and our observation of the discussion. As such, the results might contain inaccuracies compounded by the translation and us being alien to this sociocultural context.

Further, when collecting data from group sessions there is a general tendency of individuals higher up in the social hierarchy, e.g. elders, leaders, and men; influencing who speaks the most and that

the others might conform to their statements. A possible disadvantage of using FGD is that the discussion might reflect 'group thinking', which could interfere with individual expressions (Slocum, 2003). It would be non-reflective to state that social hierarchy had no implications during our group activities, but we conducted our data collection with this concern in mind, attempting facilitate equal participation. Also, we want to emphasize the time-limitations of conducting research for a master's thesis in 8 weeks in a foreign country with no former cultural knowledge in conclusion, section 6, since we did not manage to establish enough connection with the farmers. When including participatory elements in the data collection it is crucial for the researcher to gain trust and credibility (Krueger et al., 2001), which was emphasized by the FGD participants as well. It is supposedly even more important in our case, since we've been handling a sensitive issue, with the risk of people not being honest or not telling the whole truth.

The choice and application of DOI and IBM-WASH as theoretical frameworks for the analysis of our data can pose another limitation. Currently, we cannot negate assumptions of us misinterpreting or distorting the concepts of our chosen frameworks, since both frameworks holds a myriad of elements from various theories.

Another limitation in this context arises from us being white women. The intersectionality of our identity makes the power balance in this situation complex, as sexist hierarchies in place might have reduced our status for being gendered as females, but present racial hierarchies might have increased it due to us being white. As such, our research may contain a power-related research bias because of inherent power imbalances due to our identity, but also coupled with the participant-researcher relationship (Cho, Crenshaw & McCall, 2013).

3.5 Ethical Considerations

In line with ethical guidelines for sound research, we asked all participants in our study for their consent to use their statements for this thesis and informed them about their rights and what they could expect from the study. Verbal consent was obtained from all participants involved in our study, except for the user interviews which signed an informed consent form (see appendix D). FGD participants were informed that we were asking about their opinions and feelings regarding fertilizers, and that they were free to leave because they were participating voluntarily. We emphasized that there were no promised advantages from participating, but that we aspired to give recommendations on how to improve fertilizers. All agreed to the session being recorded and taking pictures during the session. The participants were offered to take part of the results of the study

which some were interested in. The FGDs and FCS were initiated and ended with a prayer, in accordance with the cultural code.

Ethics can be characterized in terms of different stances taken on an issue (Bryman, 2014), and one of these stances is where ethical transgression is pervasive. Gant (1962) states that:

> If the researcher is completely honest with people about his/her activities, they will try to hide actions and attitudes they consider undesirable, and so will be dishonest. Consequently, the researcher must be dishonest to get honest data (p. 44).

We did this to some extent in out FGDs since we initiated the discussions by talking about fertilizers, then going in to animal and human manure, before talking about HF and NR FS. We did this because we didn't want them to believe that we had a finished product for them to choose whether or not to use, since this could be benefitting for their socio-economic situation and challenges. Also, the topic of "poop" can be quite repugnant based on key-informant and user statements, and initiating with this might have scared them off. Other than that, the ESRC's principles[8] for research ethics was followed. However, since it is a sensitive topic it is questionable if there were no harm to participants in the research, causing stress or inconvenience to them. But by easing in to the questions about human manure, we did our best to facilitate a safe environment for them. According to these principles, the researchers' partiality in the topic is important, but our lack of knowledge regarding the technological aspects of the innovations could work as our advantage, since we don't know enough of the product in order to promote it. However, as researchers we still have a normative stance in exploring the barriers and how these could be overcome.

In regards to doing ethically sound research, where one is not coming as the "expert" and striving for finding objective truths to present, we rather tried to embody Haraway's (1988 in Locher & Prugl, 2001, p. 121) approach of "providing visions, alternative accounts that makes a difference in the world". Hence, the execution of the study was in line with feminist "grounding" knowledge (see section 3.1), where knowledge claims is in relation to the social context they are produced in (Harding, 1991) and "reflecting interests and culture of the groups in question" (Habermas, 1979; 1874; 1978; 1988, in Locher & Prugl, 2001, p. 119). It also entails to critically reflect on where our knowledge as researchers is issued and the biases this entails, thus we tried to be aware of our own subjectivity throughout the different interactions with the participants.

[8] Economic and Social Research Council created a Framework for Research Ethics (FRE) including six principles: the research should be of high quality, transparent, confidential, involving participants voluntarily, avoiding harm to participants, and any partiality or interest must be explicit.

4. Theoretical Framework

In this section we will present the theoretical frameworks chosen to aid our data analysis. Firstly, the integrated behavioral model generated for sanitation practices (IBM-WASH) will be described, which we used for coding the data from the FGDs. Secondly, Rogers' (1995) 'Diffusion of Innovations' theory will follow, which was applied in the data analysis of the user interviews and the FCS.

4.1 Integrated behavioral model-WASH

The integrated behavioral model (IBM) was developed to guide research in the field of water, sanitation and hygiene (WASH) and was derived from the socio-ecological model (SEM), which is widely used for analyzing and addressing multiple levels of influence (Alemu et al, 2017). As such, the IBM-WASH model is the result of combining previous existing frameworks and theories for assessing the change and maintenance of WASH behavior (Dreibelbis et al., 2013). The Integrated Behavioral Model for Water, Sanitation and Hygiene (IBM-WASH) evaluates how the psychosocial, contextual and technological dimensions interact and operate at the societal/structural, community, interpersonal/household, individual and habitual levels (Dreibelbis et al, 2013). IBM-WASH was developed to understand all these aspects when assessing why people do or do not adopt certain WASH behaviors, and is specific to these issues as adoption of other behaviors and products is not centered around private matter as such.

We use this framework since it evolved to be applied in a development context, specifically to target behavior and attitudes regarding sensitive topics. The five different vertical levels (see table 1) in the IBM-WASH model is commonly seen in multi-level models. The societal/structural level refers to the institutional, organizational or cultural factors which influences behavior in the different three dimensions. The community level entails the physical and social environment of the individual and what formal and informal institutions shapes their individual experiences. The interpersonal/household level describes the interactions between the individual and their family, close friends and neighbors. The individual level represents sociodemographic factors and the last level, the habitual level, includes factors for maintaining behavioral change. The three dimensions which influences these levels are; the contextual, the psychosocial and the technological. The contextual dimension includes the background characteristics shaping an enabling or disabling environment. The psychosocial represents the factors that are susceptible for interventions and change, i.e. behavior, social or psychological determinants; which have been described in various behavioral models such as the 'Theory of Planned Behavior'. The technological dimension describes

the physical product or technology which can strongly influence behavioral outcomes and sustained use (Dreibelbis et al., 2013).

Table 1. IBM-WASH developed by Dreibelbis et al (2013) to explain WASH behavioral change.

Levels	**Contextual factors**	**Psychosocial factors**	**Technological factors**
Individual	wealth, age, education, gender, employment	self-efficiency, knowledge, disgust, perceived threats	perceived cost, value, convenience and other strengths and weaknesses of the product
Interpersonal / Household	roles and responsibilities, household structures, division of labor, available space	injunctive / descriptive norms, aspirations, shame, nurture	sharing of access to product, modelling / demonstration of use of product
Community	Access to markets and resources, built and physical environment	shared values, collective efficiency, social integration, stigma	location, access, availability, individual vs collective ownership/access & maintenance of the product.
Societal / Structural	policies and regulations, climate and geography	leadership/advocacy, cultural identity	manufacturing, financing and distribution of the product, current and past national policies and promotion of products.
Habitual	Favorable environment for habit formation, opportunity for and barriers to repetition of behavior	Existing agricultural practices / habits, outcome expectations	Ease/Effectiveness of routine use of product

4.2 Diffusion of innovations

Social norms are thus widely known for influencing WASH practices, but also has a central role in DOI (Dreibelbis, et al., 2013). Our study is not only related to WASH behavior since it also includes adoption of a new product or innovation, i.e. NR FS. To further analyze how some farmers have become adopters of this new innovation we apply Rogers (1995) theory on 'Diffusion of Innovations' to elaborate on how a new idea or technology may be spread.

