WHAT INFLUENCE PEOPLE'S WILLINGNESS TO INSTALL COMPOST TOILETS?
- A CASE STUDY FROM SARAWAK, MALAYSIA

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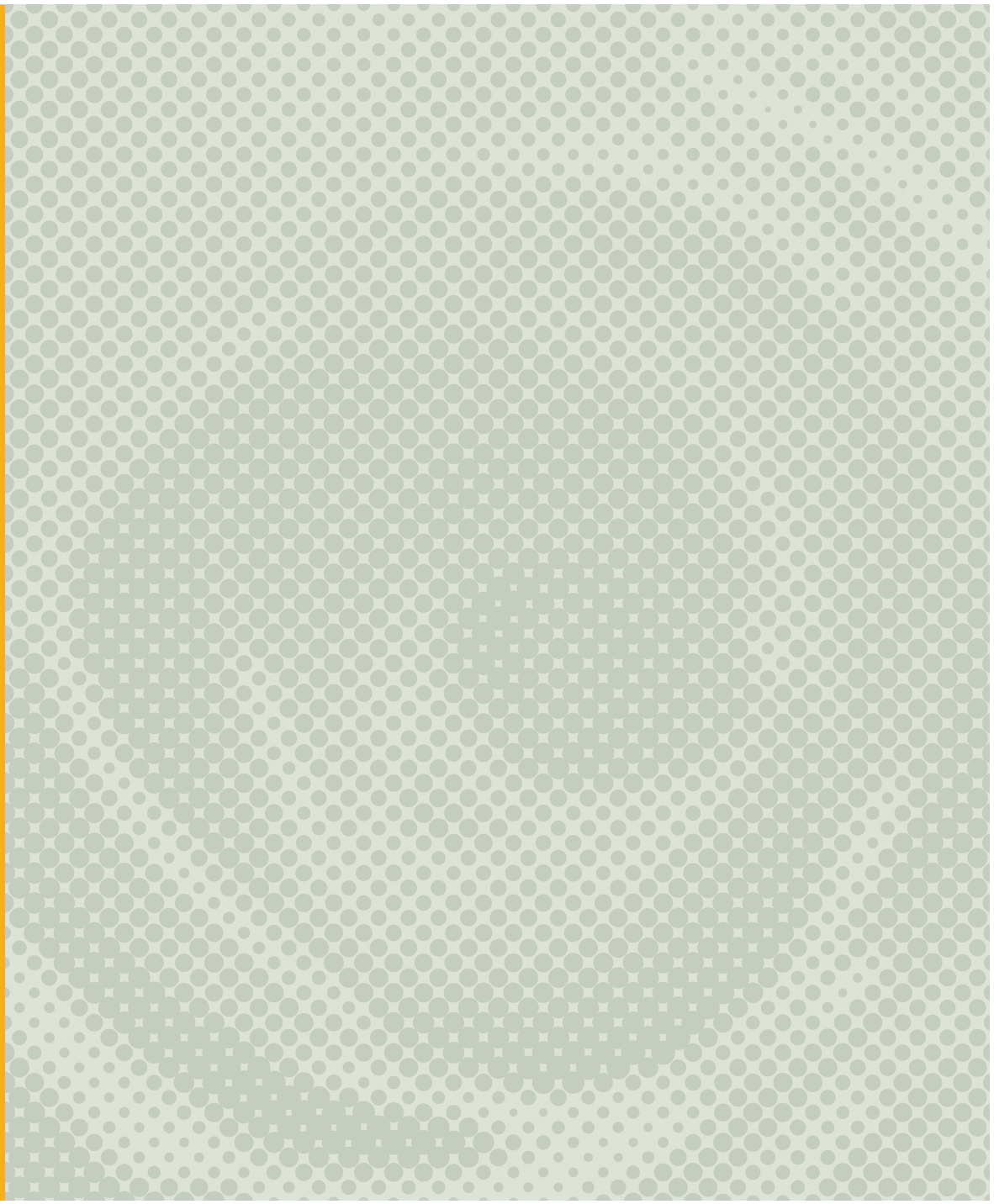

Declaration

I, Heidi Kristensen, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Signature……..

Date……

Acknowledgement

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Abstract

Lack of adequate water supply and appropriate sanitation are obstacles towards development and a main source of diarrhea which causes the death of 1, 9 million children every year. One of the targets in the 7th Millennium Development Goal is to "reduce by half the proportion of people without access to safe drinking water and basic sanitation" (Lee & Ghanime 2004) by 2015. Reaching this goal proves to be most challenging. NGOs, trying to introduce different sanitary solutions, have in many occasions not succeeded due to lack of local participation. Because of this reason, I visited three villages in Sarawak, Malaysia, to learn about the local people's perception of their sanitary systems and to see whether or not they would be willing to install composting toilets.

Structured interviews and focus groups were carried out in three villages in the Padawan area in Sarawak. The inhabitants in these villages had quite different views on sanitation. The respondents in two villages, named Sadir and Simuti, were very concerned about blackwater pollution and wanted to install composting toilets. Most people in the third village, Danu, did on the other hand not see their existing sanitary system as a pollution source and very few people wished to install composting toilets. Such different results were surprising because the villages were seemingly very similar.

What affected people's willingness to install composting toilets was whether or not they talked to others about blackwater pollution, whether or not they felt that blackwater was the most severe pollution source in their village, how often they had diarrhea, income level, age and in which village they lived.

Without carrying out a study, it would have been impossible to know that there were such big differences between these seemingly similar villages. This shows that if wanting to implement composting toilets, it is crucial to involve the local people. Only the locals know which solutions that can be accepted in their village.

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1. Introduction

1.1 The importance of adequate sanitation

Worldwide more than 1 billion people lack adequate water supply and 2,6 billion people lack appropriate sanitation (UNICEF 2006). These two problems are interlinked both due to over-consumption of clean water for flushing toilets and because of pollution from toilet waste. Where water sources are polluted from blackwater, appropriate sanitation could contribute in giving people clean water (Jenssen et al. 2006b). Lack of adequate sanitation inhibits many girls from attending school and about 443 million school days are lost every year due to diarrhea (WaterAid s.a.). Diarrhea also causes the death of 1,9 million children every year (UNICEF 2006). "If current trends continue, there will be 2.4 billion people without basic sanitation in 2015, with children continuing to pay the price in lost lives, missed schooling, in disease, malnutrition and poverty" (UNICEF 2008).

