Ecological Sanitation: A sustainable dream or reality?

Exploring complexity of transitions to more sustainable sanitation practices: A case-study of Burmi Tola, India

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Abstract

In the world today 2.5 billion have no access to improved sanitation. This causes social, economic and environmental consequences and therefore weakens all three pillars of sustainability. The sanitation deficit although decreasing in relative terms has increased in absolute numbers since 1990. Conventional water-based systems are costly, pollute the environment and require heavy resource use. This study looks at ways to implement and design more sustainable sanitation technologies. Using a qualitative case study design semi-structured interviews were taken in the field on site of an ecological sanitation pilot project where human excreta is collected, rendered safe and then used a fertiliser. From the data collected it showed that although people may use the technology there exists important social barriers that contradict with community values. The results and subsequent discussion show the need to include communities in the designing of new sanitation technologies therefore lessening this conflict. A new model is proposed based on the Transition Management literature to search for new sustainability visions and come up with innovative designs that are valued by the people who will use them.

Key words: Sanitation, Toilets, Transition Management, Transition Theory, International Development

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Abbreviations

CLTS	Community-Led Total Sanitation
Ecosan	Ecological Sanitation
EM	Ecological Modernisation
NBA	Nirmal Bharat Abhiyan
ODF	Open-Defecation Free
SEI	Stockholm Environment Institute
SIDA	Swedish International Development Agency
TM	Transition Management
TT	Transition Theory
UDDT	Urine Diverting Dry Toilets
UNEP	United Nations Environmental Programme
UNICEF	United Nations Children's Fund
WASHi	Water, Sanitation and Hygiene Institute
WHO	World Health Organisation

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1. Introduction:

Approximately 2.5 billion people worldwide have no access to improved sanitation facilities (UNICEF and WHO, 2012). The World Health Organization defines unimproved sanitation facilities as facilities that are unable to ensure the hygienic separation of human excreta with human connect (WHO, 2013). Of the 2.5 billion people who have unimproved sanitation facilities 1.1 billion people practice open defecation (UNICEF and WHO, 2012). The lack of improved sanitation causes social, economic and environmental problems. Models of conventional sanitation, with a sewage system and flush toilet, are viewed as the pinnacle of modernisation (van Vilet et al., 2011). However, this approach leads to the pollution of water bodies, environmental damage, eutrophication, consumption of huge amounts of water, high investment and to the loss of valuable resources (Werner et al., 2009). Ecological Sanitation (ecosan) is an alternative approach which attempts to promote healthy sanitation practices, reduce environmental impacts and recycle nutrients (Tumwebaze et al. 2011). Introducing new sustainable sanitation systems, especially more controversial sanitation technologies like ecosan, is often very difficult as they contradict societies psycho-socio-economic mentality (Avvannavar and Mani, 2008). Focusing purely on the technological and infrastructural aspects has led to problems meeting the sanitation challenge (van Vilet et al. 2011). Like most societal and environmental problems it requires a combination of technical, organizational, economic, institutional, social-cultural and political changes (van den Bergh et al., 2011). Thus, it has already been argued that research into sanitation which traditionally is the work of engineers must become more interdisciplinary and include social scientists, behaviour change experts, health professionals and virtually everyone (Mara et al., 2010). On that basis, concentrating on social aspects, this thesis will analyse and assess the potentials of ecosan as an alternative more sustainable sanitation system. This is done by first assessing the barriers to implementing ecosan which is being promoted as a more sustainable and cost effective sanitation alternative than both conventional approaches and of continued open-defection. Having analysed the barriers, the reasons why these barriers exist are then explored by looking at the current way sustainable development framed is and understood by dominating global institutions. Finally, a hypothetical way to overcome these barriers on the micro level is suggested.

Using a sustainability science approach, a qualitative case study is conducted focusing on an ecosan pilot project run in a rural community. In order to steer a transition to more sustainable sanitation systems various changes at various levels are required. Thus, we need an approach like sustainability science that can deal with complexity and span a range of different spatial scales (Kates et al., 2001). This field deals with problem-driven investigations of human-environmental systems that are motivated by efforts to combat sustainability challenges (Clarke, 2007). Practices of open-defecation

have economic, social and environmental consequences therefore weakening all three pillars of sustainability. Searching for sustainable sanitation practices is a way to address this challenge. Transition Theory (TT) is at the heart of sustainability research (Grin et al., 2010). TT is a theoretical approach that looks at the multi-dimensional character of transitions to more sustainable sociotechnical systems, concentrating on complex and long-term processes involving a multitude of actors (Geels, 2011). Transition Management (TM), as part of TT, is used as an analytical framework by sustainability scientists to outline problems and suggest points of intervention. This study uses this lens to analyse and discuss the data collected.

1.1 The Sanitation Challenge

'Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation' Millennium Development Goal Target 7.c

The target for drinking water has already been hit however the target for sanitation has seen far slower progress. Although access to improved sanitation has increase from 36 per cent in 1990 to 56 per cent in 2010 (UN, 2012) due to population growth the absolute number of people without access to improved sanitation facilties has actually seen an increase since 1990 (WaterAid, 2012). Currently predictions show that there will be 67 per cent coverage by 2015 short of the Millennium Development Goal target of 75 per cent (UNICEF and WHO, 2012). One third of the global population without improved sanitation and nearly 60 per cent of people who practice open-defecation live in India (Ibid). In South Asia it is estimated that 692 million people resort to open-defecation (Ibid). All this comes with social, economic and environmental consequences. For example, faecal-oral pathways are greatly increased in communities without improved sanitation, increasing rates of diarrhoea which is the cause of 1.6-2.5 million people dying worldwide a year (Mara et al., 2010). While a WHO report stated that '10% of the total disease burden worldwide could be prevented by improvements in drinking-water, sanitation, hygiene and water resource management' (Prüss-Üstün, et al. 2008, p.7). From an economic perspective figures from 2006 show losses in India due to inadequate sanitation amounted to US$453.8 billion which is 6.4 per cent of the country's total Gross Domestic Product (Water and Sanitation Program, 2010). Costs occur due to health-related impacts, domestic water-related impacts, access time impacts and tourism impacts (Ibid). In addition, the disposal of human waste is a major cause of widespread water quality problems (UNEP, 2010) and soil pollution (Avvannavar and Mani, 2008). Bihar has a population of 103,804,637 (Census of India, 2011) of which 25 per cent has access to improved sanitation facilities (SEI and WASHi, 2012). This percentage is well below the national average of 34 per cent (UNICEF and WHO, 2012). It is in this setting that the research was conducted.

2. Ecological Sanitation:

Ecosan has been presented as an approach to tackle some of the global sanitation problems. It is a range of technologies which can be altered depending on the social and ecological situation (Nawab, et al., 2006). Unlike conventional approaches to sanitation which are based on the premise that human excreta are waste that need disposing of (Werner et al., 2009) ecosan promotes sanitation that looks at human excreta as a resource that can be rendered safe for reuse in agriculture so as to reduce human and environmental impacts and recycle nutrients (Tumwebaze et al., 2011). The term reuse is used rather than use as the nutrients are being reused as fertilizer. The aim of the ecosan approach is to reduce health risks, prevent pollution, prevent degradation of soil fertility and optimise the management of nutrients and water resources (Langergraber and Muelleger, 2005). Conventional approaches to sanitation have various environmental problems such as the pollution of water bodies causing eutrophication and rely on the consumption of large amounts of water. In addition they require high investments and lead to the loss of valuable resources (Werner et al., 2009). In developed countries conventional sanitation although being generally robust and hygienic still have economic and environmental problems making them unsustainable (Hegger et al., 2007). Ecosan on the other hand reduces the health risks related to contaminated water, prevents pollution and soil degradation and optimises the management of nutrients and water resources (Langergraber and Muellegger, 2005).

It is important to stress that safe handling of both urine and faeces is a key component of ecosan (Richert et al., 2010). One way of doing this is through separation. Although not a prerequisite for ecosan, faeces and urine are often collected separately (Werner et al., 2009). Other technologies such as dehydration toilets and composting toilets are also used (Haq and Cambridge, 2012). However, urine diversion reduces the odours and avoids the urine being exposed to bacteria and other pathogens found in faeces. Faeces can be left to dry so that the pathogens die and can then be safely reused. Urine on the other hand can be reused almost instantly (Ibid). One approach to separate collection is Urine Diverting Dry Toilets (UDDT). In these systems alongside faeces and urine being collected separately no water is required other than in communities that practice anal cleansing.

3. Research questions and disposition

The aim of this research is to look at ways to move from unsustainable sanitation practices such as open-defecation towards more sustainable practices. By analysing the barriers to implementing ecosan it is hoped that recommendations can be given on how best to manage a transition towards more sustainable sanitation practices. Therefore, this research is divided up into three different sub-questions:

i. What are barriers to implementing ecosan in communities?

ii. Why do these barriers exist?

iii. How can we overcome barriers to create sustainable sanitation practices?

The following chapter explains the pilot project and the case. This is followed by a detailed explanation of the theoretical foundations of the study, TT and TM. Chapter 6 concentrates on the first research question using a TM lens to analyse data collected from the field. A discussion is then followed addressing the last two research questions where theoretical ideas are used alongside the data collected.

4. Case-study: Burmi Tola, Bihar, India:

Burmi Tola is part of Rupaliya village in West Champaran district in Northern Bihar. It is made up of 37 households with a population of 217 people (WaterAction, 2012). The community also has a local privately run school. The community had migrated from India for Burma where they were expelled in 1962 and had to return back to India. Between 1974 and 1980 the majority of the community lived in a transit camp in the area surrounding Bettiah, the district capital of West Champaran, where at some points the practice of reusing sewage as fertiliser was common however this has not continued since locating to Rupaliya (Personal Correspondence, 2013). In 1980 they bought land and Burmi Tola was founded. In addition to plots to build houses they were also able to purchase agricultural land for cultivation. Of the 37 households in Burmi Tola 31 are currently land owners. The main livelihood is farming with people working either on their own land or on others peoples land. In the community 75% of households have kitchen gardens where vegetables are cultivated for personal consumption in addition to the agricultural land (WaterAction, 2012). Of the 37 households, 36 belong to the Koiri caste (vegetable sellers) with one household belonging to a shopkeeper caste. This means that the community has a fairly homogenous caste system.