By ‘diffusion’ Rogers (1995) means how the innovation is communicated over time among the participants in a social system. There are different stages in the innovation-diffusion process which individuals’ moves through in different rates, meaning that the diffusion of innovation theory helps us understand variations of how a community respond to new innovations; such as using faecal sludge as fertilizer. The different stages the individual or group goes through are *knowledge* (gets exposed to the innovation but lacks knowledge about it), *persuasion* (becomes interested in the innovation and actively seeks information), *decision* (decides whether to adopt or reject the innovation as well as change in behavior), *implementation* (if the innovation is adopted and employed) and *confirmation* (if the innovation is used continuously) (see Figure 8). This process is both influenced by the individuals and the innovation itself (Rogers, 1995). Depending on the rate of adoption, the individuals can be categorized as innovators, early adopters, early majority, late adopters and laggards (who often resist change and are critical towards the innovation) (Rogers, 1995).

Of particular interest to us is to examine and identify what affects the likelihood of a farmer to be persuaded, or rather motivated[9], to adopt a certain technology. We do this by studying the persuasion stage in more detail by examining five different characteristics more closely:

1. NR FS perceived relative advantage over other innovations (fertilizers in use)
2. NR FS compatibility with existing norms and beliefs
3. The degree of complexity involved in adopting NR FS
4. The “trialability” of the innovation (i.e., the extent to which it can be tested)
5. The observability of the results, and its importance (McCloskey et. al. 2012, p. 25).

Trialability and *observability* are interlinked since they cover to what extents the innovation can be tested and observed (Rogers, 1995).

[9] We chose to use the word ‘motivated’ instead of ‘persuaded’, as the latter word in our minds reduces the farmers own agency to make a choice. Instead, using ‘motivated’ reflects our own aspiration to find opportunities on the farmers own terms.

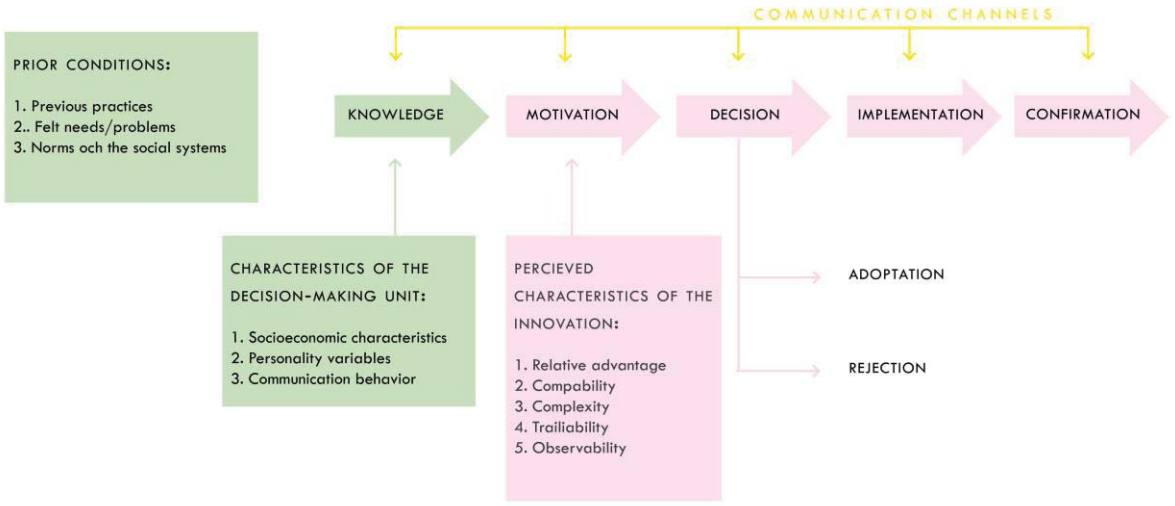

Figure 8. Model of the stages in the innovation-decision process according to DOI (Rogers, 1995), own modified illustration in accordance with the original model, made in InDesign.

4.3 IBM-WASH & DOI interlinked: Assessing the current perceptions and possible adoption

IBM-WASH and DOI are highly interlinked since the contextual dimension in IBM-WASH overlap the prior conditions and knowledge step in DOI, which describes characteristics of the user and the setting (see figure 9). The knowledge step is influenced by socio-economic characteristics, personality variables and communication behavior (Rogers, 1995).

Moreover, the psychosocial dimension in IBM-WASH can also aid to describe the prior conditions in the DOI model, such as the 'norms of the social system' (see figure 9) more in depth, since we aim to understand the sociocultural barriers hindering the adoption of NR FS.

The question whether or not to adopt the innovation (i.e. decision – confirmation in DOI) is therefore influenced by the level of motivation which entails: the innovations relative advantage, compatibility, complexity, trialability, observability (Rogers, 1995) mentioned in section 4.2, which again we see in IBM-WASH in the form of the technological dimension (individual: perceived cost; interpersonal: demonstration of product; community: location and access; societal: national policies etc. and; habitual: ease of use) (Dreibelbis et al., 2013). Decision, implementation and confirmation which are the next steps in DOI does not interlink with IBM-WASH, but is then builds on motivation which decides if the innovation is adopted or not (see figure 9).

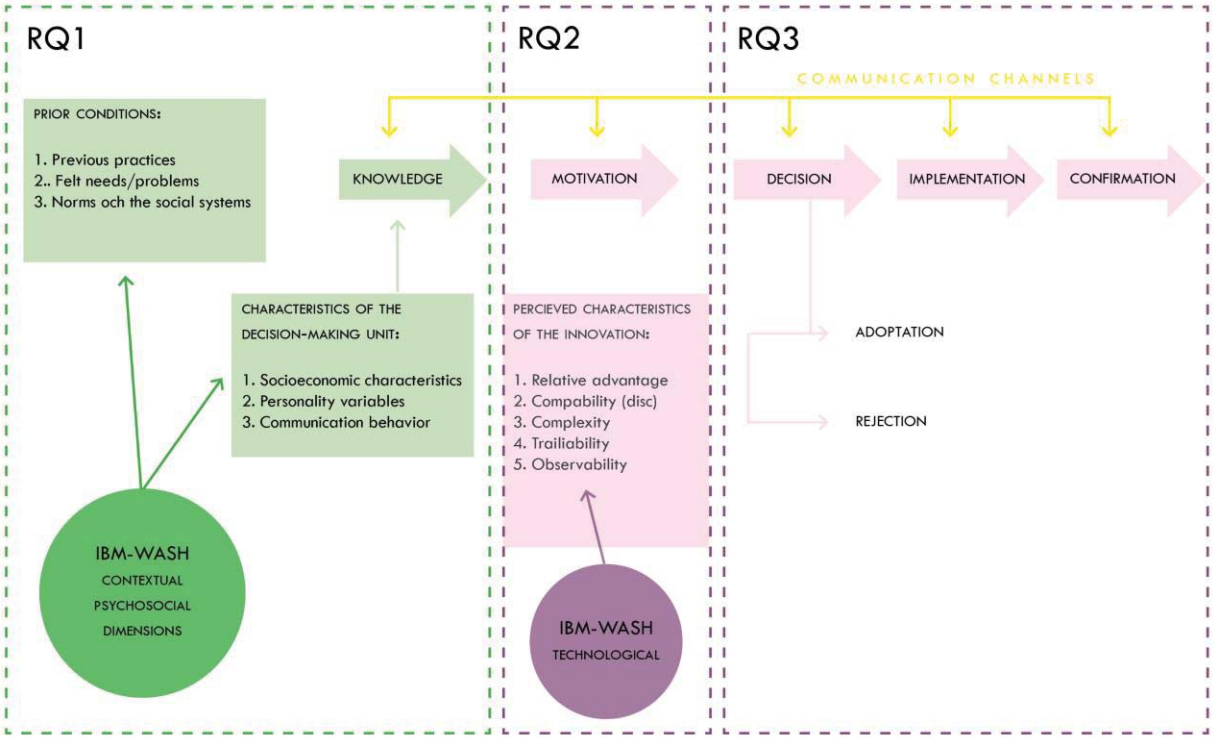

Figure 9. Visualization of the linkages between DOI (Rogers, 1995) and IBM-WASH (Dreibelbis et al., 2013) (own modified illustration of the original model made in InDesign), and their application in our analysis.

5 Analysis & Discussion

The analysis is structured according to our research questions. Firstly, 'RQ1: What are the sociocultural barriers for adopting NR FS?' is discussed, guided by the contextual and psychosocial dimension in IBM-WASH, and previous conditions and characteristics of decision making unit in DOI. Secondly, 'RQ2: how can farmers be motivated to use NF RS?', is discussed, guided by the technological dimension in IBM-WASH, and persuasion (or rather motivation) in DOI. Finally, 'RQ3: How can adoption of NR FS be up scaled?', is discussed based on the findings in the previous RQs.