Today, phosphorous and nitrogen are polluting water sources. Phosphorous is an essential, non-renewable nutrient which is said to last only for another 130 years. "If one includes commercially unviable reserves, we can go on for another 130 years but at much higher prices" (Science and environment fortnighly 2004). From 1993 to 2001, the worlds' fertilizer consumption increased from 120 to 138 million tons (International Fertilizer Industry Association 2002). Recycling of these nutrients which are found in human waste, would diminish the pollution problem together with diminishing the need for fertilizer production. Humans produce on average 50 kg faeces and 500 litres of urine every year. The nutrients in "waste products" from one person would be sufficient to produce 230 kg of cereals (Jenssen et al. 2006c). By utilizing blackwater as soil amendment and fertilizers, one could return nutrients and organic matter to the soil and with this close the recycling loop. In addition to decrease pollution and reduce the need for fertilizer production, it would contribute with important fertilizers to poor farmers who are not able to buy expensive fertilizers.

1.2. Objectives of the study

The objectives of this study have been:

1. Assess the existing sanitary systems in villages in Sarawak, Malaysia, to see how they work and where the wastewater is led.

One of the targets in the 7th Millennium Development Goal is to "reduce by half the proportion of people without access to safe drinking water and basic sanitation" (Lee & Ghanime 2004) by 2015. In the study area which this thesis is based upon, people had basic sanitation. I wanted to see whether or not this "basic sanitation" was adequate.

2. Clarify people's assessment of the existing sanitary systems; to see whether people are satisfied with this system and to see if they consider blackwater contamination as a problem.

It would be interesting to see whether or not people had different judgement of similar sanitary systems.

3. Gather knowledge about how willing people are to change their existing sanitary systems to a compost toilet and establish insights about what influences these attitudes.

The reason for installing compost toilets is to reduce pollution, increase peoples health and in some cases to contribute with fertilizers and decrease the water use for flushing. These types of installations are often based on financial support and technical expertise from outside. It is in other words often not the local people who request these solutions, but outsiders who "want to help". Previous installations of similar systems have in some cases failed due to lack of involvement among the local people. I therefore wanted to make a survey on people's willingness to have a compost system, both to see what motivates people to have this sanitary system and also to see whether or not a possible future instalment might be successful in the villages visited for conducting this study.

1.3. Delimitation

1.3.1. Chosen study site

In 1994, Kuching became a part of a Healthy Cities initiative by WHO, where safety from water pollution was one of the important topics addressed (State Planning Unit Sarawak 2001). Despite this, a report made in 2004, in cooperation between the Sarawak Government and the Danish International Development Assistance (DANIDA), stated that the Sarawak River is "heavily polluted mainly due to the discharge of partially or untreated wastewater from Kuching and the surrounding areas" (Lynghus & Larsen 2004). Between 2001 and 2005, the Malaysian Government spent 1,5 billion MYR (= 2,4 billion NOK) on sewerage (1,2 billion went to sewage treatment plants) (United Nations Country Team 2005). Malaysia is one of the few Asian countries who has succeeded in reaching six of the eight Millennium Development Goals (United Nations Development Group 2007) and they now work towards reaching the remaining goals. In 2007, 96 % of the urban population and 93 % of the rural population had access to improved sanitation[1] (United Nations Development Group 2007). I wished to see whether or not this "improved sanitation" is adequate. The reason for choosing a rural area was because "around the world, the health status of people living in rural and remote areas is generally worse than that seen in people living in urban areas" (Wonca 2003) and 75% of all poor people in the world live in rural areas (Ibid 2003). Problems in these areas are therefore important to face.

1.4 Outline and structure of the thesis

In the next chapter, background information about Malaysia and ecological sanitation will be given. If people in the visited area want to install composting toilets, I wish to find out what motivates these attitudes. Because of this objective, I present different theories for human behaviour in chapter 3. On this basis, I will develop a model and a set of hypothesis to support the empirical analysis of people's willingness to change to composting toilets. Chapter 4 offers an overview of previous studies concerning successful / unsuccessful implementations of ecological sanitation. These studies illustrate the importance of local participation to

[1] Improved sanitation is "facilities connected to a public sewer or a septic system, poor-flush latrines, simple pit or ventilated improved pit latrines" (Jenssen et al. 2006a).

succeed in the implementation of ecological toilets. In chapter 5, I will describe the methods that have been used in this thesis, both in the field and also when analyzing the data. This thesis is based on field work conducted in three villages in Sarawak, Malaysia. After having introduced these villages in the beginning of chapter 6, I will present the results from the field work. Pictures, observation and information obtained from the local people will be important in discussing the results from the statistical analysis. All three objectives stated in the introduction will be answered. In chapter 7, findings from chapter 6 will be more thoroughly discussed and linked to theory and previous studies, before I in chapter 8 conclude the results from this study.

2. Background

2.1 The study area

2.1.1 Physical and climatic conditions

Malaysia is divided between Peninsular Malaysia (west Malaysia) and east Malaysia which is situated north on the island, Borneo. This study was conducted in the state, Sarawak, North-West on Borneo. Most of the 2.357.500 inhabitants in Sarawak live close to rivers or the ocean. The capital in Sarawak, Kuching, has a population of 435.000 (UNIMAS s.a.). Three topographic features are found in Sarawak; the costal plain, the hill-and-valley region and the mountains which divides Malaysia from Kalimantan. The soil is on average acidic, coarse textured and has little organic matter. Nutrients have been leaking out and soil erosion is a danger in steep areas (Encyclopedia Britannica 2007).

Figure 2.1: Map over Malaysia (Google Earth 2007)

Malaysia has a tropical climate. The air is humid and the temperature is rather stable throughout the year, not exceeding 32°C. There is a lot of rain in Malaysia since the country lies in the tropical rainforest-belt, about 120 inches annually in Sarawak (Encyclopedia Britannica 2007).

2.1.2 The people

Of Malaysia's 27 million inhabitants there is a great mixture of people's origin, culture and religion. 2/3 of the population are Malay and they are of Muslim belief (Encyclopedia Britannica 2007). People were however of Christian belief in the three visited villages. Rural people in Sarawak are cultivating "rice, maize, peppers and other subsistence crops" (Seidu & Jenssen 2006). The land is degrading in this area and many people cannot afford to buy fertilizers, which again has lead to low productivity. The nutrients in faeces and urine are not utilized to benefit the agricultural practices in Sarawak. Instead, lack of adequate sanitation is one of the main causes of health problems for the rural people. The reason for this is that the blackwater is discharged into the rivers. Water borne diseases such as cholera, typhoid and diarrhea has often been the result due to lack of handling the blackwater (Ibid, 2006).

2.2 The recycling loop

Water and sanitation are basic human rights, but worldwide more than 1 billion people lack adequate water supply and 2,6 billion people lack appropriate sanitation (UNICEF 2006). Dealing with these problems are most challenging and the water and sanitation target stated in the United Nations Development Goals, ("water and sanitation for all within a decade") "will be missed by" 234 and 430 million people respectively (Watkins et al. 2006).