Figure 1: Map of India with Bihar highlighted (Google Maps, 2013).

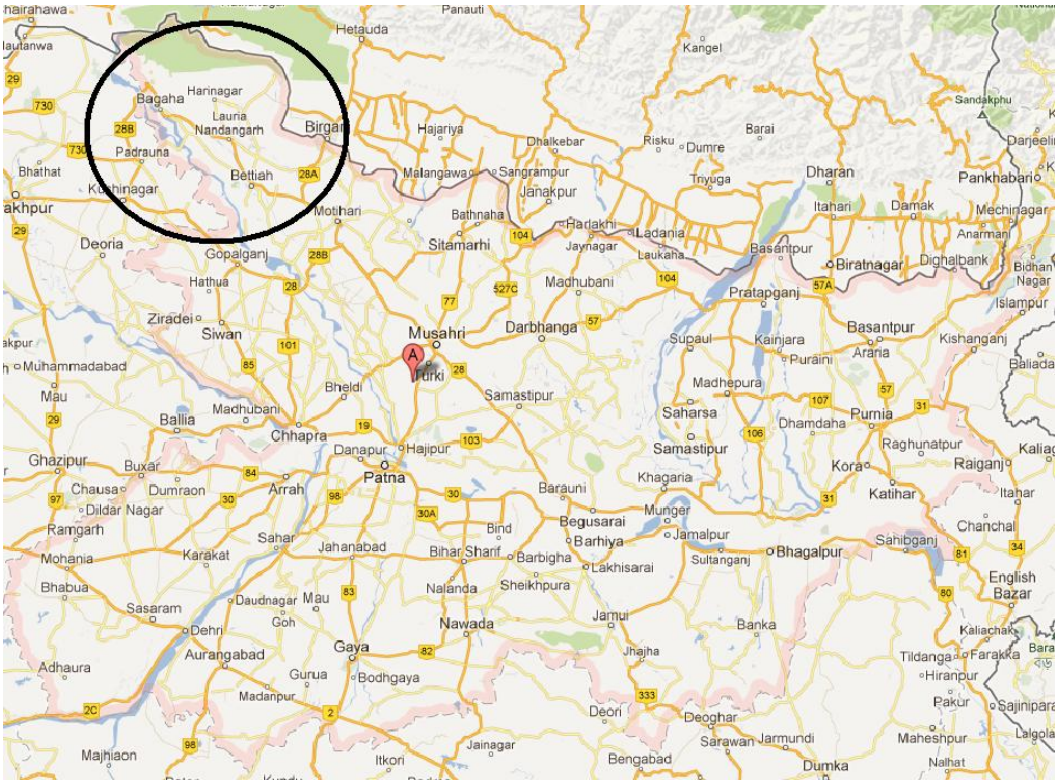

Figure 2: Map of Bihar with West Champaran highlighted (Google Maps, 2013).

Figure 3: Map of West Champaran with area of main study site highlighted (Google Maps, 2013).

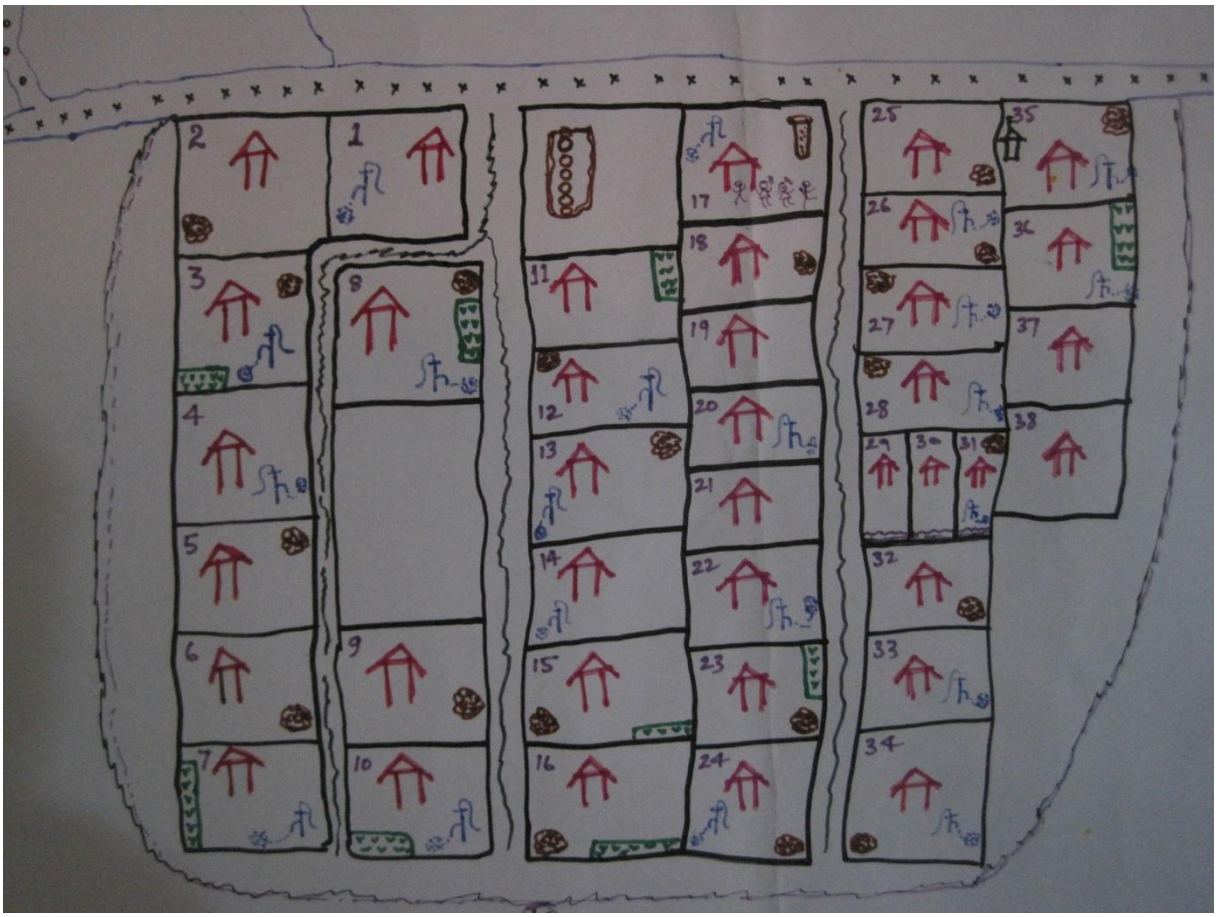

Figure 4: Map of Burmi Tola created by WaterAction with the help of the community. All households are listed. Number 17 is the school. At the top of the map is the main road (Photo taken by Myers, 2012).

The area experiences flash flooding around seven to ten times a year which last about three to five days. Of these one or two are considered to be worse than others where the water in the houses is one and a half to two feet deep and even higher in the fields (WaterAction, 2012). This is followed by waterlogging with areas being waterlogged at least three months of the year. During periods of flooding open-defecation is extremely difficult and the road is used for defecation with different time slots allocated for women, elderly and men; 4-5am, 5-6am and 6-7am respectively (Ibid). Moreover, the flooding leads to rubbish from outside entering the houses causing unhygienic conditions (Ibid).

Under the guidance and support of The Stockholm Environmental Institute (SEI) and the Water, Sanitation and Hygiene Institute (WASHi) WaterAction, a local NGO, is in the process of installing UDDT in each household and at the school. WaterAction is a local organisation run by one man who has employed two field workers for this project. It functions under an umbrella organisation called

Megh Pyne Abhiyan which is made up of five NGOs who work with water and sanitation issues across Bihar. The idea behind the project in Burmi Tola was to establish a community centered, driven and owned alternative secure sanitation process and facilities and create an Open-Defecation Free (ODF) community (SEI and WASHi, 2010). Each household has its own separate UDDT built on the same plot of land as the house. For the construction to begin on the substructure the household must first undertake the foundation work themselves. WaterAction, with the funds from WASHi and SEI, then build the substructure out of concrete and bricks. The superstructure is then financed and built by the individual households (see figure 5). The project started in April 2012 and at the time of the first field visit in February 2013 only five units had been fully completed (Personal observation, 2013).

The UDDT systems installed in Burmi Tola are constructed out of brick and then covered in cement. The structure is made up of two chambers where the faecal matter is stored. The entrance to the chamber is through a hole at the top, it has a lid that needs to be removed when using the toilet for defecation. After each defecation ash is placed in the faeces chamber to ensure that it is dry and to minimize the smell. Once one of the chambers is full it is not used for six months until the faeces has decomposed and is ready to be reused as fertiliser. While the faeces in one chamber are decomposing the other chamber is used. Therefore, only one chamber is being used at a time. The system is raised so that flood water cannot enter and the chambers remain dry. The urine is directed into another hole and travels down a pipe straight into a jerry can where it can be used immediately. At either end of the system there are separate pipes for wash water used for anal cleansing. Some households collect this water in a pot and dispose of it in a safe manner while others have planted a banana tree underneath the pipe as the wash water makes the ground very fertile.

Figure 4 shows what the top of the chamber looks like. The two holes on the far ends are for wash water. The peg in the hole on the right is a way to indicate that the other tank is currently being used. The blue lids cover the faeces chambers while the hole in the middle is for the urine. In the picture you can also see a bucket full of ash that needs to be placed in the faeces chamber following each time that someone defecates. Next to it is a jug filled with water used for anal cleansing. Figure 6 shows the system from the outside. The two pipers to the left and the right of the system are where the wash water exists. The household here are collecting the wash water in a clay pot which can be seen on the left hand side of the picture. Immediately left of the stair case is the urine pipe which transports the urine into a jerry can.