5.1 RQ1: What are the sociocultural barriers for adopting NR FS?

RQ1 is discussed in relation to the contextual and psychosocial dimension in IBM-WASH, and 'prior conditions' and 'characteristics of decision making unit in' DOI (see figure 8). The contextual dimension focuses on the participants' and the interviewees' accounts regarding the situation they are in, linked to 'felt needs/problems' and 'previous practices' in DOI - which serves to explain the space for adopting a new fertilizer. The psychosocial dimension describes the current state of the sociocultural barriers towards the adoption of NR FS, which is linked to 'norms of the social system' in DOI.

5.1.1 Contextual Dimension

When analyzing the contextual dimension, we found that there is a need for adopting new measures to tackle challenges in the agricultural sector (see table 2). Even though the general accounts from all the FGDs regarding yields during the last years varied; where some have been good, some bad, and some unchanged; they all expressed that they were meeting challenges with their farming practices, as did the users.

Table 2. The main findings from the contextual dimension, describing a favorable environment for promoting a new fertilizer. The findings are stated separately when the answers differed.

	Contextual (IBM-WASH)	**Findings**
Individual	Wealth, age, education, gender, livelihoods/ employment	Focus groups: Men and women; Mixed age; Subsistence farmers (relatively low income) (see Appendix F) Farmers using NR FS: In general highly educated, stable and relatively high income; Male; Early Adopters
Household/ Interpersonal	Roles and responsibilities, household structure, division of labor, available space	Focus groups: Small plots of land Farmers using NR FS: various scales for market production
Community	Access to markets, access to resources, built and physical environment	Fertilizers are expensive, low access to markets
Societal/ structural	Policy and regulations, climate and geography	Changing climate with longer drought periods; Declining soil fertility, government promotes NR FS (see section 5.3)
Habitual	Favorable environment for habit formation, opportunity for and barriers to repetition of behavior	Climate Change; Use of animal dung and coffee husks , not meeting the need of replenishment

Individual

The FGDs socio-demographic variables were descriptively analyzed and can be viewed in Appendix F. In general, they were subsistence farmers, the groups were of mixed age, and both female and male farmers participated. This differs from the users, who were all male, middle aged, highly educated and had relatively high income. Moreover, the users can be classified as early adopters, which is a concept in DOI relating to certain personality variables (Rogers, 1995). Early adopters usually have higher social status and can, due to this, afford to transgress norms of the social systems (Riverola, Dedehayir & Miralles, 2016). Their higher social status is linked to certain personality traits, such as higher levels of education, having more resilient economy, which fits with our users profiles

compared to the FGDs, and are in general younger (Riverola et al., 2016). Furthermore, groups with higher education has previously been found to have more positive attitudes in general towards NR FS (Mariwah & Drangert, 2011). In the forecasting scenario (FCS) it was stated that the early adopters was the youth, and the elders more restricted into adopting NR FS. Incidentally, the youth in Uganda has generally received higher education than their previous generations.

Community

In Wakiiso, the main challenge expressed in the FGDs was accessibility to organic fertilizers, which are expensive in general. In Kayunga, their main perceived challenge is their limited access to markets to sell their produce, especially during rain seasons when the roads become difficult to drive on, and fertilizers were also perceived as expensive and difficult to come by. Users on the other hand had more access to fertilizers and before adopting NR FS they had practiced application of varieties of animal dung and coffee husks. However, these fertilizers had not met their expectations to increase soil fertility and bringing good yields. A new innovation is always compared to previous practices for handling the same issue (Rogers, 1995). Adopting a new innovation carries a degree of uncertainty, and the worth of taking that risk is judged against the previous practice (Rogers, 1995). The challenges and the dissatisfaction stated by the users had been facilitating for looking into other measures.

Related to the societal/structural level, most FGDs elaborated on the topic of climate change having implications for their farming, with prolonged dry periods and less precipitation. One organic farmer even kept a record of the precipitation stating that for the last 3 years, they have received 900mm/year, but according to "the books" it should be 1800mm/year (FGD 5, Wakiiso). Moreover, declining soil fertility was an issue mentioned by all FGDs as a factor for decreasing yields. The interviewees also stated that they faced challenges of a changing climate, with prolonged droughts and soil erosion:

> I'm coming from the angle that generally nutrients disappear every time you plant something. I need to replenish the nutrients or else you'll be shocked with low yields. (Farmer 6)

and;

> Most farmers don't have the knowledge on this; we have a challenge, most areas have been depleted from natural resources. Because of deforestation, erosion and poor farming practices have made the soils a bit infertile. (Farmer 4)

These aspects of the contextual dimension and prior conditions can be viewed as facilitating for the adoption of NR FS: the concerns of climate change and deteriorating soil fertility can induce a felt need to adopt new measures (Rogers, 1995) to tackle these challenges to good harvests.

5.1.2 Psychosocial Dimension

When analyzing the psychosocial dimension to answer RQ1, we found that the current conceptualization of HF; its entailed social norms, combined with culture, pose as barriers for the adoption of NR FS (see table 3). In contrast to this, we also found that Buganda cultural practices are in dissonance with these shared perceptions.

Table 3. Application of the psychosocial dimension (WASH IBM) explaining the barriers of using NR FS

	Psychosocial (IBM-WASH)	**Findings**
Individual	Knowledge, perceived threats, disgust	Faeces is disgusting, smelly and bad (also users & FCS); Can contract diseases/infections; Lack of knowledge that it can be used and how it should be adequately used
Interpersonal / Household	Injunctive/descriptive norms, aspirations, shame	Toilets should be kept far from house; Faeces should not come close to food
Community	Shared values, stigma (Norms of the social system, DOI)	Fear of being boycotted by the community; Faeces is dirty; Religious constraints (Islam); witchcraft; bad words for HF
Societal/Structural	Leadership, cultural identity	*connected to motivational aspects as well as potential for upscaling (see 5.3)*
Habitual	Existing agricultural practices / habits, outcome expectations	Faeces is used for spraying against monkeys; Bananas from old pit latrines are consumed; Kids' poop is put on fields

Individual level

Knowledge is paramount to forming attitudes, in this case; knowledge about agricultural practices, soil fertilizing, and knowledge about NR FS/using HF as fertilizer. Yet, even without knowledge, people consistently form attitudes towards new ideas and innovations, and the shaping of an attitude to something novel is mainly drawn on evaluation of the innovation is useful for one's

situation and perceived social norms (Rogers, 1995). None of the FGDs participants knew about NR FS or how to use it, except one who had used it before, and therefore the majority related the product to their knowledge and conceptualization about HF. The conceptualization of HF is similar to Douglas' (1966) dirt being a matter out of place; it is not clean, dirty, and disgusting, and thus something which should be disposed of. This conceptualization of shit has been found in other faecophobic cultures, for example in Ghana (Mariwah & Drangert, 2011; Appia-Effah et al., 2015). Some of the elder participants showed facial expressions of distaste when discussing HF. The users further confirmed this conceptualization as they had experienced negative attitudes from neighbors. One user said:

> Popo… is actually something that is bad in our language, we usually say 'it's dirty', 'it's filthy' things like that. That's what people usually refer it to. It is something you shouldn't share in public. (Farmer 1)

All but one group stated that the bad smell was the issue of NR FS, which was also mentioned in FCS. Another worry expressed in the FGDs was infectious diseases that one could get by associating with it. The users stated that they would prefer if the smell could be reduced, which was especially an issue during the rainy season when it is usually applied. This has previously been found in two Ghanaian communities where the barriers to adopting NR FS were related to health risk handling the fertilizer, appearance & smell (Mariwah & Drangert, 2011; Cofie et al., 2010). Also, the fear of touching HF, due to it being a direct health hazard, was found to be a barrier towards the utilization of ecological sanitation in southern Uganda (Drangert, 2004). In some cultures, even the smell is thought to have an impact on human's health (personal communication, Niwagaba, 2018; Semalulu, 2018). Moreover, there are policies on how far the toilet should be built from the home, in preventing infections, and past sanitation programs have taught people strictly not to have human excreta close to food. We believe that these past health sanitation programs and policies telling people that HF are dangerous have contributed to the construction of the taboo related to shit and that one should not be associated with it, which has been confirmed by Anderson et al (2016) when analyzing the past MDGs focusing on access to sanitation and not the sanitation management system as a whole. One group also mentioned the fear of being arrested by a medical worker if they started using NR FS, probably because they think that the product would be dangerous to people. Fearing diseases from fresh HF is realistic, but as of now this fear is embedded in the conceptualization of HF and constitutes a barrier for adopting NR FS.