Dealing with these problems is most challenging. The "nutrient & energy loop" presented in figure 2.2 demonstrates how human waste can be looked upon as a valuable resource instead of a problem to get rid of. Human waste can through anaerobic digestion become biogas. After aerobic treatment, human waste can be used as fertilizer and soil amendment for agricultural purposes.

The “nutrient & energy” loop is illustrated in the right circle below.

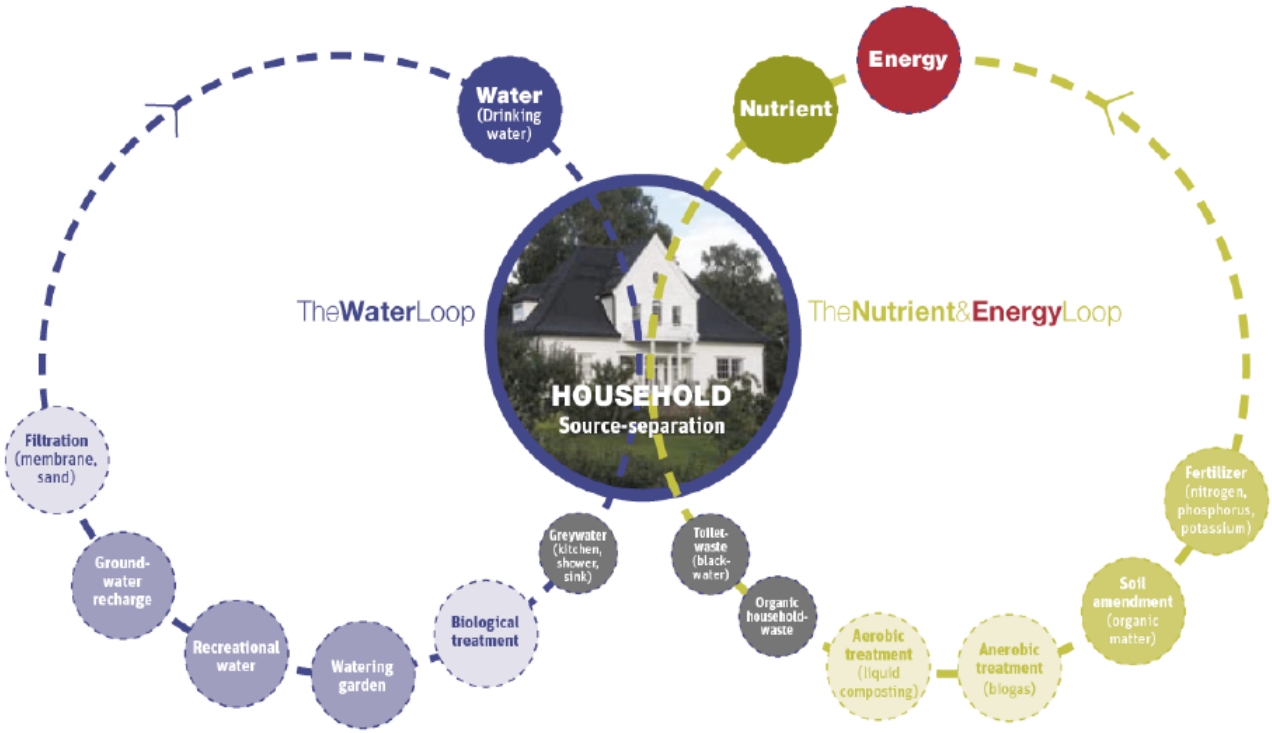


Figure 2.2: The ”water loop” and the ”nutrient and energy loop” (Jenssen et al. 2006d)

There exists a variety of ecological toilets necessary to complete the nutrient and energy loop. Ecological toilets do not need much water for flushing so that nutrients can be recycled and, if installed properly, do not pollute the environment. The only ecological toilet presented in this thesis is the composting toilet described in chapter 2.3.

2.3 Compost toilet

A composting toilet is a dry system. This means that no water is needed for flushing and excreta are kept in collection chambers under the toilet bowl. Bulking material such as ash, bark or leaves should be added to eliminate excess liquid and help maximizing the aerobic degradation. The excreta volume can be reduced to 70 – 90% of the original volume if the degradation is functioning properly (right moisture content and high temperature) (Jenssen et al. 2006d).

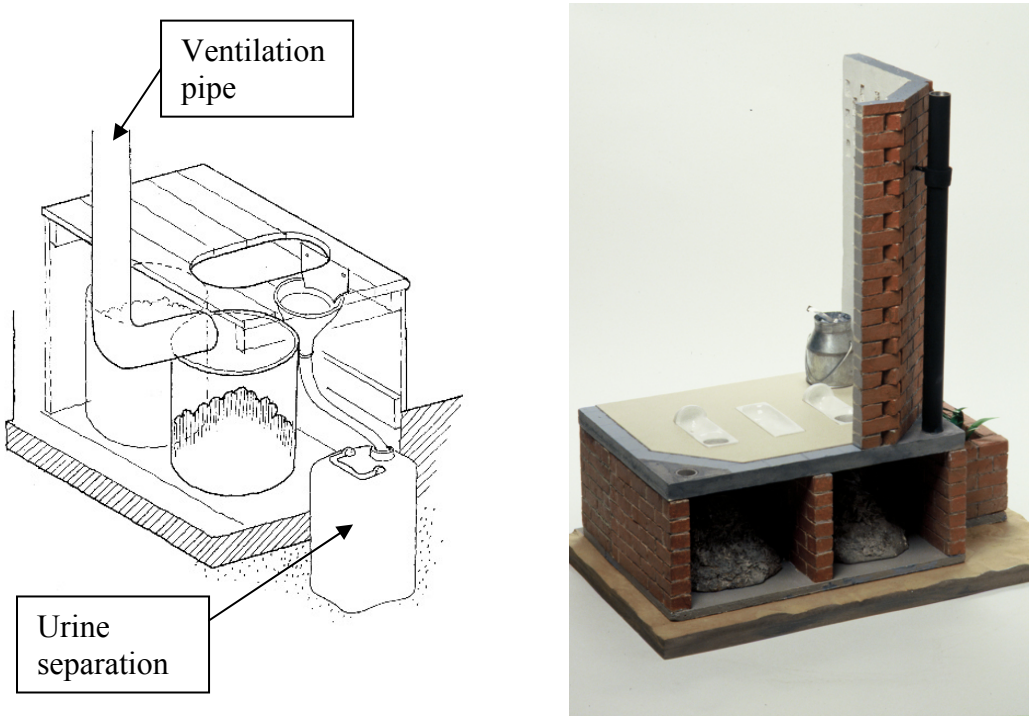


Figure 2.3 and 2.4: Compost toilet with dual chamber, urine separation and ventilation

Figure 2.3 demonstrates a composting toilet with urine separation. Many people are reluctant to use human excreta as soil amendment, but see the use of urine as a good fertilizer source. Urine contains 80% of the nitrogen, 55% of the phosphorous and 60% of the potassium in human waste. Urine contains less pathogens than excreta and can be used safely on any crops after 6 months storage at a temperature of 20°C (Jenssen et al. 2006e) (see appendix 1a). One person produces about 500 l of urine per year (Jenssen et al. 2006c). When separating the urine from the excreta, smell is reduced. Good ventilation is also important for smell reduction.