Figure 6: A completed UDDT. The substructure includes the concrete chamber and the stairs. The superstructure refers to everything on top of the concrete. The household have made the super structure out of grass, bamboo and mud. They have also chosen to erect a hand rail to help elderly members (Photo taken by Myers, 2013)

Figure 5: A picture of the top of the sub-structure. What each hole is for is written in Hindi. The chamber on the left of the picture is currently in use (Photo taken by Myers, 2013)

Ecosan appears to be an economically efficient and environmentally friendly technology which will benefit the community for various reasons. Firstly, before the project started one toilet had been constructed by one family for an elderly man however there were no other facilities. Open defecation was practiced by the rest of the community and in the school with economic, social and environmental consequences. Ecosan toilets are also considerably cheaper than conventional water based models with units costing approximately 8,000 rupees as opposed to the septic tank which in the nearest town costs 20,000-22,000 rupees to construct with costs in Burmi Tola being even higher (Personal communication, 2013, #15). The economic benefits are also favourable for this project as fertiliser costs will be lower. Furthermore, unlike in the Western world where large-scale socio-technical networks for water transportation and treatment of wastewater have developed (Hegger et al., 2007) these are non-existent in this area.

There are however many barriers to implementing this kind of controversial technology that requires the handling of human excreta. Despite the project beginning in April 2012 after ten months one member of WaterAction believed that only 60% of the population had been convinced about the reuse of urine whereas only 40% have been convinced by the reuse of faeces as fertilizer (Personal

correspondence, 2013, #17). While another employee put the figures even lower saying only 50% were convinced about urine and 30% about the reuse of faeces (Personal correspondence, 2013, #18). Along with this social resistance there are also economic, environmental and technical barriers to the up-scaling of this project.

5. Methodology

5.1 Meta-physical perspective:

This study examines the world through a transition lens; the research questions and the collection of data were theory-driven having been developed under the ideas proposed in TT and TM and therefore a predominantly deductive approach is taken.

In this study knowledge has been created using interviews and observations to look at the barriers associated with implementing new technologies. In order to generate this knowledge interviews and observations were made with data being collected objectively and the results being described and discussed (Bryman, 2008). TM was used as a framework and the ideas behind TT were accepted. The theory was used to assume that a possible transition to more sustainable sanitation systems was possible. To look into reasons for these barriers and ways to overcome these barriers theories and frameworks become important parts of this discussion.

Cultural and social views are assumed as being shared amongst communities which has impacts on the uptake of new socio-technological regimes. Cultures and social views are seen as a major constraint on the implementation of ecosan. Therefore, an objectivist ontological stance is taken (Bryman, 2008). Beliefs and values then become important factors to assess (Ibid)

5.2 Approach:

Strategy: This thesis takes a qualitative single case study approach looking at the introduction of ecosan in Burmi Tola. Data was collected on site over two one week periods in February and March 2013. Two additional trips were made where observations were taken. In addition two focus groups were run in another community. However, this exercise was conducted in order to support and confirm the findings from Burmi Tola which is the main focus of this study.

Case study: A case study is the investigation of an issue or a problem through one or more bounded systems (Creswell, 2007) and are usually used to investigate groups, organisations or social phenomena that are set “in a real-life context” (Yin, 2003). In this study the aim is to conduct a detailed and intensive analysis of a case followed by a theoretical analysis (Bryman, 2008). Consequently, a case study research approach is appropriate for this study.

Qualitative study: Qualitative research methods are usually employed in case study designs because these methods are viewed as particularly helpful in the generation of an intensive, detailed

examination of a case (Bryman, 2008). Additionally, a qualitative stance is necessary because the research questions require an in-depth study of people's different views about the project in order to reach a proper representation (Ragin and Amoroso, 2011). What are under examination are the opinions community members have about the whole project with the interest being to uncover the key barriers (Ibid).

Triangulation: More than one method was used in order to confirm findings (Bryman, 2008). Semi-structured interviews and observations were undertaken in Burmi Tola. Alongside this two focus groups were carried out in another village were identical UDDT systems had been installed to cross-check the data collected in Burmi Tola helping to gain validity. This project was run by another organisation also under the Megh Pyne Abhiyan umbrella in a region that also experiences periods of flooding during the monsoon.

5.3 Methods and techniques:

Semi-Structured Interviews: Doing qualitative interviews is an appropriate method because this study looks for visions and opinions instead of facts (Silverman, 2010). The study is interested in how participants frame and understand issues and what they view as important and not important (Bryman, 2008). It is also important that interviews have a certain level on comparability. Consequently, semi-structured interviews are the main method of data collection rather than structured or unstructured interviews.

Those interviewed included sixteen villagers and all three employees of WaterAction. Purposeful sampling (Bryan, 2008) was employed in order to interview people of different genders, ages and positions in the household. The selection was also based on what stage in the building process the toilet was in. One member from each of the five households with completed units were interviewed while the remaining eleven were at different stages. Despite planning for a gender balance complications on the ground meant that of the sixteen villagers nine men and seven women were interviewed. The age of those interviewed ranges from nineteen to seventy-two. The interviews ranged from thirty-one minutes to one hour and twelve minutes. All interviews were recorded and transcribed fully immediately in English following the interviews. Interviews were stopped after nineteen interviews due to saturation and no new insights were being gained (Ibid). The interviews were taken using an interpreter fluent in Bhojpuri, a local dialect of Hindi.

Observations: The pilot community was visited numerous times in order to conduct the interviews. While on site simple unstructured observations were conducted (Bryman,2008). No schedule was

used to record behavior however while in the field notes were taken (Ibid). Photos were also taken which can be seen in figures 5 and 6 and Appendix 1.

Focus Groups: Two focus groups were run in another village where identical UDDT systems had been installed. Separated by gender one focus group with men and one focus group with women were conducted. Like the semi-structured interviews an interpreter was used, interviews were recorded and transcribed immediately following the discussions.

Documents: Documents written by WaterAction, SEI and WASHi were also used. This included primary data collected in a study carried out by WaterAction in 2012 and project outlines written by SEI and WASHi.

5.4 Scope, Limitations and Transferability

Scope: This thesis is focused on the implementation of ecosan on the micro level. Discussions on national and global scales are only discussed in relation to the effect they have on the pilot project. Therefore, this thesis is looking at ways of how a small scale niche project, such as the one in Burmi Tola, can be managed to support a transition to a more sustainable sanitation system.
It is also only focusing on communities that currently have no improved sanitation facilities in place and are currently practicing open-defecation. It does not look at the barriers and opportunities to introducing more sustainable systems into areas where there is already sanitation infrastructure in place.

Limitations: A critique of the case-study approach is that it is difficult to generalize because of different contexts in different cases (Creswell, 2007). However, it adds to other cases written on other innovative sanitation pilot projects. Moreover, it contributes to TT and TM by operationalizing it in a different context.

There are also many limitations to this kind of study in this kind of area. Firstly, being unable to speak the language an interpreter was used. Being a man and having a male interpreter may also be a limitation when interviewing women about private issues such as sanitation practices. Secondly, being an outsider in the community has implications such as not necessarily trusted. Thirdly, finding places to interview people without any disturbances was also a problem. Due to the lack of space and large households many interviews were taken outside with disturbances from other family and community members.

Finally, with regards to TM, using a framework developed and used in the developed countries is problematic when taken into a different context however this is discussed further later and adapted accordingly.

Transferability: By taking a qualitative approach focusing intensively on such a small case the results and the subsequent discussion can become difficult to transfer to other projects. However, this thick description enriches the database of knowledge (Bryman, 2008) on ways to improve discussions on sustainable sanitation and increase improved sanitation coverage. What is learnt and recommended can be used in other similar environments.

5.5 Ethical considerations:

The six key principles of ethical research outlines by the Economic and Social Research Council in *ESRC Framework for Research Ethics (FRE) 2010* (see Appendix 2) were followed. Firstly, the research had been designed and undertaken to ensure integrity, quality and transparency. The methodological explanation has shown the research procedures and how findings were arrived at (Bryamn, 2008) Secondly, everyone involved in the research process was informed of the nature of the study, the methods and the use of the research. Thirdly, the information gathered through interviews, observations and focus groups were collected in a way to ensure anonymity. No names were taken and interviews have been numbered. To ensure anonymity in such a small community the gender and age of the interviewees has not been disclosed in the thesis or in the appendix as this could lead to people discovering who the person is. Fourthly, participants were told at the beginning of every interview that they did not have to be there and that they were free not to answer any question they did not want too. Fifthly, no risks were taken so no harm came to me, my interpreter or the research participants. Finally, although the study was designed and undertaken by independently it was contributing to a wider project being undertaken by the SEI and the WASHi and the research presented was made possible by their financial assistance and support.

6. Theoretical Framework

6.1 Transition theory:

Sustainable development requires system innovations that see changes in social and technological systems (Schot and Geels, 2008) this includes the redesigning of products, lifestyles, processes and structures (Wal et al., 2009). Transition Theory (TT) is already at the core of sustainability research (Grin et al., 2010) and provides frameworks to analyse socio-technological system changes or transitions. Transitions are changes in structures, institutions, culture and practice at a societal level (Loorbach, 2007). Unlike standard innovation transitions span a much longer lifetime, are surrounded by uncertainties, affect a wide range of fields and are not focused on market demands but on the development of public goods and services where markets are yet to function properly (Ibid). Transitions happen when prevailing societal structures, or regimes, are put under pressure by external changes in society alongside the development of innovations described as niches (Loorbach, 2010).

TT and TM are both important for this study as the research is concerned with understanding how a niche technology can be successfully managed to enable up-scaling. A change to ecosan is a socio-technological transition rather than just standard innovation because of a number of different reasons. Firstly, the transition and scale-up of this technology in northern Bihar and other flood areas is expected to take a substantial period of time. Secondly, due to many different factors including social, cultural and technical factors uncertainty is high if the installed ecosan systems will be used to their full potential, the toilets are used and the excreta are reused as fertiliser, in the pilot project. Even higher uncertainty exists if we consider the scaling-up of the technology where further economic and institutional factors are added. Thirdly, these new systems affect many different fields including health, gender equality and agriculture. Finally, the project is funded by the Swedish International Development Corporation Agency (SIDA) a governmental development agency that is more concerned with development of communities rather than increasing profit. Below TT is presented with both the multi-phase (Rotmans, 2005) and multi-level (Geels, 2002) being outlined. TM is then presented with detailed descriptions of each of the four phases.