Interpersonal/Household

Despite HF in general being something bad, it historically was and currently is used in various cases without being referred to as a fertilizer (which is also linked to the habitual level, see table 4). For example, in the FGDs it was stated that children defecated in the fields or their faeces are put there, farmers themselves defecating in the fields to bless it, spraying plants with faeces to prevent monkeys from consuming them and planting a banana stand in an old pit latrine. Some also said that the bananas grown in old pit latrines usually comes out with better quality compared to others, and most participants stated that they eat the fruits of these plants. This can be seen as injunctive norms going against descriptive norms i.e. what one think you should do versus what is done (Cialdini, 2003). Thus, related to the FGDs, the injunctive norms are that HF are bad, but the descriptive norms are that HF is in various cases put to use and people even consume fruits grown with it. Also, when conceptualizing that the banana has been grown with HF in the pit latrines people get reluctant, and yet it is a widely common practice. For the very few FGD participants who said they do not eat these bananas it is difficult to tell whether they in fact do not consume these fruits, or if they give this answer in a group and to outsiders when it is put in the context of being cultivated with shit, as a way to distance themselves from norm transgressive behavior.

Community

During the FGDs, we consciously talked about the raw product (faeces) before talking about the product itself (NR FS) and we observed that the opinions shifted when we were discussing it as a treated product; after people began to understand its usefulness and became interested in hearing and learning more. An example of this is one participant stated that "After all it is no longer poopo it is a fertilizer, so yes I could use it" (Group 8, Kayunga). The only clear opponents to this came from the few participants who were Muslims, since it is forbidden within Islam to associate oneself with faeces after cleansing[10]. Religion has previously been an ascribed barrier to using NR FS in areas where social norms are strictly held in place by religion, for example in the North West Province of Pakistan, where according to Islamic beliefs, HF is regarded as *najas* (impure), and the religious values advocate cleanliness and proper disposal of excreta (Drangert & Nawab, 2011). However, communities in general in Central Uganda, have a mix of different beliefs. And perhaps for the majority of mixed Christians the social norms might not be held up by religion. One FCS participant,

[10] A religious act in Islam

affiliated to 'born again Evangelicalism', also argued for the use of NR FS and that it was God's will: "Man was made from soil and goes back to soil - it's right according to the bible". (FCS, Wakiiso)

Something else posing as a barrier to adopting NR FS is the fear of being stigmatized, which was discussed in the FGDs, due to HF being inflicted by social norms (Douglas, 1966), and a few stated that they didn't want others to know it they were using NR FS. Furthermore, in the FCS it was mentioned that women would play a key role in the diffusion of NR FS, which does not contradict our own presumptions built on a previous study in eastern Uganda where women were more inclined to start using human urine (even though it was transgressing the social norms) as fertilizer even though it was highly stigmatized[11] (Andersson, 2015). However, this contradicts our own findings from our FGDs where we noticed a tendency of female participants being more hindered by the norms; talking about witchcraft[12] and stigmatization - whereas the male participants were more pragmatic and discussed the usefulness or NR FS. This is similar to the findings of the Ghanaian study, where women in general were more inclined to have a negative attitude towards using fertilizers from human excreta compared to men (Mariwah & Drangert, 2011). Witchcraft has previously been found as a barrier towards the adoption ecological sanitation in Uganda (Drangert, 2004).

Moreover, language which is used is important to consider and for example if the point of entry into the conversation is on popo or HF these are value laden words with different connotations. For instance, the FCS emphasized that it should be called something with a name without bad connotation (see table 4).

[11] The women in this study were widows, which in the cultural context meant that they had little to lose already in terms of stigmatization, making their vulnerable position in a way untouchable (Andersson, 2015)

[12] By witchcraft they mean that when taking something that belongs or comes from another person; i.e.: faeces, clothes or other belongings, one can exercise witchcraft on that person.

Table 4. Different meanings of faeces in Luganda (spoken by the Buganda tribe in Uganda)

Luganda	**Meaning**
Ekijimusa or Ebigimusa	Human excreta in the context of reuse/fertilizer
Popo	Refers to faeces
Obucafu	Can also mean dirt, garbage or solid waste
Bbi	Decent way of saying amazi, still has a bad connotation
Amazi	Worst word for human excreta

Stories from the field

There is a cultural belief about child's poop before teething to be unharmful and that it is normal to dig a hole in the banana plantation where children defecate, otherwise the parents' fear that they will fall in the pit latrine, or that the action of throwing the poop in to the toilet would harm them. According to Buganda culture in the past, you bless your garden by defecating in it, and it would also be a blessing if others did it. But this action could also be seen as witchcraft.

Farmers are implicitly using poop as fertilizers for the banana plants, when planting them in old pit latrines - which many has eaten from as well. The fruit often comes out better and the plant is more vigorous. It was also used for spraying plants to get rid of monkeys. But these practices are not really spoken of; only some knows that they exist. It is also common that children's poop used as fertilizers indirectly in the fields due to old traditions. Women would usually give birth in the banana fields and therefore it seemed natural that the children defecate there as well.

5.2 RQ2: How can farmers be motivated to use NR FS?

To answer RQ2 we discuss the motivational factors for decision to use fertilizers from HF; which is further emphasized in a study by Nimoh et al., (2014), by applying the persuasion stage in DOI; including perceived relative advantage, compatibility with existing norms, complexity of the product, trialability and observability; coupled with the technological dimension in IBM-WASH. We found that motivating aspects to adopt NR FS was the price being relatively cheaper compared to other fertilizers previously used, which also did not live up to expectations; that NR FS improves soil quality; knowing other farmers are using it and not being the only one transgressing norms; knowing that NR FS is of other character than fresh HF and observing good results of using NR FS (see table 5).

Table 5. Motivations for adopting NR FS, explained with DOI and IBM-WASH

DOI (persuasion)	IBM-WASH (technological dimension)	Findings
5.2.1 Perceived relative advantage	Individual level (perceived cost, value, convenience, strengths and weaknesses)	Advantages: Limited accessibility to other fertilizers; animal manure have unwanted effects and not living up to expectations; NR FS is cheaper; more than adequate nutrients and can improve soil moisture holding capacity.
	Societal / structural (current and past national policies)	Government recommendations
5.2.2 Compatibility	*Refers back to the psychosocial dimension and NRFS compatibility with existing norms and beliefs*	Seeing other farmers using; the state of NR FS is different from fresh human excreta (appearance)
5.2.3 Complexity	Habitual (ease/effectiveness of the product)	Easy to use, quick results
5.2.4 Trialability and Observability	Interpersonal/Household (demonstration of use)	Observing effects and results of using NR FS, such as quick response, good yields and quality of product; sensitization

5.2.1 The perceived relative advantage

One aspect of being persuaded, or rather motivated as we will call it from here, to adopt a new innovation is the *perceived relative advantage* of the product compared to others (Rogers, 1995), which is linked to the individual level in the technological dimension in IBM-WASH. According to the FGD participants, there seemed to be a discontent with the fertilizers currently used and available as described in section 5.1. In general, fertilizers are expensive and hard to come by, echoed in World Bank's (2013) statistics of Uganda as one of the least fertilizer consuming countries in the world. Animal manure is common to use as fertilizer but the FGDs expressed some difficulties or rather unwanted effects of using animal manure. For example, animal manure can burn the plants if it is too fresh, sometimes brings pests, and has an unpleasant smell. However, there is usually a limited supply of animal manure to satisfy the demand which was stated both in FGDs and by the users. One group thought that using NR FS would give less quality to the crops, and others though they would improve. The smell and that NR FS would attract flies was also perceived as disadvantageous.

The users said that price was an aspect making NR FS more advantageous, which was also mentioned in the FCS where it was described as being a cheap alternative fertilizer available in large amounts. Another relative advantage of NR FS explained by users is the nutrient content and the function to hold soil moisture better compared to other fertilizers, which has further been confirmed by Strande et al., (2014). However, a disadvantage mentioned by one FGD participant is the aspect of transportation and application. Currently, the NR FS has to be picked up at Lubigi by trucks, leading its availability to depend on either customers having their own, or access to, a truck or can afford to hire a truck driver. Another possible disadvantage is the fear of pathogens and the risk of sickness related to using NR FS. However, the users had no experience of them, or their employees getting sick. Another disadvantage of NR FS which users stated was that it sometimes contains solid waste like sanitary pads, which is not speaking in its favor[13].