Figure 2.4 shows a composting toilet with a dual chamber. The first chamber is filled up and sealed before the second chamber is taken into use. This way, the excreta in the first chamber will have enough storage time (about one year) for safe use as a soil amendment (Jenssen et al. 2006d) (see appendix 1b). As already mentioned, the waste will be considerably reduced. People who do not wish to use excreta for agricultural practices can therefore make big enough chambers so that these never need to be emptied.

Below, two different designs of urine separation toilets are showed:

Figure 2.5: Sitting toilet with urine separation

Figure 2.6: Squatting toilet with urine separation

Figure 2.5 shows a design where a “balloon” turns when using the toilet. This “balloon” functions as a lid so the waste is not seen. If putting some paper before usage, there is no need to clean the toilet more than “normal” toilets (Jenssen 2008).

3. Theory

In chapter 2, I introduced ecological sanitation and described how these solutions can reduce pollution and contribute with fertilizer. But what makes people choose these solutions? There exist a number of theories trying to describe human behaviour and I will now present a few of them. These theories will lead up to the model used to give answers to the third objective of this study; what influences people's willingness / unwillingness to install composting toilets.

3.1 Consumption behaviour

Mary Douglas said in 1976 that "An individual's main objective in consumption is to help create the social world and to find a credible place in it" (Douglas 1997)[2]. There are a number of factors which influence our consumption behaviour. Unsustainable consumption might sometimes be explained by "incentive structures, institutional barriers, inequalities in access, and restricted choice. But it also flows from habits, routines, social norms and expectations and dominant cultural values" (Ibid 1997).

3.2 The prisoner's dilemma

When looking at local pollution problems, one might study people's actions and attitudes through the lens of the "prisoner's dilemma". The prisoner's dilemma is a game illustrating a type of collective choice problem. It is based on microeconomic theory which assumes that each agent acts rationally (Mathis & Koscianski 2002). When dealing with a collective good, which we often find when dealing with environmental issues, the prisoner's dilemma states that people will end up not cooperating even though it would be best for the group if all did. The reason for this is that a person will gain most if everybody but oneself pays the personal cost of cooperating. The prisoner's dilemma is illustrated in figure 3.1.

[2] Cited in Jackson 2005 p.v

	Cooperate	Not cooperate
Cooperate	**A** 10 10	**B** 15 -10
Not cooperate	**C** -10 15	**D** -5 -5

Figure 3.1: The prisoner's dilemma

When dealing with for example pollution problems, the prisoner's dilemma shows that cooperation will give the best results for all (A). The theory states however, that because people see that "free riding" will give them the biggest personal gain (B), everybody will choose not to cooperate and therefore end up in situation D. When dealing with collective goods, all seem to loose (D) if no punishments or state regulation is applied. If the "game" is repeated several times however, more people may choose to collaborate. The reason for this is that people might fear that less people will cooperate if oneself does not and therefore end up in situation D. Hence, it is in their interest to cooperate, so that they will end up in situation A.

Vatn argues however that "typically, people are also willing to share in situations where this gives them a personal loss, and to punish others who do not share in a situation where sharing is expected" (Vatn 2005, p.122). This is a form of social rationality where "kind acts are rewarded and unkind ones are punished" (Ibid 2005, p. 122). In the next chapter, I will discuss that people not always act to obtain personal economic gains.

3.3 Humans and institutions influence each other

People are often not maximizing their economic benefits. One explanation might be that people do not know what gives the highest individual gains by ignoring the transaction costs or that time limit and habits makes people choose without looking at alternatives. Even if not thinking at economic benefits, people's actions could be very rational. One reason is that people are formed by the society in which they live. Conventions (such as how to greet people), norms (what people consider as right behaviour and sanctioned rules (the rules such as business transactions and a society's constitution) all form the institutions in which we live. According to Vatn (2005) there are basically two main views in the literature in how to explain the linkage between human behaviour and institutions. One view looks at institutions

as constraints for human choices which do not influence human characteristics. The other view states that institutions influence each individual's "perceptions, values, preferences and capabilities" (Vatn 2005). Most people will probably go quite far to save another persons life, not because some "rule" say that they should, but simply because it has become a part of that person's values that one should help each other. Vatn further argues that because norms become a part of human's characteristics, "humans both influence and are influenced by the institutions" (2005, p.25). Two people with very different values might end up acting similar if growing up in different institutional settings.

3.4 Fishbein and Ajzen´s Theory of Reasoned Action

As we have seen from the above, there are many and partly competing ways of understanding human behaviour. In this "landscape" I have chosen to build my framework for analysis on the belief that humans and institutions influence each other.

In the light of Fishbein and Ajzen´s Theory of Reasoned Action, I have made some changes to be able to analyze people's wish for installing / not installing compost toilets. Fishbein and Ajzen´s model will now be presented. In chapter 3.5, I will explain the reasons for the changes made in this model to be able to analyze people's behaviour in this study.

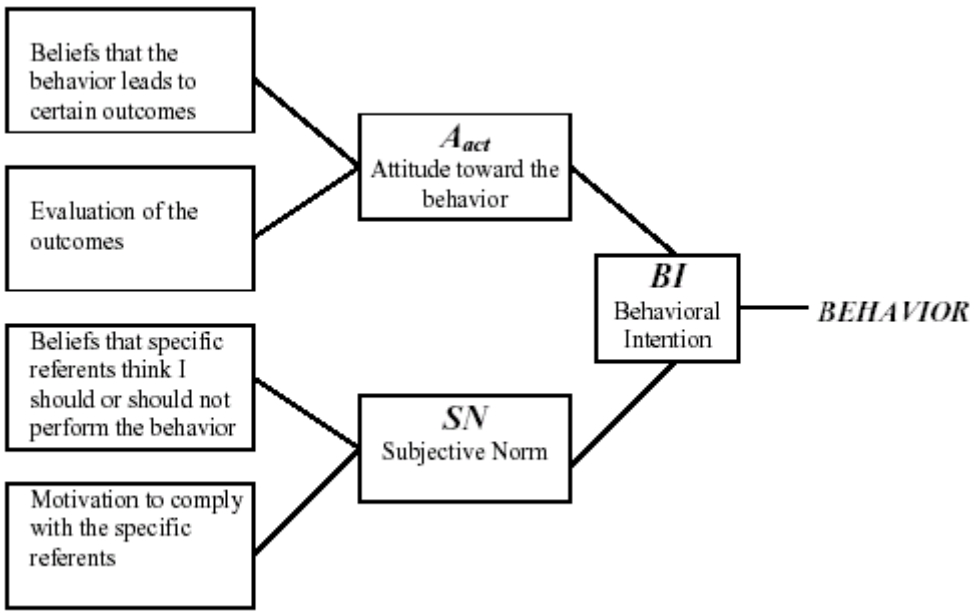


Figure 3.2: Fishbein and Ajzen's model (Jenkins 1999)