TT has two different analytical concepts: the multi-phase and the multi-level. The multi-phase (Rotmans, 2005) identifies four different stages of a transition; predevelopment, take-off, acceleration and stabilization. The hypothesis behind this is that *'*transitions in time can be described as alternating phases of relatively fast and slow dynamics, which together form a strongly non-linear pattern where there is a shift from one dynamic to another' (Rotmans, 2005, 23). It is represented by

an S-curve which outlines an ideal transition where a successful take over is achieved and stabilized however this is not the only path that can be taken and there can be non-ideal outcomes and reverse transitions (Rotmans, 2005).

The multi-level concept (Geels, 2002) discusses three levels: the landscape/macro level, the regime/meso level and the niche/micro level. Proponents of TT suggest that transitions are the result of interactions and innovations at these three different levels (Kemp and Loorbach, 2006).
A landscape can be seen as a set of deep structural trends. It contains diverse factors like oil prices, economic growth, wars, emigration, broad political coalitions, cultural and normative values and environmental problems (Geels, 2002). Changes in trends can take place but progress and developments are relatively slow (Rotmans, 2005). In a transitions study looking into the possibility of ecosan in Europe the landscape was defined as 'cultural beliefs and routines that have been built up around the handling of human waste, the appealing flush-and-forget principle of conventional toilet systems' (van Vilet, 2006, p.351). For this case study the landscape factors are similar with cultural beliefs and values conflicting with the handling of human excreta. Other landscape trends include how sustainable development is viewed which has an effect on what policies and practices are undertaken (Faran, 2010). Furthermore, the wider economic system can be described as a landscape factors.

Regimes consist of a network of actors and social groups, regulative, normative and cognitive rules and material and technical elements (Berkhout, 2010). They are the dominant practices, regulations and interests and have high levels of resistance to change (Rotmans, 2005). Regimes embody strongly held convictions and interests concerning technological practices and ways to improve them (Smith et al., 2005). It is at this level where the stability of existing technological development is (Geels, 2002). The regime here consists of the current practices of open-defecation alongside institutional arrangements, how development projects are funded and the idea that conventional water based sanitation systems are the best solution.

Niches are described as 'spaces where innovative activity takes place and where time-limited protection is offered against dominant selection' (Berkout et al., 2010, p.264). They are less defined than regimes and do not follow the same rules (Jørgenson, 2012). Consequently, it is here where radical innovations are produced and developed through learning processes, price and performance improvements and support from powerful groups (Geels and Schot, 2007). Niches are essential for any technological transition because it is here where change begins (Geel, 2002). In this case the ecosan pilot project in Burmi Tola can be seen as a niche.

TT mainly looks at the importance of a technological push (Schot and Geels, 2008). Although technology is important 'niche innovations are rarely able to bring about regime transformation without the help of broader forces and processes (Schot and Geels, 2008, 545). As social scientists our role is to look at the non-technical barriers to the widespread implementation of innovations (Hegger et al, 2007). For sanitation this is very important as 'real-world implementation of such new sanitation concepts would require no less than a multi-level, social and institutional change' (Hegger et al, 2007, p.737). In addition, sanitation is a much more delicate issue in comparison to energy, water or transport systems (van Vilet et al., 2011). Therefore, social and cultural issues are of extreme importance. The importance of changes in the social system into transition research is highlighted. The barriers against a transiton to more sustainable sanitation practices that should theoretically improve social, environment and economic conditions are assessed. There has been much work on technological experimentation but far less on new forms of social organisation that incorporate these technologies into new systems (Hegger et al., 2007). Consequently, this is also what is explored.

6.2 Transition Management:

Based on TT Transition Management (TM) has been developed as an lens to evaluate how complex societal issues are dealt with as well as a way to develop and implement strategies to influence governance processes (Loorbach, 2010). It can therefore be used both analytically by researchers and as a practical management tool by practitioners. TM is based on both the multilevel and multiphase understanding of transitions alongside insights from governance literature. Proponents of the technique argue that is can tackle the many problems of sustainable transitions at the same time in an integrated way (Kemp et al. 2007). Transitions consist of societal processes of fundamental change making them extremely complex and therefore unable to fully plan or govern (Frantzeskaki et al., 2012). What TM provides are 'steering mechanisms and tools that coordinate societal and political processes in a participatory and deliberative fashion while engendering commitment to sustainability values' (Frantzeskaki et al., 2012, p.21). Four different governance types are identified: strategic, tactical, operational and reflexive. Activities are developed to influence, organise and coordinate these difference governance types so they align and reinforce each other (Frantzeskaki et al., 2012). These four types are the basis for the Transition Management Cycle depicted below where they are aligned with certain activities:

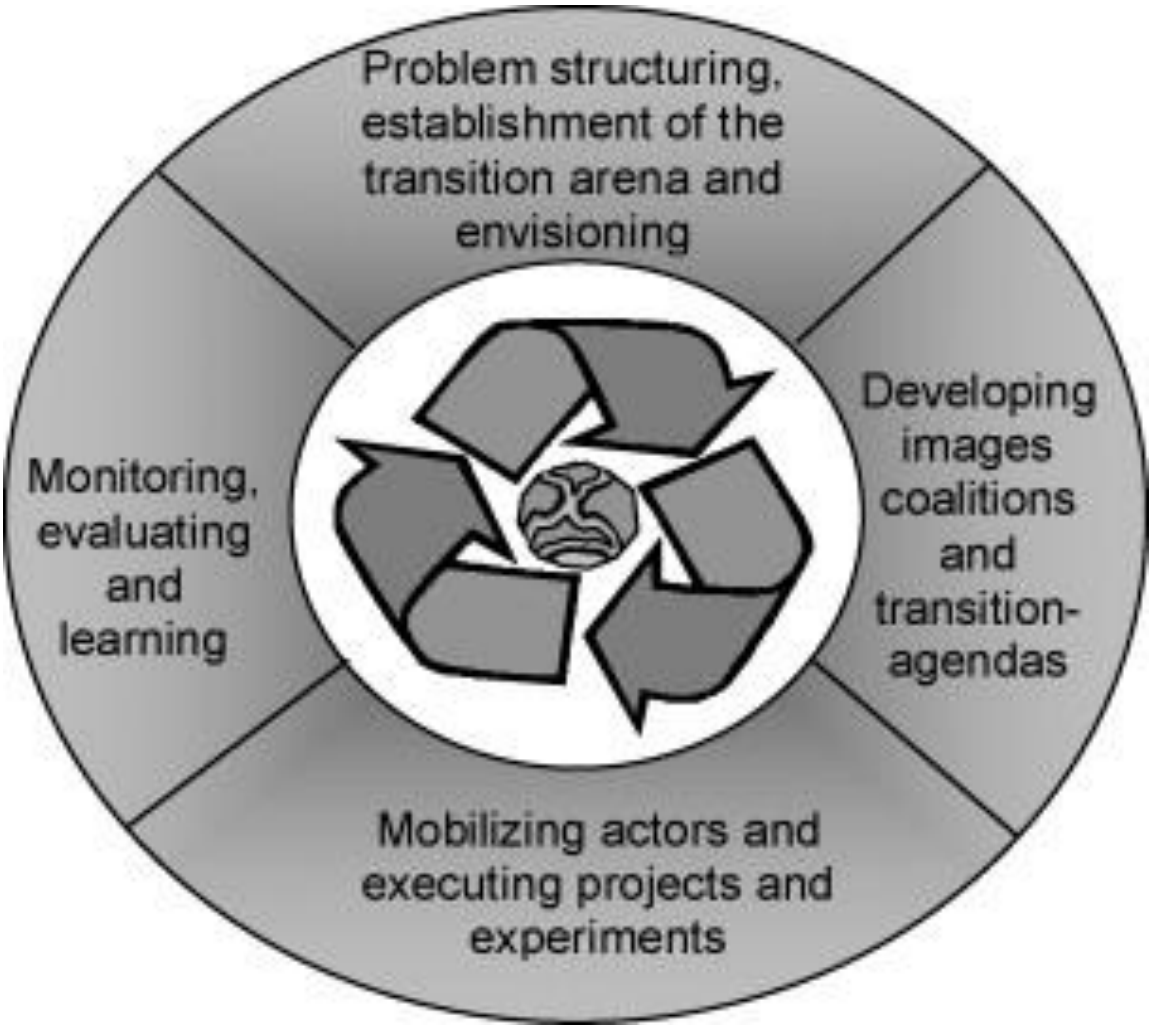

Figure 7: Transition Management Cycle. Phase 1 is at the top with phases 2, 3 and 4 following in a clockwise direction (Loorbach, 2010)

The first is strategic which entails structuring the problem, envisioning and establishing and organizing the transition arena. In TM the arena is a virtual space; it is a network used to stimulate innovation through creating a shared problem definition (Loorbach, 2007). Secondly, is tactical governance where future images are developed and a transition agenda and the necessary transition pathways are decided upon. The operational phase is where transition experiments are established and carried out and networks are mobilized. Finally, there is reflexive governance which requires monitoring, evaluating and learning from the transition experiments and other phases. It is in this phase where adjustments of the vision, agenda and coalitions occur (Frantzeskaki et al., 2012; Loorbach, 2010). These four different phases relate to management instruments that are participatory and focused towards stimulating or facilitating innovation (Frantzeskaki et al., 2012). These different phases shown in figure 7 are described in more detail below and presented alongside the results from the field study.

7. Results: A Transition Management analysis

Using the TM lens the Burmi Tola pilot project can be viewed as being in the third phase, the transition experiment, where experiments are established and carried out. It has however missed the first two phases of the cycle. There are many barriers that have been identified in the community which are analysed below.