5.2.2. Complexity to use and adopt the product

Regarding the *complexity* of using NR FS and its application, the users utilize gloves, spades and in one case gumboots for protection towards potential pathogens; and states that the product is easier to apply if it is dry, hence the product is not particularly complex to use. The FGDs said that it also depends on whether the communities would treat the human manure themselves or buy it from

[13] Solid waste is currently removed manually (M. Orwiny, personal communication, February 5, 2018).

Lubigi. Most groups wanted to be taught on how to treat it themselves because it would be more sustainable and economically feasible, which were also stated in a similar Ugandan case where they were not willing to handle or use it before understanding the storing and composting (Drangert et al., 2002). One farmer in the FGDs said:

> Yes, if taught well how to use it. We are negative about it because we are ignorant about it. If it was brought and it could be proven that it works then people will love it (Group 1, Wakiiso)

However when asked what would make them consider using it, the majority answered that the product should be treated and ready to use which was contradictory to the former statement. This could be due to the lack of knowledge regarding the treatment process, and if being trained to treat it themselves, which was mentioned in the FCS, this would be preferable. But some of the groups would prefer to buy the ready product since they were worried about the sickness related to HF, and that it would attract flies and smell. There seems to be a divide between owning the treatment process and being offered a product ready to use. Less complexity of a product will enhance the adoption, because it doesn't require more from the farmer then to start using it, which is in line with Rogers' (1995) account on complexity and the adoption of innovations, where treating NR FS is far more complex in comparison. However, owning the treatment and having control over it seems to be facilitating for some farmers, and thus contrasts this previous statement as it would increase the complexity of what is being implemented; with everything from collection and storage to treatment - the knowledge and the capacity to adopt and maintain this whole process. But as stated by the farmers themselves, for long term socio-economic advantages and from a sustainability aspect we would support their claim of ownership, and can see that giving them the tools and the agency to have control over the process themselves would be a favorable alternative.

5.2.3 Compatibility with existing norms

Visiting Lubigi had convinced a couple of users that NR FS is okay to use, since they became aware of other farmers going to the wastewater treatment plant to pick up the fertilizer. This relates to compatibility with norms and practices by seeking social reinforcement from other peers (Rogers, 1995). Drangert (2004) claims that it is essential to prove that it is safe to use treated HF before promoting nutrient recycling of faeces. However, this was contrasted by another study in Ashanti, Ghana, where the health risk was not a major reason for negative attitude towards the use of fertilizer from human excreta. Instead, it was the fear of social rejection (in Appiah-Effah et al., 2015). This was confirmed by users, since some of them had met some negative feedback from their

communities due to the adoption of NR FS, one farmer stated that their neighbor did not like it because it smelled. However this did not prevent them from continuous use, since the benefits outweighed the community's opinion. Despite the possible stigmatization of their community they are happy with the result of using NR FS and gives no reason for discontinuance. However, the perceived advantages or disadvantages of NR FS according to the FGDs are based on their limited knowledge about the product; its costs, its performance, its risks, and its other properties. Nevertheless, these perceptions are important to understand in order to meet any misconceptions about the product and to enhance sound judgements based on accurate information.

5.2.4 Trialability and observability of using the product

Regarding where the users had searched for more information about the product, a few had talked to a friend already using it or gone to Lubigi themselves. The messages they have received promised them quick and positive results, and information that the product is properly decomposed and prepared. One users also stated that he had acquired information from research stating that it can bring good vegetables if handled properly. Trialability and observability are facilitating for the adoption of innovations (Rogers, 1995), as seeing is believing. This was found in a study from a Ghanaian community, where the utilization of NR FS was widely used, and the innovation had spread from farmer to farmer (Cofie et al., 2010). What the users had seen from their own implementation of NR FS, or someone else's, were good results, i.e. it has increased their yields, the quality and size of the plants, and the plants endurance during dry periods. Words like "extraordinary", "success story", and "vigorously" were used to describe the results they have observed. Hence, observation had made some decided to adopt NR FS.

Many FGD participants pointed out that demonstration could facilitate the adoption of NR FS if they could see how it works and that brings good results. They also emphasized the importance of sensitization, making it even more important to provide rigid information about the usefulness of the product. Some examples of how this could be conducted were either by own sampling, led demonstrations, visiting farms using it, and training. All groups except one (which was already interested in trying the product) propose sensitization programmes as a way to facilitate adoption of NR FS. This came up again in the FCS where observation was facilitating for adoption and it was imagined that the large-scale farmers in the community was taught on how to use it first and people would follow after seeing the good results. They also superimposed that demonstration helped changing people's attitudes, by for example farmer's groups facilitating the demonstrations. This

again goes in hand with Rogers' (1995) claims that getting first-hand experience of how an innovation works, and in so knowing that it is useful for one's purpose, is motivational.

Some FGDs also mentioned government promotions (see 5.1.1) as motivational aspects. Interestingly enough, the Ugandan government do in fact recommend the use of human excreta for fertilizing purposes as part of a strategy to promote ecological sanitation (Drangert et al., 2002). While being unfortunate that this recommendation has not reached our participants, it also offers an opportunity to extend its reach for the facilitation of adoption.

5.3 RQ3: How can upscaling of NR FS adoption be facilitated?

Building on the answers of the earlier research questions; what are the social barriers and what motivational aspects there is for adopting NR FS, we arrive at the question of upscaling (RQ3). As stated, the contextual dimension entails the facilitating environment of adopting the product, such as soil degradation, prolonged droughts, expensive inaccessible fertilizers etc. however the psychosocial dimension includes barriers which needs to be understood before a possible scaling up process (see table 6). Hence, when answering question 5.3, these findings builds on 5.1 and 5.2 which is in line with DOI; where the steps build on each other. Thus, understanding local perceptions of human excreta (RQ1) and motivational aspects (RQ2) can offer a segway for the upscaling of NR FS (RQ3).

Table 6. Main findings related to RQ3, pointing towards considering an integrated approach for interventions to facilitate an upscaling of NR FS adoption

Dimension	**Aspects to consider for upscaling the adoption of NR FS**
Contextual	- Changing climate with longer droughts, soil degradation - Former unsatisfactory agricultural practices
Psychosocial	- Raising awareness and increasing knowledge - Training of treatment process and application through sensitization programs including safety aspects, health, appearance and smell as well as use of language - Building on the practices in place, and emphasizing the injunctive/descriptive norms, i.e. what is actually being done vs what people think in regards to socially constructed norms - Strong leadership (Societal/structural) and communication networks
Technological	- Cheap and accessible

Technological Cont.	- Favorable characteristics regarding a shift in appearance, smell and packaging as well as reducing the solid waste. As well as matching requirement of it being organic - Mobilize resources for demonstration of product showing the clear benefits (high nutrients, quick result, good quality of crops, water-holding capacity, influencing improved sanitation and reducing food insecurity). - Better communication on policy recommendations of NR FS.

5.3.1 Decision, implementation and confirmation, rejecting or adopting the product?

To arrive at upscaling, the innovation first has to be put to use which Rogers (1995) explains through the decision - implementation - confirmation stages. In general, most individuals would not adopt an innovation without trying it first (Rogers, 1995). This trial-period (either by themselves or substituted by a peer) is part of the decision to adopt since it decreases the uncertainty the individual holds for the innovation. Some users already made a decision in the persuasion stage, which can precede the decision stage in some cases (Rogers, 1995), when having observed the advantages of using NR FS from their peers. Others tested it themselves on a probationary basis, and state that they could see results after only a few weeks. One participant said that he visited Lubigi and saw that it was decomposed well and user friendly, which he found as reason enough to start using it. In the FCS, the decision to start using NR FS was imagined to be facilitated by extensive sensitization programs held by NGOs and demonstration farms. The importance of strong leadership and the role of individuals with influencing positions in the community was emphasized as a facilitating aspect, which is further highlighted by McCloskey (2012). Furthermore, strong leadership is an aspect of importance conceptualized in the IBM-WASH model (psychosocial dimension: societal/structural level), and further emphasized by Rogers (1995). Thus, it would be advantageous to identify the individuals in a community having leadership roles and aspire to include them in the process of promoting NR FS. Understanding the communication networks in a community is also linked to this, and integral to map out in a potential upscaling process (seen as communication channels in DOI) (McCloskey, 2012; Rogers, 1995). It would also be strategic to initially seek out individuals with early adopter characteristics, similar to the users we interviews, and turning to the youth, to facilitate an initial increased adoption as they have higher social and economic capital as these personality traits increase the likelihood for adoption in early stages of the innovation-diffusion process (Rogers, 1995). Another interesting point that came up during the FCS was that open defecation was assumed

to decrease due to the gained knowledge of shit being a resource which spurred the use of pit latrines.