Fishbein and Ajzen's model takes into consideration both attitudes towards behaviour and the subjective norm in explaining behaviour. A_{act} is a person's positive or negative attitude towards performing a behaviour. SN refers to the social pressure of performing a certain behaviour. Two people might expect the same outcomes when behaving in a certain way, but have different perceptions about whether this outcome is positive or negative. Another situation might be that two people have the same perception about whether or not the outcome of a behaviour is positive or negative, but that they have different expectations of the outcome. These aspects are important to take into consideration, as it affects the behavioural intention (Jenkins 1999).

Because of the necessity to take into consideration the fact that people have different "skills, abilities, knowledge, time, financial situation, availability, and access to other inputs" (Jenkins 1999), Ajzen developed Fishbein and Ajzen's model further which included perceived behavioural control (PBC).

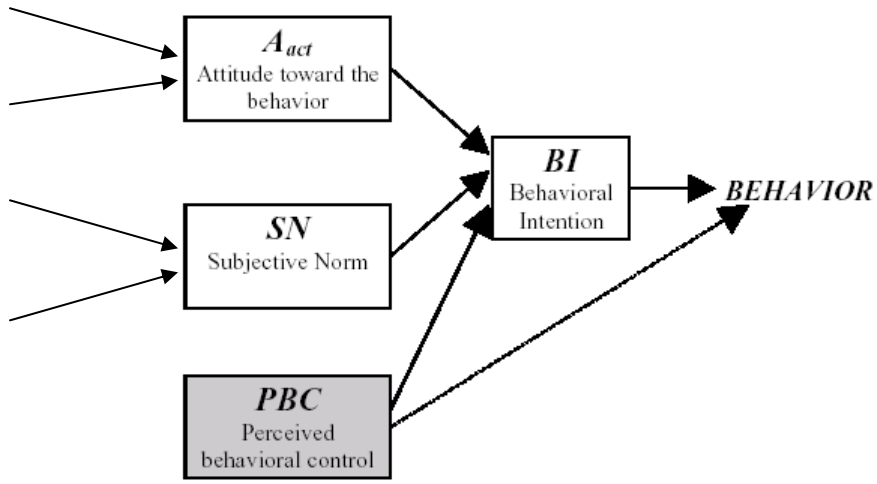


Figure 3.3 Ajzen`s Theory of Planned Behaviour (Jenkins 1999)

This version of the model states that people's possibilities might directly or indirectly influence behaviour. In cases of sanitary decisions in developing countries, these aspects are most important as sanitary systems often are costly investments. Studies also show that in cases where past experiences influence the behaviour, SN is less important while A_{act} and PBC becomes more important (Jenkins 1999).

3.5 The framework used in this study

The model used in this study is based on Fishbein and Ajzen`s Theory of Reasoned Action. Adjustments are however made because important aspects lacked in the process of explaining peoples behavioural intention when dealing with sanitation.

The behavioural intention (willingness to change present system to a compost toilet) is the dependent variable. A concerning issues is what the neoclassical economist, Samuelson, was most engaged by; people "say one thing and do something else" (Vatn 2005, p.115). Samuelson came up with the solution to this problem in 1948, where he focused on which choices people actually made (Ibid, 2005). In this study, it was however not possible to introduce examples of the new sanitary system and analyze people's reactions (behaviour) after they had seen these toilets and had time to reflect. Implementation was not possible, neither the objective of this study.

The variables from Fishbein and Ajzen's model are shown in bolded letters. New independent variables have been included such as health issues and characteristics of the actor. Even though norms will be an important part of this analysis, it has in this model been included in the "characteristics of the village". All the independent variables will be discussed in more detail after the model has been presented.

The arrows in the model show that the independent variables influence each other. This will be emphasized in this thesis, even though not taken directly into the statistical analysis. Each independent variable will only be analysed in relation to the dependent variable.