7.1 Phase 1 - Problem Structuring and envisioning

In phase one we see the setting up of a transition arena consisting of a small selection of front-runners selected based on their competencies, interests, and backgrounds (Loorbach, 2010). In-depth conversations are held based on the systems approach. The discussions work towards bringing people's perspectives, assumptions and ambitions in line with one another. It is through this process that a shared understanding of the problem and the challenge this poses is acknowledged (Rotmans and Loorbach, 2009). A transition vision is created providing direction and focus for future work (Loorbach, 2010).

No shared problem:

Data collected from the field show that a barrier in this pilot project is that there is no shared perception of what the problem is and what is to be accomplished by introducing this technology. Is it a problem of poor farmers reliant on chemical fertilisers? Then the project is an attempt to reduce the costs of fertilisers. Is it an issue of people having no place to defecate during periods of flooding? Then making toilets that can be used during flooding is important. Or is it the health problems associated with open-defecation? If so the creation of communities free of open-defecation is the aim. In reality the project is trying to address all these pressing needs at the same time however this has not been communicated effectively to the community. Although an open-defecation community is strived for by SEI and WASHi this ideal is not as important to households as the reuse of excreta or places to go during times of flooding. A lot of stress has been put on the utility and productivity of the reuse of urine and faeces as fertilisers (Personal communication, 2013, #19). This focus on reuse has seen extremely positive results and has been an important factor in influencing the acceptance of this technology. All those interviewed spoke of the effect that urine has had on their crops (Personal correspondence, 2013). People take notice once they realise

they can save money as they do not need to purchase as much fertiliser, pesticide or insecticide. Furthermore, many of those interviewed spoke of the need to show new communities the difference it can make to plants as the best way to promote it to new villages (Personal correspondence, 2013). However, from the data collected relying too heavily on reuse will not lead to open-defecation free communities. Although speaking very positively about the benefits of these new systems three cases were noted where members of households were still openly-defecating (Personal correspondence, 2013). Two people spoke of the inconvenience of coming back to the house to defecate when they have to start work early in the field while one interviewee from a considerably large household stated that if the toilets were occupied members of the family would use the field (Personal correspondence, 2013). In addition, while walking through the village to look at the different UDDT systems one elderly lady said that this technology was for young people and that she would still go outside (Personal correspondence, 2013). Not all community members see it as a health problem with only six of out sixteen saying that using toilets can increase the health of villagers (Personal correspondence, 2013).

The environmental conditions of the area also contribute to people's understanding of the needs of toilets. Of the sixteen people interviewed six mentioned the importance of safe places to go during flooded periods. One interviewee said:

'Recently there was heavy rain and water was everywhere, this kind of latrine was very useful' (Personal communication, 2013, #4)

While another person mentioned the dangers of open-defecation saying that:

'*In the rainy season in flooded areas we have to face many dangerous snakes and poisonous creatures'* (Personal correspondence, 2013, #1).

Yet, this does not mean people will use the toilets all the time and therefore the community becoming ODF all year round.

7.2 Phase 2 – Development of Sustainability Images, Pathways and a Transition Agenda

In phase 2 images are created which are used for mobilizing social actors (Rotmans and Loorbach, 2009). These images can be reached on various transition pathways and include transition goals

which are qualitative rather than quantitative (Ibid). Pathways for this case include the adoption of ecosan, the continuation of open-defecation or the uptake of conventional water based toilets. These images can be altered depending on the results of transition experiments (Ibid). The agenda is used as a compass for the group of frontrunners and contains content, process and learning objectives (Ibid). A wider group of people are invited into the process from NGOs, governments, knowledge institutes and intermediaries (Loorbach, 2010).

No shared image or pathway:

There is no clear vision on what pathway to take or what is being strived for. If the sustainable image is that of communities being ODF then this can be achieved through different pathways. One pathway is households having conventional water based septic tank toilets with another pathway being UDDTs. Most of the world views conventional sanitation models as the pinnacle of modernisation (van Vilet et al., 2011; van Vilet, 2006). It has been shown by others that UDDTs are viewed as a sign of poverty, underdevelopment and low status (Rosenquist, 2005).These beliefs are also apparent in this community with many of those interviewed still preferring the conventional water based septic tank model; even when people have started using ecosan systems (Personal correspondence, 2013). Of the sixteen villagers spoken to six said their ideal toilet is the ecosan model while seven would prefer a septic tank model, one did not wish to answer, one was not asked and one person said that if they had a field then ecosan is best but if not they would rather use a septic tank (Personal correspondence, 2013). One interviewee who preferred a more conventional toilet said that:

'If a government project will come I will ask for a community toilet with a septic tank model and bathroom. It is better.' (Personal correspondence, 2013, #11)

From the data collected there is clearly not an agreed upon idea about what the best system is and how it should be envisioned.

7.3. Phase 3 – Initiation and Execution of Transition Experiments and Mobilization of Actors

In phase 3 experiments are created which are derived from the visions, images and pathways developed. Connections existing projects can also be made provided that they link to the context of transition (Loorbach, 2010; Rotmans and Loorbach, 2009). In these experiments actors such as small businesses, local groups, citizens and consumers can become involved in the long-term sustainability

issues (Rotmans and Loorbach, 2009). Diversity of experiments is important but they must contribute to the envisaged transition on the systems level (Loorbach, 2010). As well as being costly, this stage is also time-consuming taking approximately 5-10 years (Ibid).

Within the transition experiment phase three processes become important: *deepening*, *broadening* and *scaling-up*. *Deeping* refers to learning as much as possible about a transition experiment within a specific context. Learning about local shifts in ways of thinking, values and perspectives and practices is important. This learning process is contextual and partial so variation is essential. Therefore *broadening*, repeating transition experiments in different contexts, is important. This does not mean repeating without further variation; each new experiment is a new adventure. *Scaling-up* involves embedding experiments in dominant ways of thinking, doing and organising either at the regime level or emergent niche-regime level. Sustainable practices that are deviant or unusual become dominant or mainstream. *Scaling-up* is less concerned with products, services or users but about perspectives, ways of thinking, routines, legislation and institutions (van den Bosch, 2010).

Conflicting values

Handling is a major barrier to using this technology and consequently a problem for implementing new experiments. Concerns expressed were a fear of toilets due to things such as the smell, the fear of insects and the dirtiness. Others are concerned with having a heap of human excrement so close to the house. Others were nervous about what other people in the community and guests will think about them (Personal correspondence, 2013). However the concern regarding the handling of urine and faeces appears to be the biggest barrier that needs to be tackled. There is a conception that human excreta are impure and not to be touched. Every person interviewed talked about originally feeling hatred towards the handling of urine and faeces when the project was first proposed (Personal correspondence, 2013). Having always avoided excreta in the fields many people questioned at first if they would be able to touch and carry it themselves (Personal correspondence, 2013). One interviewee said:

'*Many people think that when the tank is full they will have to carry it to the field so they continue to openly defecate. It is still happening with some people who have toilets and some people who do not think like this'*. (Personal correspondence, 2013, #14)

The unwillingness to handle human excreta is the most frequent concern amongst community members. Also, a religious barrier was identified by one respondent who spoke of the problem of

using ‘impure’ substances on plants that are offered to gods and to guests (Personal correspondence, 2013, #1).

People may use the toilets and reuse the product as fertiliser however certain community members still view human excreta as being impure and hold reservations about using it. One person described their feelings towards urine and faeces being different depending on what they think about at the time:

‘If I think about the utility it is useful if I do not I feel hatred. It smells. I cannot bear the smell even when someone urinates outside in the summer time and there is a wind the house smells’. (Personal correspondence, 2013, #16)

While another person said that:

‘These things are impure no doubt but when you use it it does not matter if it is impure or not.’ (Personal correspondence, 2013, #9)

When asked why they answered:

‘From childhood I have been told it and from seeing and smelling it. I do not wish to touch and try to avoid it in the field. I think it is impure and cannot handle it but going through the usefulness it does not matter’ (Personal correspondence, 2013, #9)

There is clearly a tension between the utility and the interests and values people hold.

Lack of participation and diversity:

The pilot project is testing and experimenting with UDDT systems however little work is done to develop this innovation. There has been little involvement by community members in the technical and design part of the project and little variation. Although people stated that the NGO had taken on certain design ideas such as raising the place people put their feet when squatting for more comfort and increasing the height of the hole to the faeces chamber lessening the distance between the anus and the entrance to the chamber to ensure all faeces enters (Personal correspondence, 2013). Yet there is little evidence of these suggestions being taken on board in later designs. In addition, people who requested more steps up to the toilet, as the height of them can be steep for less mobile users,

were told by the NGO that they were unable to deviate from the original design (Personal correspondence, 2013). Innovations are not born perfect but take time for adaptations to occur that fit with user preferences (Kemp et al., 2007). This has also been noted by members of the community with two young residents stating a problem being that:

'the design is the same everywhere. There should be variation so new ideas develop. New thoughts based on location. Planning should be flexible.' (Personal correspondence, 2013, #2)

There is little work being done to try to develop this existing technology and therefore more suitable designs are not found.

Economic issues:

The project has also suffered from a lack of financial resources. The technology is still unaffordable to many with 11 out of the 16 spoken to saying that they would not have been able to bear the full costs (Personal correspondence, 2013). While 2 respondents questioned why the organisation were not covering the whole costs (Personal correspondence, 2013). Consequently, communities are reliant on subsidies. Furthermore, overspending on the first set of units has led to costs being cut on later units with some problems in the construction. One household spoke of their anger due to the concrete sub-structure crumbling away. Other units have cracks that have already started to appear (Personal correspondence and observation, 2013). This has meant that trust in the project by certain members of the community is being undermined.

Time constraints

Transitions experiments are lengthy processes with the amount of time recommended being 5-10 years (Loorbach, 2010), however this project is only funded for a two-year period. Therefore, there is a time issue as the project is unable to run the experiment for an appropriate amount of time.