Implementation

Implementation is different from decision, as it is in the former stage that the decision is materialized, and behavior change occurs (Rogers, 1995). The users have already implemented the practice and put it to continuous use. The participants in the FCS imagined that by observing the usefulness of NR FS and the promotion through sensitization programmes, a decision was made to implement the use of NR FS. Although, it was perceived that a general issue in the implementation stage was the cultural norms in place.

Confirmation

The innovation-decision process could ultimately lead to either adoption or rejection of the innovation. Even if the innovation is adopted it is possible that discontinuance occur. This can happen during the confirmation stage, if the innovation has been unsatisfactory or gets replaced by another innovation. From our findings, the users feel that the NR FS is generally working very well, it is increasing the soils uptake of water, decreases soil erosion and conditions it; creating higher yields and improving the quality of their different crops. No sickness among the workers has been noticed despite that only some of them take precautions in applying the NR FS as mentioned before. It is mainly the smell bothering some users. The FCS imagined that implementing NR FS brought along effects which were speaking in favor for the continued use: positive impact on sanitation, with cleaner environment and less diseases; decreased malnutrition due to better availability of food; increased incomes due to good harvests, and saved money from not having to spend on expensive fertilizers; with increased income, domestic violence was reduced and relationships within the community and the family was improved; the soil regained its quality and fertility.

5.3.2 Upscaling NR FS in the context of Uganda

Building on the notion that there is a need for new measures to tackle the challenges the farmers are facing, scaling up in the best way possible would entail interventions on a large scale with interventions in all three dimensions. The contextual is often outside the scope of intervention programs (Dreibelbis et al., 2013), since these factors are difficult to change. However, we have seen that education matters for adoption of NR FS, both with the users being highly educated, and as an aspect emphasized in the FGDs and FCS such as education.

When asking if the participants could use HF, or poop as we called it in the FGDs, the initial reactions from our participants were divided. Many participants had used urine for pests before, but not faeces. Few participants stated that they could never use HF as fertilizer. One group joked about it being ok to use for export, but not for the local market. This is similar to another study in Ghana, where farmers accepted that human excreta can be used as fertilizer, but were unwilling to use it themselves or eat crops produced with it (Mariwah & Drangert, 2011). In most FGDs participants expressed that they could use HF as fertilizer, and one group stated:

> It's okay to use human poop as a fertilizer as long we know how to handle it in the right way (everyone in the group agrees) and as long as we are benefitting from it, we have no problem. (Group 4, Wakiiso)

When asked if they would eat a crop produced with NR FS, the responses varied with some FGD participants saying no, however the yea-sayers were in majority. The users saw no problem at all consuming crops produced with NR FS, or using it for any kind of crop, and were in general happy to display and share their crops with us. This contradicts a statement from a report on norms and attitudes towards ecological sanitation, where the general perception is that it is not good to use on crops for human consumption (Drangert, 2004). However, another report concluded that "there is no taboo or cultural belief in Uganda hindering the use of treated human-derived manure in agriculture and eating the so produced food" (Drangert et al., 2002, p. 43).

In former studies, the recommendations were to improve communication on the benefits and the risks of using fertilizers from human excreta, and enhance their knowledge on how to handle and use the fertilizer appropriately (Nimoh et al., 2014; Abedi, 2015; Appiah-Effah et al., 2015; Mariwah & Drangert, 2011; Drangert & Nawab, 2011). Cofie et al., (2010) also stresses the importance of communication, since in their study, the practice of NR FS had spread mainly from farmer to farmer, where the observed benefits from using it served as an incentive for farmers to adopt. Some users had seen farmers equipped with rubber boots and gloves when using the NR FS, indicating that it is not safe. Therefore it's important to include the safety-aspect in any future sensitization program[14], which was emphasized by the participants in the FCS as well, so that possible farmers using it will not get stigmatized. Some general statements regarding the adoption process in the FCS was that

[14] Sensitization programs or sensitization; is making people familiar and aware of a problem or a unfavouring situations (https://dictionary.cambridge.org/dictionary/english/sensitize)

ignorance was stated as a barrier and that changing people's perception was not easy since it required a lot of training and sensitization. Some of the participants in the FGDs practices organic farming, and emphasized the importance of it being locally treated so they could control it being organic. Although, a suggestion could be that they first try the NR FS from Lubigi on probationary basis, and secondly develop community efforts to maintain the treatment themselves, if desired. Because there are other issues with extracting the HF, which was mentioned in the FCS, since the pit latrines are very deep as well as problems with storage of the NR FS since many farmers have small plots of land. This adds to the complexity in DOI (Rogers, 1995) and could make them reject the innovation. However, there is a complexity aspect with arranging the transport to and from Lubigi as well, and these disadvantages has to be weighed.

Based on earlier cases, scholars have suggested that overcoming sociocultural barriers will need scientific proof that fertilizer from human excreta can be produced into a pathogen free and non-offensive looking and smelling product, as changing appearance and odor will give it another cultural meaning (Mariwah & Drangert, 2011; Drangert & Nawab, 2011). Tanner contrasts this (1995 in Drangert & Nawab, 2011), saying that cultural beliefs often win over scientific knowledge. So there is a need for the dissemination of these efforts to increase knowledge about the product, which our findings confirm. In a different shape, shit can be accepted as a fertilizer, and using it will not be an act of transgressing the norms (Drangert & Nawab, 2011; Findings from FGD; FCS). Perhaps, there are negative attitudes towards HF in general, but when presenting it as a treated, safe, product of other appearance compared to fresh HF, the norms shifted with it; leaving opportunity for upscaling the adoption. Hence: Shit matters!

Figure 10. Happy poop emoji because we stated that shit matters.

6 Conclusion

Increasing challenges in Uganda such as soil infertility and prolonged drought seasons has highlighted the need for conditioning and replenishing the soil (Strande et al., 2014). However, fertilizers are both expensive and hard to come by which have spiked the idea of using already existing resources, such as faecal sludge (Strande et al., 2014). Previous studies show that focusing on faecal sludge management and recovering nutrients would have positive impacts on 14 out of 17 SDGs (Anderson et al., 2016) which the research project SPANS is currently looking into; to enhance the fertilizer (NR FS) which can be bought at Lubigi Wastewater treatment plant in Kampala. However, data is lacking concerning the possibilities to upscale this usage (RQ3) since there is inadequate information on the enabling environment and context (Niwagaba, 2009). Thus, to understand the socio-cultural barriers concerning faeces (RQ1), and possible motivational aspects of using NR FS (RQ2), an exploratory study has been done in the surroundings of Kampala; through interviews with farmers using NR FS, focus group discussions (FGD) and a forecasting scenario. Since the topic is highly connected WASH behavior, the theory IBM-WASH was applied (Dreibelbis et al., 2013), and further explained by the theory Diffusion of Innovation which regards the adoption process of a new innovation (Rogers, 1995). From our findings we can conclude that there is a favorable context for adopting a new fertilizer such as NR FS since it could improve the soil fertility and water holding capacity, as well as work as an alternative for current (in)accessible fertilizers on the market with high prices; or as a substitute for animal manure which there is a scarcity of. The socio-cultural norms in place confirms that the Buganda culture is a relatively faecophobic one, as Africa in general, (Jewitt, 2011), and the barriers towards the use of human excreta in agriculture are built on variables from IBM-WASH (Dreibelbis et al., 2013): perceived threats (fear of diseases), lack of knowledge (not knowing that it can be useful for one's goals or how it could be used), disgust (shit is disgusting, smelly and bad), social norms (toilets should be kept far away from house, shit should not come close to food, shit is dirty, has a bad smell, is disgusting), stigma (fear of being boycotted by the community). However, the injunctive norms are in dissonance with the descriptive norms, as bananas grown in old pit latrines are consumed and kids' poop is placed on fields. Yet when human faeces changes appearance (from raw to the treated product) and smell, the opinions change with it (Douglas, 1966; own findings). Thus, if the farmers are sensitized about the innovation the hindering norms and barriers could be circumvented by demonstrations, education, influencing leaders and/or governmental recommendations.