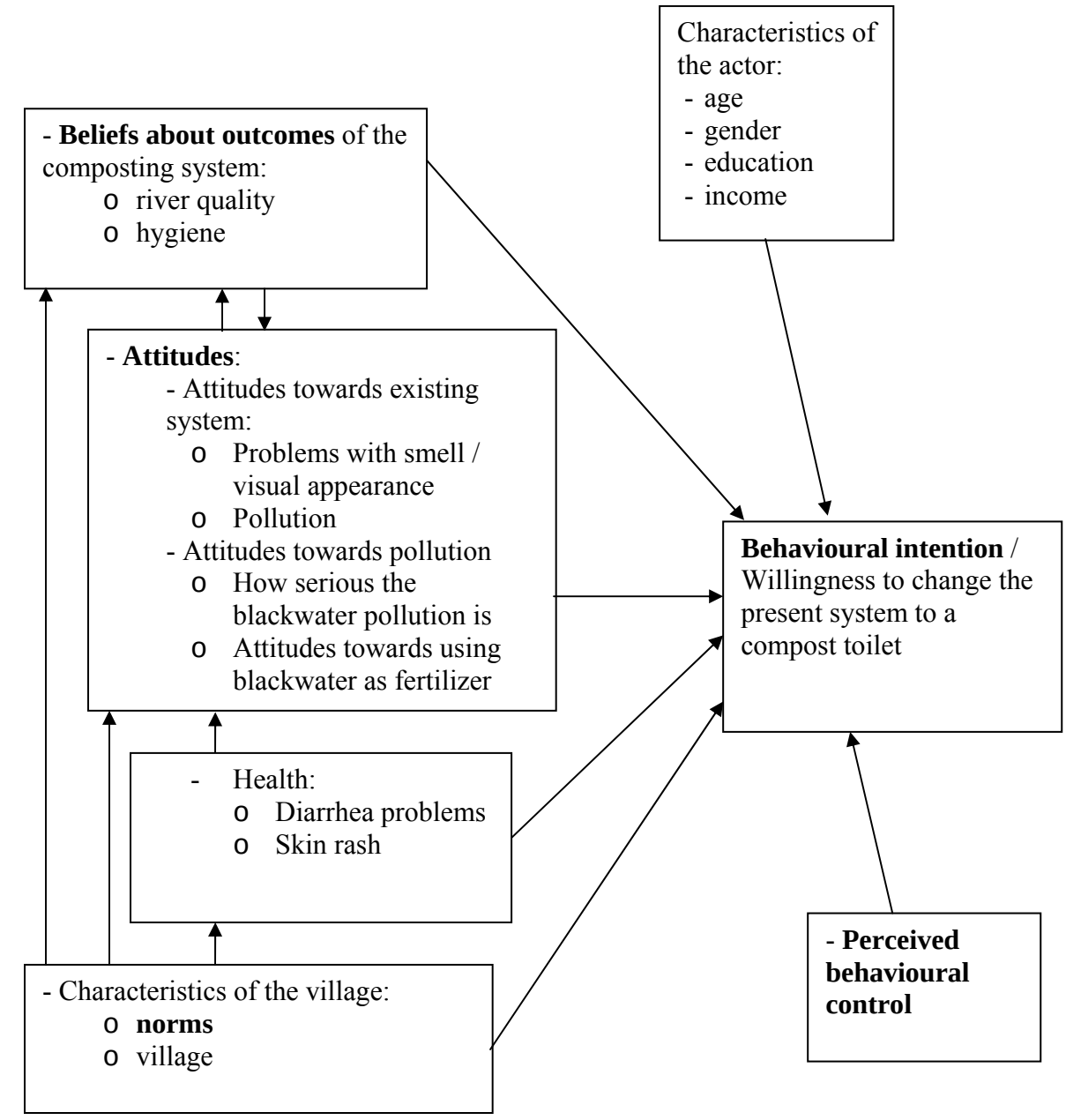


Figure 3.4 The model used in this study

Beliefs about outcomes of the composting system

People might have different opinions about whether or not a composting toilet will lead to less pollution of the environment. Opinions about whether the hygiene in the bathroom will be better or worse with a composting system, is also highly subjective. These beliefs will directly influence people's willingness to install a composting system. This study leaves out "evaluation of the outcomes" which is included in Fishbein and Ajzen`s model. The reason

for this is that it makes no sense to argue that some people think that pollution is better than a clean environment, or that a dirty bathroom is better than a clean one.

- Hypothesis 1

  People who believe that a composting system will lead to a cleaner environment are more willing to have a compost toilet than the people who do not believe it will have any positive effect on the environment.

Attitudes

Whether or not people are satisfied with their existing sanitary system will probably influence people's willingness to install a new toilet. It is reasonable to expect that this also will be linked to whether or not people believe that their sanitary system is polluting as well as their perception on how severe this problem is. People's need for fertilizers and their attitudes towards using blackwater for agricultural purposes is also taken into consideration. This reasoning form the basis for the following hypothesis.

- Hypothesis 2

  People who are not satisfied with their present sanitary system are more willing to change to a compost toilet than the people who are satisfied.

- Hypothesis 3

  People who believe that the river is heavily polluted and that blackwater is a main contributor to this, are more willing to have a compost toilet than people who do not worry about these problems.

- Hypothesis 4

  People who wish to use fertilizer from blackwater are more willing to have a compost toilet than those who do not want to use blackwater as fertilizer.

Health

- Hypothesis 5

People who are sick or believe that their sanitary system causes negative health consequences, are more willing to change to a compost toilet than the people who do not think that there are any problems caused by their present system.

Characteristics of the village

In Fishbein and Ajzen`s model, the subjective norm is one of the variables affecting the behavioural intention. Norms may have great impact on the attitude variable as well as on behavioural intention. The reason for this is what was discussed earlier; as much as the humans create the institutions, the institutions also influence our attitudes.

- Hypothesis 6

People who are not reluctant to talk about sanitation are more willing to have a compost toilet than people who look at sanitation as a taboo.

- Hypothesis 7

People who are not concerned about having the same sanitary system as their neighbours are more willing to change to a compost toilet than the people who wish to have the same system as their neighbours.

Other differences between the villages will be analyzed in a "village" variable. Factors common for all people in one village are for example physical variation such as the location and size of the river.

Perceived behavioural control

Perceived behavioural control will shortly be discussed, although not taken directly into the analysis. The reason for this is that the goal of this study is to look at willingness to change to compost toilet if investments would come from outsiders.

Characteristics of the actor

Characteristics of the actor such as age, gender, education and income will be used as control variables.

Before going into the methodology used and the results obtained in this thesis, the next chapter will introduce previous studies. Lessons learned from earlier studies / projects are important knowledge when finding out why some projects are successful while others fail.

4. Previous studies / projects

Studies about implementation of sanitary systems are often based on technical aspects. The social aspects are however crucial for the success of a project. People's perceptions of sanitary systems will vary between cultures, but also between individuals within the same area. This chapter looks at previous successful as well as failure sanitary projects. Even though these studies are based on projects in different countries with diverse points of departure, they all argue for similar factors necessary for the success of a project. These studies shows in other words that some key factors will be important when implementing sanitary systems, while at the same time it is clear that social aspects are necessary to take into account in each individual case.

4.1 Community Led Total Sanitation (CLTS)

Kamal Kar wrote a paper for the Institute of Development Studies in 2003 about subsidized latrine construction in rural Bangladesh. He made a crucial point out of the true nature of "successful" projects. He wrote that "success has generally been measured on the basis of the number of latrines constructed within a given period of time instead of the extent of open defecation, which in most cases has continued unabated". Even in cases where large amounts of subsidies and information were given, it was difficult to "convince people to construct their own toilets and stop open defecation" (Kar 2003).

> *"Most agencies working to improve environmental sanitation spend resources on motivating people to construct latrines and toilets with subsidies provided at different rates. NGOs train and motivate villagers in good hygiene practices and on ways of treating diarrhoea. Protection from diarrhoeal diseases is explained by the external agencies to the local people, who are then motivated to construct toilets from amongst the prescribed models. In Bangladesh, hundreds of NGOs have become engaged in this sector but after thirty years of such efforts it is difficult to find even 100 villages from amongst nearly 85,000 that are 100 per cent sanitised and totally free from open defecation" (Kar 2003).*

Community Led Total Sanitation (CLTS) is an approach to get rid of open defecation. CLTS was introduced in Bangladesh in 1999 and has later expanded to "around 5000 villages around the world" (Karn 2006). CLTS takes into account exactly what Kamal Kar criticizes many NGOs for; lack of empowerment of the local people. Karn (2006) and Kar (2003) both base their argumentation on a number of case studies where the successful outcomes have been in cases where subsidies have not been given. The reason for this, they say, is that the empowerment of local people leads to more motivation and finally behavioural change. Kar (2003) describes earlier unsuccessful projects based on giving people subsidies. Landless people were excluded because they did not have land to construct toilets, poor people could not afford to build and wealthier people waited to construct until they received subsidies. By focusing on information spreading so that people realized what negative health consequences open defecation could lead to, people were more eager to construct latrines. In CLTS, an outsider contributes in the beginning of a project where information, mobilization and attitudes towards the projects are introduced. Later on, however, it is preferably the local people who get the power to develop the projects (Karn 2006).