7.4 Phase 4 – Monitoring and Evaluating the Transition Process

Phase 4 requires monitoring and evaluating of the transition process. Continuous monitoring of the transition and the TM process is essential (Rotmans and Loorbach, 2009). The transition process can be monitored through physical changes in the system at different levels. Monitoring TM involves monitoring actors involved, the agenda, the experiments and the process as a whole (Ibid). The *deepening* process is a key part of this phase.

Evaluation

There are problems with evaluating these projects on the ground. With the case of Burmi Tola there is a big difficulty in evaluating the successfulness of the project. Many contradictions were identified throughout the data collection process. There is evidence to suggest that people agreed to take part in the pilot so the community image would rise and other programs would come such as the building of a road and projects to increase the water quality (Personal correspondence, 2013). Therefore people could be reluctant to speak about problems with the pilot. It was said that people might also think that if they accept the pilot toilets they might get 'better' (conventional) toilets (Personal correspondence, 2013). People were very keen to show their allegiance to the project. One household said that they were using the toilet and spoke of the benefits of this system even though it was apparent after two visits that they were not using it (Personal observation, 2013). One person spoke about people who argue against this system having no self-respect however when spoken to later they said they had yet to use the toilet despite its completion three days previously and had been continuing to openly-defecate. The also had a problem with the tank as the outer layer of concrete had begun to crumble away. When asked why they did not mention this before they said that she had been told not to by other members of the community so as not to jeopardise the rest of the project (Personal correspondence, 2013).

8. Discussion:

As outlined in the previous section there are many barriers associated with the new niche technology. Having analysed what the barriers are using TM the next question is why they exist and how they can be overcome. Concentrating on the micro level appropriate changes to the landscape, regime and niche level are discussed below.

8.1 *Dynamics between landscape and niche levels*

In the Burmi Tola pilot project landscape factors, such as societal values and different ideas of sustainable development in the sanitation sector, are not considered when designing UDDTs but seen as barriers that need to be overcome through promotional techniques. For example, it is not questioned if UDDTs is the correct solution in line with sustainable development in sustainable sanitation. The focus is on convincing people to use this technology. Sustainable development means different things to different people and many competing metaphors have been used to outline what it means including growth and abundance, sustainability, security, an illusion, lodestar and freedom (Grieg et al., 2007). All development practitioners argue that societies need changes however debates come about as to what sustainable development should entail, what changes are necessary, what are the tools and who are the actors required (Hopwood et al., 2005). Depending on how development is envisioned will affect what policies and practices are undertaken and what tools are used (Faran, 2010).

The implementation of ecosan toilets can be seen as being in line with the ideas surrounding Ecological Modernisation (EM) although not prescribing to it uniformly. EM is used as a way to describe a technological-based and innovative-orientated way to environmental policy (Jänicke, 2008). In Burmi Tola UDDT systems are relied upon to deal with the environmental, health and economic problems. EM emphasises the reinforcing nature that environmental and economic benefits can have (Christoff, 1996). The UDDT systems are low cost solutions costing 8,000 rupees as opposed to 22,000 (Personal correspondence, 2013), so are more affordable. Also, farmers are able to save money by spending less money on fertilisers, a point heavily stressed while promoting them to the community (Personal correspondence, 2013), while also protecting the environment from contamination by human excreta. EM projects can be reached without public participation in decision-makings (Wright and Kurin, 2010) as it is ‘ambivalent on participation, taking a fairly technocratic, top-down approach to

community involvement' (Young, 2000, p.27). This has also been seen in other studies on ecosan in Ghana (Mariwah and Drangert, 2011), Bangladesh (Quazi, 2006), Pakistan (Naweb et al., 2006) and in more general studies (Avvannaver and Mani, 2008; Rosenquist, 2005). This approach of promoting a specific technological solution in Burmi Tola has failed to tackle deep rooted landscape factors such as culture and values due to a the technological push based on ideas of what development should be. Viewing development differently can therefore help incorporate social values into projects.

Ideas of development can broadly be categorized into two competing concepts of sustainability, weak and strong, both of which have distinct ideas about development. These two opposing visions however are more concerned with the debate surrounding the substitutability of natural capital for manufactured capital. Weak sustainability believes that natural and human-made (or manufactured) capital is interchangeable while strong sustainability is more pessimistic about this substitutability (Ang and van Passel, 2012). However, this debate is more concerned with the environmental impact and economic consequences and fails to bring the social aspect to the center of the debate. These philosophies are therefore not appropriate where social aspects need explicit concentration. As an alternative to ways of envisions sustainable development in sanitation, Amartya Sen's metaphor of sustainable development being freedom (1999) and the Human Development paradigm, with its strong social perspective can strengthen the current niche experiment on the ground. It differs from weak sustainability by integrating environmental concerns while does not subscribe to the strong sustainability approach arguing for preservation of the environment in order to preserve freedom for future generations (Faran, 2010).

Accepting the ideas behind Human Development requires a commitment to strive for human freedoms including both opportunity freedom and process freedom. Opportunities are the capabilities people have while process freedoms refer to the freedom people have over their own actions and decisions. This means that the *ends* and *means* of development are both important and are interlinked (Sen, 1999). For this project the *ends* of the project is an ODF community with a UDDT installed in every household and in the school. The aim is also to increase the health of the people and the environment alongside people's economic capacity with the reuse of human excreta as fertilizer. The *means* of this pilot has been through the promotion of this technology by emphasizing the productivity of this toilet and the benefits it will have to health (Personal communication, 2013, #19). Demonstration of handling by the NGO (Personal communication, 2013, #17) and the construction of trial plots using human excreta have both been relied upon. However, with regards to

the *means* there are certain processes and procedures that cannot be ignored and must be respected (Sen, 1999) which have not been included in this project. Social choice exercises are an example of one of these practices (Ibid). Social choice is how groups of people come to an agreed decision given the differences in personal preferences, concerns and predicaments (Sen, 1999a). Social choice requires participation and public discussion. It is through these processes that a shared set of values and commitments can be formulated. This leads to the *ends* of development being changes that people value and have reason to value (Sen, 1999). This project, like others that promote ecosan technologies, have failed to acknowledge the need for social choice exercises in contributing in the design of appropriate solutions by not involving participation or public discussion at earlier stages. Consequently, there is a higher risk of a conflict between values and technologies.

Choice is an important factor in Sen's ideas of development. If lifestyles are disrupted and people are preventing from or forced into undertaking activities that can be sensibly seen as their personal choice then it is argued that the state of affairs has in fact worsened (Sen, 1995). Despite acceptance of UDDTs many people would still rather the conventional systems however were never given the option (Personal correspondence, 2013). Bringing choice into the equation would require communities to be able to select from a range of technologies for transition experiments. Rather than insisting on the narrow option of UDDTs other sanitation systems must be discussed; some which are based on the ecosan philosophy and some that are not.

The way sustainable development is viewed, a landscape factor in itself, reinforces other landscape factors which in turn has detrimental effects on the niche. Deeply ingrained cultural and value barriers to implementing a sustainable transition in sanitation are not taken into account. The change in one landscape factor can be beneficial for other landscape factors. By looking at Sen's Human Development paradigm to understand what sustainable development should be, it can be concluded that what is needed for this project and for similar projects it to acknowledge and incorporate deeply ingrained cultural beliefs and community values into designing new socio-technological niches.

Consequently, a change at the landscape level is required. A niche such as this, despite how powerful it may become, is powerless to change the landscape force of how development is viewed. This power is in the hands of international institutions such as the World Bank which is viewed as the archetype for development management (Murphy, 2010) with unique power and influence (Lera St. Clair, 2006). The World Bank along with other global institutions hold tremendous power over the direction societies develop (Ibid). EM is a crucial part of this hegemonic perspective that developed in

the 1980s and 1990s (Brand, 2010). EM is a hegemonic idea about environmental and social problems and the ways to deal with them which means technical and technological solutions (Ibid). The World Bank Institute, the research arm of the World Bank is one of the most important sources for knowledge creation on development and poverty. Therefore, the World Banks not only spreads its ideas of what development is but legitimizes it setting the scene for global politics and global knowledge creation (Lera St. Clair, 2006). It can be assumed that the World Bank has tremendous influence over other institutions. Consequently, although not funding the Burmi Tola pilot project it is structures at this global level that perpetuate these ideals and effect development projects outside of those they are directly investing in. In order to change these landscape factors it is these structures that need changing. Yet, this does not make the next discussion point irrelevant. There are still processes that can be changed at the niche level that make gradual steps towards changes in current sanitation practices causing regime and landscape changes and transitions to idealized sustainability visions.

8.2 Community participation in transition arenas

For a successful transition to more sustainable sanitation practices this section will look at how to operationalize TM at the niche level. Including phases 1 and 2 into pilot projects can help steer society in these socio-technological transitions. This would therefore involve setting up a transition arena where a selected group of frontrunners could come to a consensus about what the problem is and develop sustainability images as well as the different possible pathways to follow. Based on four different case-studies, three in the Netherlands and one between Dutch and Belgian actors, transition arenas have been shown to play a pivotal role in developing new ideas and visions, supporting networks and learning and to influence existing regimes and regime actors (Loorbach and Rotmans, 2010). However, the question arises who should be involved in these discussions and debates? Who should these frontrunners be? How should it be structured? By accepting the "development as freedom" metaphor it becomes clear that the participation of community members is a necessity. The TM literature does not specify who exactly to include but gives guidelines. In the initial stage it should include innovators and strategic thinkers with the capacity to: consider complex problems; look beyond their own discipline and background; have a certain level of authority; can share and explain sustainable development visions within their own networks; ability to think together; be will to explore innovative ideas (Loorbach, 2007). This section shows the importance of including community members in this process and a possible way of doing this is explored. Frontrunners for this process are then identified.