Moreover, it would be favorable if the NR FS could be produced and locally and being trained on how to treat it, since some of the focus groups thought this would be more sustainable and economical advantageously, as well as wanting to have control over the product being organic. However, since it is a sensitive topic and that one could be stigmatized of utilizing faeces in agricultural practices, this is a gradual process over time through e.g. sensitization programs as mentioned by the farmers themselves. Here is where being aware of the stages in DOI (Rogers, 1995) could assist in such a process. It entails: understanding the different attitudes towards the innovation and the motivational aspects of using NR FS, which can help community leaders or organizations (e.g. NGOs) to promote adoption of the product. For example; raising awareness of the soil infertility and need for replenishment together with the health aspect of an enhanced sanitation management system with its sustainability advantages (knowledge), and converting that knowledge into the concern of these problems (persuasion, or rather motivation), create a community initiative or collaboration based on this (decision), establish the means for utilizing the product (implementation) and reassess the project and its impacts (confirmation) (McCloskey, 2012). Hence, our proposition would be that the farmers come together in the community (which is especially convenient in Wakiiso since they have already established several farmers groups) and testing the product to see that it works (in line with DOI: trialability and observability) (Rogers, 1995) before putting money and efforts into establishing any kind of treatment process themselves.

Looking at the bigger perspective of the enabling environment for NR FS, as well as improving people's capacity and lives, favoring interventions to start with would be to focus on education, since education is one important aspect of being an early adopter (Rogers, 1995) and higher education leads to a more positive attitude in general towards NR FS (Mariwah & Drangert, 2011). Furthermore, we can't stress enough the importance of motivational aspects (5.2), meaning the farmers desires and aspirations to utilize NR FS, and not "persuading" them to use it. Again, this is highly contextual and needs to be assessed through all dimensions (contextual, psychosocial and with the matching technology) to understand if it is applicable in that certain situation.

Ethically sound research in 8 weeks?

Firstly, recovering nutrient from human faeces is not a phenomena which is widely practiced in the global north. This is much due to the sewage-system lock, but is this reason enough to discard the idea and push other countries to adopt it?

Not knowing much of what to expect or comprehending the cultural context of Uganda, we set of to carry out a field study during eight weeks. In the wake of this, there is a few points we need to shed a light on. When arriving to the pearl of Africa, we were most welcomed. This is important to emphasize because we absolutely loved spending time there. However, our own conduct of doing research is something we have thought a lot about. There were some bumps along the road in mobilizing farmers who could participate in our research, and if this have been done differently if could have changed the outcome. However, this is not what we wish to elaborate on, moreover we feel there is a need for discussing if ethically sound research can be done in eight weeks, when involving "subjects" in the study elaborating on a sensitive topic. Spending approximately 1 day per focus group and 1 day for the forecasting scenario, it failed in establishing connections and trust as emphasized by many scholars (Anderson et al., 2016; Dreibelbis et al., 2013; Slocum, 2003). We basically came with our own driver, extracted information and left them wanting more (even though we had a clear introductory consent, stating that they would not directly benefit from taking part in the study). Since this is an aid-receiving country which has been prone to many development projects, this might have influenced their expectations on our research. Simply asking them questions about their feelings and thoughts about poop and not offering any hand-on improvement seemed unsatisfactory. All in all, it gave us a bad taste in our mouths and felt neocolonialist, which is reinforced by the fact that we are white people, intruding in their lives; extracting information and not giving anything back in return. This feeling might have been subdued if we've done the research process differently: mobilizing farmers through the chairman and police in the community, which we were told post focus group discussions. However, we don't believe that 8 weeks would have been enough. The experience is well elaborated on in Creswell (2014): *There needs to be some reciprocity back to the participants for their involvement in your study. This might be a small reward for participating, sharing the final research report, or involving them as collaborators. Traditionally, some researchers have "used" the participants for data collection and then abruptly left the scene…"* which summarizes our feelings of the data collection process.

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8 Appendices

8.1. Appendix A: Interview protocol 'users'

Background information:

- Gender:
- Age:
- Size of farm:
- Educational level:
- Religious affiliation:
- Organic or conventional?
- What market do you produce for (local, regional, international)?

Questions for farmers buying dried faecal matter from Lubigi:

1. How long have you been using the product?
2. How did you come to know about this product?
3. What was your first reaction to this product?
4. How did you decide to start using it, what made you take this decision?
5. Have you changed your view on this type of fertilizer after you started using it?
6. How much do you buy each time (truck size)?
7. Do you use all of it yourself, or do you sell it to other farmers?
8. Is it safe to handle?
9. Do you treat it yourself, by composting or so?
10. How do you apply the fertilizers (mechanized process, any particular equipment)?
11. What kind of crops do you cultivate?

12. Which crops are you using the fertilizer on? Do you use it on different crops? (Do you use it for own consumption or for commercial?
13. What changes with the crops have you noticed since you started using this fertilizer (good or bad)?
14. Has there been any problems with using this fertilizer (e.g. sickness)?
15. Do your customers know that you are using this kind of fertilizer? Why/why not? If not, what do you think they would say about it?
16. Would you consider using it for crops for food crops, for example bananas? Tomatoes or other vegetables? Why/Why not?
17. Is it okay to talk about human excreta in general?
18. What do you call human excreta (names for it) if you talk about it in your family, or with friends?
19.

Introduce the SPANS project: research project working together with Lubigi to create a safely packaged, pathogen free product, which is safe to use on crops for human consumption:

20. Could you consider paying more for a safer product?
21. Could you consider using this fertilizer on crops for human consumption?
22. What would be good to change with the fertilizer you currently buy? What does your ideal fertilizer look like? What is important for you when you buy fertilizer?

8.2 Appendix B: FGD questions

Start with an introduction round: ppl saying their names.

1. How has the yields been over the last few years? Think back and explain the changes, if any.
2. What do you think is the reason for these changes? (Discussion might get into soil fertility. Otherwise ask:)
3. (Start discussion on soil degradation, i.e. loss of fertility in soil.) Is soil fertility a pressing issue for you, is it prioritized? Are you taking any measures towards this issue?
4. (Continue discussion on fertilizers.) What sort of fertilizers do you use? What is important with a fertilizer for you?
5. What do you think about animal manure as fertilizer, e.g. cow dung, chicken droppings? (Possible follow up questions: Are there any issues regarding using animal manure as fertilizer? What is positive and negative about it?)
6. Have you used human urine or human poop for your crops in any way? Actually, what would you like to call poop in this discussion? (Possible follow up question: Have you planted something in an old pit latrine or used urine for weevils?
7. What do you think about using human waste as fertilizer? Would you consider using a fertilizer made out of human manure?
8. If someone in the community would use human manure as fertilizer, how would the community respond? How would you respond: think and feel?
9. What's the reason for this reaction, can you think back where these feelings and thoughts are originating from? (don't think we should mention this to the discussants: taboos, religiously inappropriate, not accepted culturally etc.)
10. Treatment of human excreta into fertilizer can be done in the community, like with ecosan toilets (Have you heard of them?). What do you consider doing this or have someone else treat it for you?
11. For example, in Kampala, at the wastewater treatment plant Lubigi they treat human waste into a dry and safe fertilizer. It has NPK (nutrients) comparable to any other animal manure

(?). We have met farmers around Kampala using this fertilizer for matooke, cassava and tomatoes. They have all been happy with using it as it has improved their crops and yields. How does this fertilizer from Lubigi make you think and feel? Would you consider using it? Would you buy crops that has been grown with this fertilizer? How is this different than animal manure?

12. What factors could make you use this product? Do you think that is possible at all?

13. If the government recommended humanure, would this change your opinion about using it?

8.3 Appendix C: Forecasting scenario

Around 10 minutes:

1. Initially, the three different groups with 5-6 participants discuss which cultural taboos and social barriers towards using human poopo as fertilizer they arrived at in their individual focus groups. Followed by a short break where we summarize the present state and opinions about poopo as fertilizer, possibly adding something that we learned which has not been mentioned (see step 3). Question: In your focus group, what issues did you discuss regarding using human poopo as a fertilizer? Social barriers / taboos?

Step 2-3 around 5 mins, question 4 around 20-30 mins:

2. Now we will state the future scenario, meaning that you should imagine yourself in the future. This is where we are right now:

    a. We have closed the food loop, meaning that we are re-using the nutrients in human poop and introducing the nutrients back into the soil (see visualization). The use of nutrient recovered human poopo as fertilizer is common in your community, and you are also using it. Meaning that no one using this fertilizer are stigmatized or shunned/alienated by the rest of the community, and people buy and consume the crops produced with this fertilizer.