CLTS has proven to be difficult in some cases. The reason for this is that many are used to practice open defecation and are not committed to the new systems when not seeing the necessity of it. In various cases, people wished to continue with open defecation even after constructing the toilets. Knowledge and empowerment is therefore the key to success (Karn 2006).

4.2 Unsuccessful implementation at a rural school, South Africa

Aussie Austin wrote in 2003 about "an unsuccessful sanitation scheme at a rural school" (Austin 2003). Emzamweni high school in South Africa used to have unbearable bathroom conditions. The teachers used flushing toilets, while the students had pit latrines without hand washing facilities. The students' toilets were extremely filthy due to both lack of maintenance and vandalism, leading to bad odour. Because of these conditions, female students waited to go to the bathroom until returning back home after a school day, while the male students went behind trees when needing to go to the bathroom.

The introduction of technically optimal toilets was expected to have positive results. The urine was to be separated and flushed to a holding tank, and both urine and excreta were to be used for agricultural purposes. Since this would be introduced at a school, information spreading of these ecological toilet solutions was hoped for. When introducing new systems in public places, lack of ownership might lead to little involvement. Due to this reason, meetings and workshops were held for the teachers while booklets and posters were produced. It was stressed that for the success of this project, information spreading to the students as well as maintenance of the toilets was crucial.

Even though there seemed to be enthusiasm about the project, the toilet conditions were awful only a few weeks after the opening ceremony. The toilets were not properly used which led to blockage of the urine pipes and unhealthy conditions.

Several issues were pointed out as important lessons to learn from this failure project. The first reason for why this project did not succeed was believed to be that the teachers did not see the sanitary conditions as such an important matter. Teachers had for several years been under a lot of pressure to "produce good academic results with very limited resources" (Austin 2003). To achieve these academic results seemed to be the teachers' first priority. Since the teachers had more hygienic toilets than the students, they might not have realized the unhygienic conditions at the students' toilets. It was suggested that education authorities should "make it compulsory for the teachers to ensure proper training for the pupils" (Ibid 2003). Enforcement would be more likely a necessity for the success of projects introduced at schools and other public places than for projects involving private households. At household level, a greater feeling of ownership is present, and therefore also a greater will for maintenance. The last lesson from this project in South Africa was that a "problem of ownership will always occur when something is given for nothing" (Ibid 2003). The following example will discuss this matter; the implementation of ecological toilets in a residential area in Kuching, Malaysia, where no costs were held by the house owners.

4.3 Ecological toilets in a residential area in Kuching, Malaysia

In 2005, an ecological sanitation project (ecosan) was introduced in a residential area in Kuching, Malaysia, named Hui Sing Garden in 2005. This project included a "9 single storey

households with an average of 5 persons/household" (Jenssen et al. 2005). 2 litre /4 litre toilets were introduced and taken to holding tanks, while the greywater went through a "horizontal sub-surface flow constructed wetland" (Ibid 2005). This project was successful in handling both the blackwater and the greywater. Interviews were carried out with each of the involved families and "a social survey was carried out" (Ibid 2005). The people liked the physical appearance and appreciated the project's success of reducing pollution so much that they even encouraged the government to make more similar projects.

Contrary to the initial results, the project was closed down due to discontent amongst the house owners in 2007. The reasons for the changes in the house owners' attitudes were much discussed amongst the project planners. The first error made, was that when these technically optimal solutions were installed, the house owners were not included (Jenssen, pers. comm.). As the previous case study also concludes, lack of ownership and involvement is likely to occur when people get something without having to work for it. As in most projects, there were initial challenges to be solved in the Hui Sing Garden project. Even though the house owners had been informed about important aspects to remember for the proper function of the grey- and blackwater treatment, some did not follow the instructions. High use of cooking oil blocked the pipelines, leading to bad odour. The fact that the construction management did not solve problems immediately, led to unwillingness to cooperate amongst the house owners, and the project finally had to be closed down (Huong, pers. comm.)

4.4 Success story in Bihar, India

In 2006, women from four village clusters in Bihar, India, won a cleanliness- and hygiene award given by the Government in India. The reason for this award was that these women led the work towards getting 100 % sanitary coverage in their villages. Their goal was reached in 2005. With support from the Public Health Engineering Department and UNICEF, it was women in the villages who worked for full sanitation coverage because, as one of the inhabitants, Sister Sabina, stated: "It is women who suffer the most when there is no toilet installed in a house. That is why it is a women's issue" (Srivastava 2006). Terti Devi, another women working to reach this goal, stated that "open defecation injures our pride and privacy. Moreover, there have been many cases of sexual harassment, rape and molestation of women,

particularly dalit women, when women have stepped out of their houses before or after sunset (always in the dark for greater privacy)" (Srivastava 2006).

It is clear that it was especially the women who felt a strong need for implementing toilets. They played a key role in both information spreading, convincing others about this necessity and controlling that nobody continued to practice open defecation. In the case studies presented earlier in this chapter, one of the reasons for failure projects was expected to be the non-existing feeling of ownership when toilets were given for free. The women from Bihar needed on the other hand to work hard to reach their goal. "We have worked hard for it. We are extremely happy to have been selected", was the comment from Rama Devi, one of the women working to reach this goal (Srivastava 2006).

5. Methods

5.1 Case study

This thesis is a comparative case study. The research was conducted in three villages in Sarawak, Malaysia. The reason for choosing these particular villages will be clarified in chapter 6. Attitudes toward different sanitary solutions may naturally vary greatly between people due to different beliefs and norms, but also because of the environment and the conditions in which they live. I wanted to see people's attitudes towards compost toilets in these villages to see whether or not implementation of these systems could be successful. Whatever the results would be in these villages, I cannot make a conclusion which would include people elsewhere. With several similar studies from different places, some general conclusions might however be drawn.

5.2 Collecting data

This study is based on both quantitative and qualitative data. The following section will treat how the data was collected, before discussing how the analysis was performed in chapter 5.3.