Participation, similar to sustainable development, is an important but fuzzy concept. There are many different levels of involvement of participation and it can be both weak and strong (Grieg et al., 2007). In the pilot project many community members felt they had participated in the project however participation could mean something as little as making a cup of tea for the mason who was building the substructure, attending a meeting or selecting an appropriate site for the UDDT (Personal correspondence, 2013). However, as the case study has highlighted this level of involvement fails to take into account the conflicts the technology has with people's values. By including members of the community in the transition arena participation becomes stronger. From a Human Development perspective it is important to turn patients of development projects into active agents (Sen, 1999). By involving communities in the arena a transition in sanitation is brought in line with the Human Development paradigm. Transition arenas are social choice exercises where discussions formulate agreement. It is here where there is a convergence of perspectives, assumptions and ambitions (Rotmans and Loorbach, 2009). At the beginning stage there is the need for a societal perspectives relevant to the system under investigation (Loorbach, 2007). People from communities have a more complete perspective of their communities than outsiders. Furthermore, arenas need to set goals that are in line with socio-cultural beliefs (Ibid). Thus the process must involve consultation with the people who hold these socio-cultural beliefs. Finally, TM argues that sustainability images should be agreed upon within the arena (Ibid) so it important that people whose lives are affected by this new image be involved in creating it. Barriers in Burmi Tola appear because the image is not agreed upon and the solution does not incorporate socio-cultural beliefs which has led to tensions between economic (the utility of the product) and social (the hatred of handling) values. By moving from weak participatory methods to strong participatory methods a transition can be more fruitful. This conclusion is the inevitable outcome of the argument that has been preceded it. What actions this requires in order to operationalize it in communities in rural Bihar and what it will look like is far more complex and difficult to conclude on.

A possible model?

Every transition project is unique and requires a contextually specific participatory role (Loorbach and Rotmans, 2010). Designing a perfect participatory process is impossible (Avelino, 2009). However, in order to increase participation from community members into the TM cycle from the very beginning a new transition arena structure is proposed. In order to help manage a successful transition a model with a core arena made up of a of group frontrunners with sub-

arenas based in communities is suggested. It is these sub-arenas that communities such as Burmi Tola can be involved in the process at an earlier stage. A similar model has been proposed as a way to develop images (Loorbach, 2007). However, the different sub-arenas in the previous suggestion are made up of members of the core arena that are divided up to work on different themes. With this new proposal community engagement is part of the process. Under this model facilitators play a duel role being instrumental in activities both in the core arena and the sub-arena. In the sub-arenas they run social choice exercises, including public discussions and participatory methods, synchronizing opinions from communities where transition experiments are to take place. In the core arena they include community perspectives, including values, into the main discussions. The relationship between the core arena and sub-arenas is strengthened by the addition of an information flow in the opposite direction (see Figure 8). Ideas proposed in the core arena are then presented in the sub-arenas and are discussed giving communities more choice. Via this process the structure can move from a multidisciplinary exercise into a transdisciplinary exercise including the technology users and therefore bringing community values at the core of the discussion.

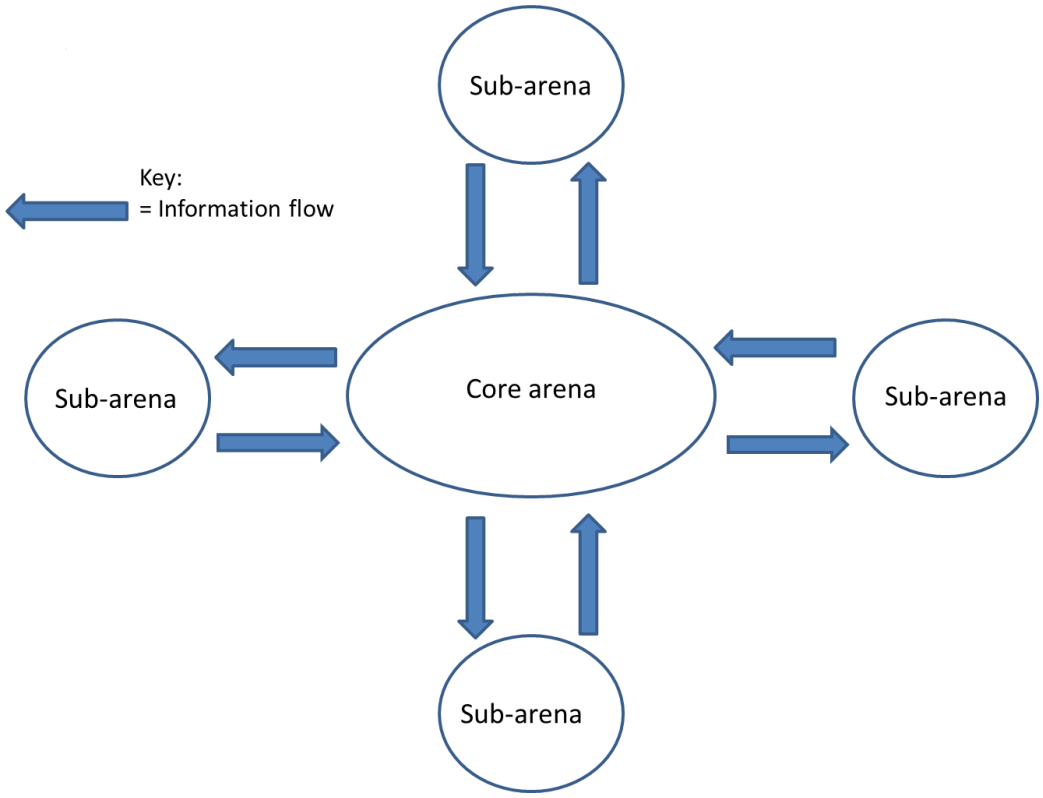

Figure 8: Shows the new management structure with a central core surrounded by different sub-arenas. The arrows represent information which flows in both directions via facilitators (Created by Myers, 2013).

Trained facilitators play a major role in this new structure. This role could be filled by Community-Led Total Sanitation (CLTS) facilitators who some of whom are based in Bettiah and already work in areas around West Champaran. CLTS facilitators are already interacting with communities discussing sanitation issues in village settings. Therefore, they are aware of local conditions and have experience of holding public discussions with whole communities. CLTS facilitators also have an understanding of the social barriers in local areas and ways to overcome them. Moreover, CTLS facilitators do not teach or instruct but facilitate communities to take their own action with no standard models of toilets (Chambers, 2009). Therefore, there is the additional benefit of no prescribed solution in mind. Finally, they have also demonstrated a commitment to facing the sanitation challenge.

In addition to the facilitators, other frontrunners must be selected for this process. Frontrunners or agents of change must be selected based on their capabilities, interests and backgrounds (Loorbach, 2007). It is recommended that 10 to 15 people are sufficient for *Phase 1* (Rotmans, 2005). Yet, TM assumes that there is the institutional and social capital in place and a portfolio of people that individuals can be selected from based on the appropriate criteria. However, very few organisations work on sanitation issues in Bihar and WaterAction is the only NGO that deals with water and sanitation in West Champaran. Therefore ideal candidates with the particular criteria as outlined by TM are not necessarily there in reality. It is then not a matter of selecting frontrunners but selecting anyone possible who is working on this issue. Frontrunners must also be able to spend large amounts of time and energy on the process (Rotmans, 2005). Yet, this takes the few people working on the ground away from overseeing and managing the transition process. What is suggested below is a number of people who are identified in the area. If they are able to commit their time to the process is unknown.

In addition to facilitators, a range of different perspectives from NGOs working at different levels should be included. Representatives from grassroots NGOs working on water and sanitation issues such as WaterAction and people from other oganisations who work in other parts of Bihar, such as SAMTA who works in Khagaria district installing ecosan toilets in Dalit communities. Individuals from national NGOs such as WASHi and Megh Pyna Abhiyan and international NGOs who work in Bihar such as SEI, Plan India and Water for People could also join the core arena. However, it is important that representatives from these organisations should not feel too attached to the UDDT or ecosan as frontrunners should not go into arenas with a strong attachment to a particular technology (Loorbach, 2010). Unfortunately with

grassroots NGOs working on a project by project basis this is impossible. WaterAction has three staff members all of which were working exclusively on the pilot project in Burmi Tola during data collection; for larger organisations such as WASHi and SEI this is more achievable due to the human capital that they have. However, it is important that they are represented by staff members who hold no specific attachment to this or other ecosan project. Joining them could be local innovative engineers as well as local craftspeople from local towns. More technically trained engineer's contrasted with more practical local craftspeople who know the local area under discussion and the availability and costs of resources could enrich discussions and make solutions more practical. In addition, experts from local universities and research institutes could also be brought to the table. By bring these different people together with different backgrounds and skills the aim is for an agreement on why a transition is necessary, what the new socio-technological regime would look like and what the different pathways are for getting there. Finally, by having facilitators represent community perspectives it means that values and societal beliefs are not ignored but brought into the transition arena model.

8.3 Obstacles to a regime transformation

In order to support and empower niche experiments certain changes at the regime level are necessary. TM has been used successfully as an analytical lens and as a practical tool under certain conditions however it can be problematic when used in a different context. Having been established in the Netherlands, TM has been used mostly in developed countries. For example the Dutch Ministry of Economic Affairs' use of TM has been well documented, described and analysed (Loorbach and Rotmans, 2010). Applying this tool to the basic needs of people in rural Bihar becomes difficult under different regime conditions.

Many resources are needed for this process. Long-term funding is necessary due to the longevity of the TM process and even more financial assistance is needed for a subsequent transition to take place. Currently the project only has enough funding for two years; the lack of long term funding has a huge impact on the possibility of upscale. The project in Burmi Tola has already suffered from a lack of financial resources with substructures beginning to show cracks and the concrete crumbling away. In order to operationalize a transition arena and empower niche projects secure funding for longer periods of time is needed. Searching for donors that can provide this is an important next step. Funding could come from the government run Nirmal Bharat Abhiyan (NBA) (originally called the Total Sanitation Campaign) or from development agencies working in the area such as Bill and Melinda Gates Foundation who run health projects in Bihar.