3. Looking back to some years ago, when this was not as widely accepted. *(Recap of answers from step 1, adding more information from the results of the FDG if needed)*

    a. Most people were not aware that this fertilizer exist or even that human poopo contains NPK/nutrients. People perceived the fertilizer as disgusting. Culturally, poop was dirty and interacting with human poopo was a taboo, e.g. keeping toilets far away from house. Religion could also teach about human poopo as something unclean and dirty, which shouldn't be handled. There were also a lot of concerns about diseases that could be transmitted when handling the poop. Another concern was that customers might not buy the produce if they found out a farmer was using this fertilizer, and that the community might alienate farmers using this fertilizer. And smell was yet another concern.

4. Being in the future scenario, and having the past issues in mind, we are now going to discuss what the necessary steps were along the way for reaching where we are now. Imagine you being in the future where it is common to use human poop as a fertilizer in your community: *The following questions are asked in English, and then asked one by one by the translators, giving them time to answer each question.*

    a. What happened, and what was the driving force(s) behind the change?

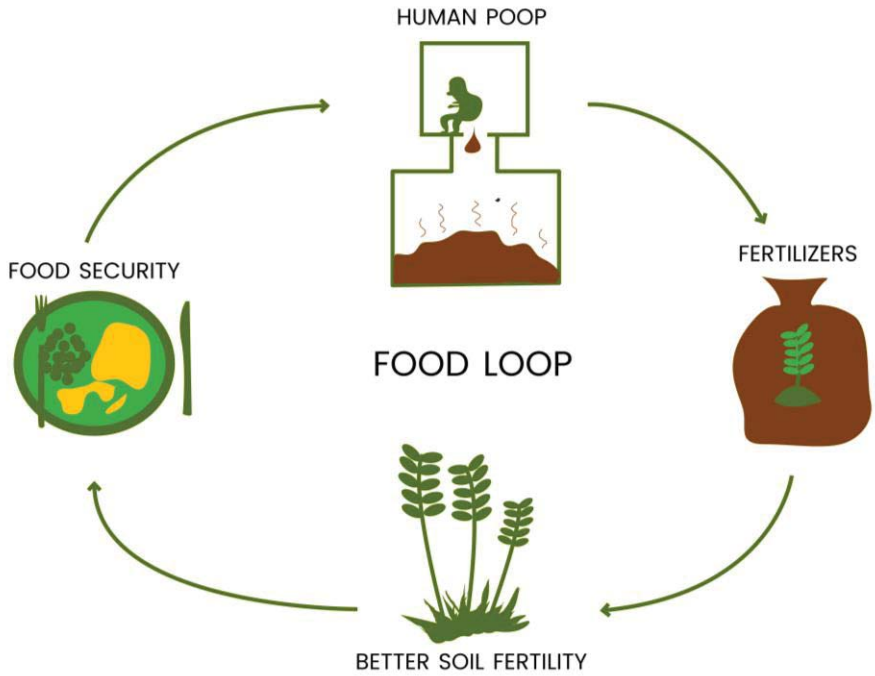
    b. What happened at first and how did the change start? How did the change happen, was it gradual or fast?

    c. Where there any bumps along the road? What were they and how did you manage to overcome them? (Maybe you can tell a story?)

    d. Who were the champions in this story? Did different groups have different roles to play in the change? Women / men / economically challenged farmers?

Additional questions, after the narrative is developed: What impacts did these changes have for sanitation in the community, food insecurity, soil degradation, health issues?

Around 30 minutes: Big group discussions with all participants, discussing their findings.



Own visualization of a food loop, created in InDesign.

8.4 Appendix D: Informed consent form

Focus group discussion with farmers

Background and purpose	Our study is exploring Ugandan farmers' attitude and perception towards different kinds of fertilizers.
Inquiry concerning participation	You have been asked to participate in our study because we are interested in your opinion as a farmer about fertilizers.
How will the study be conducted?	You will participate in a focus group discussion where we will give you questions regarding soil management and fertilizers to discuss. It is required that you answer truthfully, and don't mind what we think.
How will the information be used?	Your statements will be used as information in our field study's analysis together with other participants' answer, where we are looking for patterns to reach our study's aim. Your answers will be handled anonymously.
Compensation	We cannot offer any compensation for your participation
Voluntariness	You are voluntarily participating in this focus group discussion. You can leave at any time you want without having to state your reason.
Responsibility	The people responsible for the completion of this study are Elina Persson and Therese Hågerup, master students at Lund University, Sweden. If you want information about the study please contact: nat12epe@student.lu.se, or th1351ha-s@student.lu.se
Consent form	I have read and understood the content of this consent form. I have been able to ask any questions I have regarding the information given in this form.

Name:

Age:

Educational level:

Religious affiliation:

Signature Date

_____

8.5 Appendix E: NVivo codebook

Focus Group Discussions analysis

Coded Nodes from IBM-WASH

Name	Description	Sources	References
Contextual	The contextual dimension represents the background characteristics of the setting, individual, or environment that are often beyond the scope of influence of program activities; however, they exert significant influence on the adoption of specific products or behaviours.	1	8
Community	The community level entails the physical and social environment of the individual and what formal and informal institutions shapes their individual experiences.	1	11
Habitual	Includes factors for maintaining behavioral change.	1	20
Individual	The individual level represents sociodemographic factors	1	6
Interpersonal and Household	The interpersonal/household level describes the interactions between the individual and their family, close friends and neighbors.	0	0
Societal and Structural	The societal/structural level refers to the institutional, organizational or cultural factors which influences behavior in the different three dimensions.	1	27
Psychosocial	The Psychosocial Dimension comprises the behavioral, social, or psychological	0	0

Name	Description	Sources	References
	determinants that influence behavioural outcomes and technology adoption. The psychosocial dimension of the IBM-WASH model consists of factors that are amenable to intervention activities. These are often the focus of behavior change strategies. Psychosocial factors have been described by various names in models such as the Health Belief Model, the Theory of Reasoned Action and Theory of Planned Behavior, & SCB		
Community	The community level entails the physical and social environment of the individual and what formal and informal institutions shapes their individual experiences.	1	47
Habitual	Iincludes factors for maintaining behavioral change.	1	30
Individual	The individual level represents sociodemographic factors	1	64
Interpersonal and Household	The interpersonal/household level describes the interactions between the individual and their family, close friends and neighbours.	1	24
Societal and Structural	The societal/structural level refers to the institutional, organizational or cultural factors which influences behavior in the different three dimensions.	1	1
Technological	The specific attributes of a technology, product, or device that influence its adoption and sustained use constitute the Technological Dimension. All WASH practices – even simple handwashing with soap – require some type of physical product or technology component, and characteristics of this hardware can often have	0	0

Name	Description	Sources	References
	a strong influence on behavioural outcomes.		
Community	The community level entails the physical and social environment of the individual and what formal and informal institutions shapes their individual experiences.	1	29
Habitual	Iincludes factors for maintaining behavioral change.	1	2
Individual	The individual level represents sociodemographic factors	1	59
Interpersonal and Household	The interpersonal/household level describes the interactions between the individual and their family, close friends and neighbours.	1	15
Societal and Structural	The societal/structural level refers to the institutional, organizational or cultural factors which influences behavior in the different three dimensions.	1	20

8.6. Appendix F: FGD participant and user attributes

Focus groups	Crops market	Gender	Location	Mean age	No. participants	Organic/ Inorganic	Religious affiliation
Group 1	The farmers are growing for the domestic market: vegetables, casava, matooke, fruits, irish etc.	Female	Wakiiso	47	7	Organic	3 Muslim, 4 Cristian
Group 2	error	error	error	error	error	error	error
Group 3	Vegetables, cassava, bananas, fruits, coffee, chili, sweet potatoes, maize, beans,	Male	Wakiiso	43	6	Organic	1 Muslim, 5 Cristian
Group 4	Sweet potatoes, matooke, greens	Female	Wakiiso	25	4	Organic	4 Christians
Group 5	spinach, broccoli, using organic, garlic; produces cassava, organic practices; matooke, beans, sweet potatoes,	Female	Wakiiso	35	4	Organic	1 Muslim, Christians
Group 6	Unassigned	Female	Kayunga	51	10	Inorganic	Unassigned
Group 7	Unassigned	Female	Kayunga	30	10	Inorganic	Unassigned
Group 8	Cultivating a mix of beans, tomatoes, rice, maize, vegetables, cabbage, matooke, cassava, pineapple, sweet potatoes, watermelon etc.	Male	Kayunga	31	8	Inorganic	Unassigned
Group 9	Grow pineapples, papaya, tomatoes, bananas, cassava, maize, rice, beans etc.	Male	Kayunga	42	5	Inorganic	1 Muslim, rest unassigned, probably Christians