The process also requires a change in current institutional arrangements. It is only possible for transition arenas to be legitimized by regime players (Loorbach, 2007). Niches must also have the support of powerful groups who make up the regime (Geels and Schot, 2007). Powerful organisations and regime actors such as the NBA and development agencies such as Plan India and Water for People must give frontrunners enough space to discuss and develop innovative ideas while also supporting this process with resources such as spaces for experimentation and finances. Some frontrunners recommended above such as those representing national, international NGOs, government departments and universities work for institutions at the regime level. These institutions therefore must show some level of commitment to the cause without being directly involved in the discussion. Furthermore, governance actors involved in national sanitation development initiatives such as the NBA must be willing to give a platform for niche ideas to be presented to them so that successful solutions can be supported and up-scaled.

Technical support could be provided by initiatives such as the Bihar Technical Assistance Support Team (BTSAT) who works with the Government of Bihar through the Sector Wide Approach to Strengthen Health (SWASH). This project funded by the British government already has an office set up working on sanitation in the state capital in Bihar and has been funding CLTS activities and ecosan projects. However, this project is due to end in July 2014.

Necessary change at the regime level is a highly complex issue and many things need to be considered. Tackling the global sanitation crisis, especially in places like Bihar with 25% improved sanitation coverage, will be one of the major development challenges humanity faces in the 21st century. There is no blueprint for dealing with the deficit in improved sanitation facilities. This discussion has been centered on the micro/niche level however transitions occur on three levels. The regime and landscape levels are included but only as far as the effect they have on the niche level. Further research into the changes that would be necessary for structures and institutions to undergo in order to see a successful transition in sanitation would give a better understanding of the worked needed. Also a deeper understanding of the interactions between all levels will also enrich knowledge on how a successful transition in sanitation can be achieved.

8.4 *Reflection*

The length of time is an important element to consider and brings in an ethical and moral dilemma. Transitions are length periods taking at least one generation (Rotmans, 2005). Under what is proposed the TM process will only be extended due to an increase in community participation. Yet it is essential that it is stressed that with access to improved sanitation we are discussing providing people with access to technologies, which are currently nonexistent, so they can carry out basic human needs. One positive response to the pilot project mentioned by a community member was that:

'*The project was a necessity for the community which had no basic utilities'* (Personal correspondence, 2013, #2)

What are under scrutiny are urgent technologies to provide people with basic needs; a safe place to go to the toilet. These basic needs are even more important to address when we bring in the disruption and dangers that the flooding periods bring to people's lives. Taking a TM approach the needs of the current generation are sacrificed for a long-term vision of sustainability that future generations can enjoy. The current generation of people who openly-defecate is not a small minority of the global population but 1.1 billion peoples (UNICEF and WHO, 2012). But any solution will take a long period of time to implement. The Burmi Tola project working in a small community within a village had after approximately ten months of community engagement had only managed to complete five units. Although not explored it could be assumed that because of sewage waste had previously been used by many members of the community while living in Bettiah transit camp that this could take even longer in communities with no history of using human excreta. Therefore, any attempt to up-scale ecosan will take a considerable amount of time. However, it must be acknowledged that the needs are still urgent. Looking at ways to speed up the transition process and minimize an ethically and morally conflicting trade-off would be a vital action research project with very practical implications not just for the TM approach but also for people's lives.

Secondly, the TM literature suggests that with regard to scaling-up it is less about products, services and users but perspectives, ways of thinking, routines, legislation and institutions (van den Bosch, 2010). Furthermore, it is suggested that the focus should be on deepening understanding, searching and learning rather than on short-term results (ibid). Accepting this it could be concluded that the failure of Burmi Tola does not mean failure from a TM perspective as long as lessons are learnt and there is an adequate evaluation process. This also adds to the ethical dilemma when using TM to discuss providing people with urgent technologies under tough conditions with limited financial,

institutional and social capital. However, it is important to learn from mistakes and failures and contribute to a social learning process rather than failed projects being just forgotten and the same procedures being used somewhere else with the same negative result. Yet, failure should not be considered a success and a balance must be searched for between social learning and more concrete results.

Moreover, this approach assumes that all members are willing to participate and see the need for a change which is not always the case. One person spoken to said that some people saw open-defecation as healthy because it meant people got exercise walking back and forth to the field (Personal correspondence, 2013, #13). While another saw it as healthy practice as people could get fresh air (Personal correspondence, 2013, #14). Additionally is assumes that communities want to co-operate with one another. The case study here shows no obvious evidence of community dynamics being a problem. However, social value exercises will not necessarily work in communities who are less connected or have a less homogenous caste system. It had been argued that participatory processes are difficult to control in India where there are still issues of equity, social exclusion, marginalization of women and caste conflicts (Joshi, 2013; Platteau and Abraham, 2002). While participatory processes have been criticized for elite capture as within communities there are people with different economic circumstances, class status, ethnicities, genders, political affiliations, livelihoods and religions (Lund and Saito-Jensen, 2013). It can be the role of the facilitator to carefully mediate between the different groups. What is proposed is based on the characteristics of this specific case-study. When the community is small and homogenous these activities can function successfully. However, in other communities with very different community relations where the dynamics are more complicated and the power relations are more distinct it will be problematic to reach the desired outcome and this idea will seem utopian.

9. Conclusion

Ecosan, as a technological fix, has been promoted as a way to solve some of the world's sanitation problems. Yet, the data shows that there are many complex barriers to implementing and scaling-up new technologies. This is especially true when discussing something like sanitation practices and activities which are very personal, commonly private and in almost all cultures taboo. This study has shown that although a sustainable solution on paper ecosan faces many barriers in practice as these technologies require actions that can oppose social values. Although the outcome of this concept is supposed to strengthen environmental, economic and social pillars the social barriers must also be taken into account. This case shows that by relying heavily on technological developments can lead to perfectly designed systems that are unsustainable due to the conflict they have with cultural values. What has been argued is that in order to design technology that can lead to a transition to more sustainable sanitation systems more work on developing technologies that are valued by people who have to use them is required. By framing the issue using a transitions framework has helped to illuminate the complexity of problem and the many barriers that exist at different levels. While the TM lens shows the difficulties of not having a shared definition of what the problem is or what the best solution is and the problems this causes when conducting technological experiments. By doing this it has not made the task ahead any easier however it has shown the importance of including participation when trying to initiate transitions to more sustainable sanitation solutions.

The discussion explored the connection between the way development is viewed and the social barriers found in the data. A model was then proposed to guide a process searching for more sustainable sanitation solutions. Concentrating on the micro/niche level this management model, adapted very slightly from the ideas proposed in the TM literature about the transition arena, tries to increase participation and public discussion as a way to steer transitions. In Bihar this could be operationalised using facilitators who can take on the role of synchronizing community values and representing community views and opinions in a wider discussion with experts. The discussion with experts is then presented to the communities for further discussion. It is argued that by following this process technologies and socio-technical systems can be developed where societal norms and culture are considered at the beginning and therefore social values and beliefs are incorporated into the design process. Thus, provided there is the right support from regime institutions, it can be used to guide a transition to a more sustainable sanitation practices at a micro level. However, in order to support this kind of approach on a larger meso/regime level requires changes in to macro/landscape forces. Unfortunately, this change cannot be brought about by this niche. In order to see changes the way development is viewed by large powerful global players has to be changed. To change ideas at landscape level, niche experiments in other forms might be needed. Such as niches that are more

socially and politically active. For example, social movements can help contest prevailing ideas of development and play a central role in considering alternatives (Milton et al., 2006). The Chipko movement in India in the 1970s, a forest protection movement, is an example of where a social movement played a part in transforming forest management systems (Ishizaka, 2013).

Although there are conflicts with trying to use a TM approach in such a different context it can give some useful suggestions about what the next possible steps needed are to achieve a transition to more sustainable sanitation practices. It may not be a quick-fix however a quick-fix does not exist. Tackling the complex global problem of the improved sanitation deficit will take a long time but searching for technologies which are valued will lead a higher degree of freedom gained.

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11. Appendices

Appendix 1: Photos from the site

Picture A – Human faeces in a field. The reality of open-defecation

Photo B – A trial plot testing urine. To the left of the sticks urine is being used and to the right no fertiliser is being used.

Photo C – A UDDT under construction. The substructure has been built while the frame for the superstructure has been started.

Photo D – Concrete crumbling away from the substructure before it has been used.

Photo E – The height of some of the steps that can be difficult for children or elderly people to climb

Appendix 2: ESRC Framework for Research Ethics (FRE) 2010, Updated September 2012

Listed below are six key principles of ethical research that the RSRC expects to be addressed whenever applicable:

1. Research should be designed, reviewed and undertaken to ensure integrity, quality and transparency.

2. Research staff and participants must normally be informed fully about the purpose, methods and intended possible uses of the research, what their participation in the research entails and what risks, if any, are involved. Some variation is allowed in very specific research contexts for which detailed guidance is provided in Section 2.

3. The confidentiality of information supplied by research participants and the anonymity of respondents must be respected.

4. Research participants must take part voluntarily, free from any coercion.

5. Harm to research participants and researchers must be avoided in all instances.

6. The independence of research must be clear, and any conflicts of interest or partiality must be explicit

Appendix 3: Interview outline

1. Gender?
2. Age?
3. Occupation?
4. Number of people in the household?

5. What do you see as the negative aspects of ecosan?
6. What is your understanding of ecosan?
   - Why do you think it is important?
   - Why do you think people are building them here?
   - What do you think the benefits?
7. What are the problems of ecosan?
   - Why do you think people won't use it?
8. Do you view human waste as a resource?
   - How do you view urine?
   - How do you view faeces?
   - Do you think you need fertiliser?
9. How much would you be willing to pay for a toilet?
10. Do you think toilet use and hygiene is important?
    - Why is it important?
11. What do you think about this EcoSan
12. How involved did you feel in the process?
    - Who decided?
    - At what stage did you become involved? – planning, designing, location
    - Did you attend meetings?
    - How many designs were proposed?
    - Did you request private units?
    - Who builds/who manages/ who supplies materials?
    - Maintenance – any training provided?
    - Are you happy with the way the system looks?
13. What would be your ideal system?
14. Is there anything else you would like to discuss?

Appendix 4:

Details of the number, dates, age, gender and lengths of interviews can be made available at the reader's request.