5.2.1 Quantitative data

Questionnaire

This study is mainly based on a structured interview. The majority of these closed ended questions had answer alternatives from 1 – 5, while some of the questions demanded "yes" / "no" answers. (The questionnaire is found in appendix 2). The choice for collecting quantitative data was to have as little differences as possible between how the interviews were conducted. Translators were needed, and since a lot of information might get lost during translation, I felt it was important minimize differences between each interview as much as possible by standardizing the interviews. Two different translators carried out the interviews, and structured interviews would limit each interviewer's interpretations of the respondents' answers.

The questionnaire included questions dealing with the following themes:

- Satisfaction with the existing sanitary system
- Knowledge about other ecological toilets
- Beliefs about the impact of a composting toilet
- Health issues
- Constraints for implementing new toilets
- Attitudes towards pollution in the village
- The usage of fertilizer

Three "test interviews" were carried out before ending up with the final version of the questionnaire. It was important to visit the villages in advance to learn more about the culture and how the locals viewed the environmental problems. The questions in the questionnaire needed to be short and precise so as not to confuse the respondents. Questions which ask more than one thing or which can be interpreted differently are important to avoid. The reason for this is that conclusions drawn will be wrong if people answer the same questions but interpreted them differently. Leading questions would also be highly damaging as this can lead respondents to answer different than what their true opinions are. Due to the same reason, it is important that the translator do not transmit his attitude towards the topic. Having clear, precise questions are important for the reliability of the analysis.

When wanting to know whether or not people wished to install composting toilets, pictures together with an explanation were simply given. The pictures shown to the respondents are showed in appendix 3. The weakness of this method will be discussed further in the end of chapter 5.2.2.

5.2.2 Qualitative data

Focus groups

Two focus groups took place in each village. The reason for this is that during structured interviews, respondents only answer to a fixed number of questions. Focus groups can help both to verify answers gotten form questionnaires and also in getting a better understanding for underlying attitudes and reasons for different phenomena.

Observation

In addition to the questionnaires, focus groups and informal conversations, I observed a lot while staying in the villages. Pictures document many of the environmental issues.

Key informants

Interviews with key informants were also carried out. These key informants helped me to understand a broader picture of why pollution problems were difficult to solve in this area. The key informants were:

- Tang Huug Huong (working for the Natural Resources and Environment Board (NREB))
- James Dawos (politician giving subsidies to the villages for roads, electricity etc)
- Presley Williams and Robert Ak Ringang (various conversations with the translators)

Limitations

When conducting the interviews, I could have given the respondents a number of alternative sanitary solutions to choose between such as for instance flushing toilets and vacuum systems. I decided however to focus my research to one optional choice. I simply showed pictures of this dry system and asked for their opinion. By doing this, I might have lost valuable information about whether or not they really wanted a compost system, or if they only wanted something different / something better than what they have now. Showing a variety of different solutions and having the respondents to choose among these alternatives, might not have given an accurate picture of the priorities either. The reason for this is that some of the respondents seemed a bit confused about the pictures and had difficulties imagining how this system worked. It was therefore important to spend more time explaining one system to get an opinion about this toilet as realistic as possible. The ultimate solution would of course have been that the respondents had already seen different options so that they could have thought about pros and cons and given their opinion about something familiar to them.

This limitation leads to the question about validity of the results. Do the results really show what influences the respondents wish to install composting toilets? The composting system was explained the same way to all respondents, but the responses were very different. The questions posed by the respondents about the composting toilet also showed that they understood how it worked. In the questionnaire, similar question were posed different places about for example pollution problems to check whether or not people answered randomly. In

addition to the questionnaire, focus groups helped to verify people's attitude towards both sanitation and pollution problems.

5.3 Analysing data

5.3.1 Logistic regression

The third objective of this thesis was to see whether or not people wanted to install composting toilets and to establish insight about what influence these attitudes. The dependent variable in the statistical analysis was whether or not people were willing to install composting toilets or not, a categorical dichotomy variable (0, 1). The independent variables were categorical. Based on this set of data, I used a logistic regression.

Before running a logistic regression analysis, it is important to check for multicollinearity. Multicollinearity means that there is a strong correlation between some of the independent variables in the model. "If there is perfect collinearity between predictors it becomes impossible to obtain unique estimates of the regression coefficients because there are an infinite number of combinations of coefficients that would work equally well" (Field 2005). When having multicollinearity, the model becomes very unstable, leading to incorrect answers. Due to this reason, it is important to find the variables causing multicollinearity and exclude these from the model.

6. Analysis

6.1 The villages

This study was carried out in three villages; Sadir, Danu and Simuti, situated 60, 40 and 65 km south of Kuching city centre respectively.

Figure 6.1: Kampung Sadir, Danu and Simuti (Google Earth 2007)

Before choosing in which villages to conduct the interviews, I visited various places in the Padawan area. Sadir and Danu seemed to be villages good for comparisons. Danu is located closer to Kuching city and the inhabitants have slightly higher income than in Sadir. Both villages are located close to the river, although the river in Sadir is smaller and do not have any villages upstream. Both villages have gravity fed water supply and their sanitary system is basically the same. I wished to compare villages, but could not have too many differences because then it could have been difficult to say what would be the decisive factor if getting different results. Practical factors such as fairly easy access to the villages and people willing to translate, was also important for this choice.

After having conducted 30 interviews in each of the two villages, I noticed a great difference in people's perceptions. I therefore chose to include a third village in the study named Simuti, which was very similar to Sadir. The reason for this choice was to see whether the different results were merely a coincidence or if similar answers would be obtained in a third village. The optimal situation would have been to study a forth village which was similar to Danu, but this was not possible due to time limitations.

6.1.1 Sadir

Sadir is a village situated 60 km from Kuching. This village, which consists of 74 households, has electricity and road connection to Kuching city centre. A small river runs through the village and four small bridges connect the pathways. The inhabitants are mainly farmers, cultivating primarily rice for their own consumption. Some farmers depended on income from black pepper and rubber tapping, while rice cultivation together with vegetables and fruits are collected mainly for own use. Most people rent land for cultivating rice because the land close Sadir is not fertile. The rented land, which they change every year, is slightly more fertile. Of the 30 respondents, 11 families lived on less than 299 MYR/month (= 469 NOK).

Smelly septic tank everybody complained about

Historic development of Sadir

The people living in Sadir have traditionally been very dependent on the river. They collected water in bamboo and carried it to their houses and used to take their bath and wash clothes in the river. Their sanitary system consisted of big holes where some bamboo was laid on top. The blackwater in the holes was not covered and people also practiced open defecation wherever they wanted. People in Sadir clearly remember "the old days" when the chicken and pigs would go under the longhouses and eat the human waste.

In 1973 Sadir received subsidies for toilet bowls made of plastic and cement for making septic tanks (Williams, pers. comm.). The river, they say, became more polluted due to the overflow from the septic tanks, especially with the population increase.

Many changes have happened during the last 10 years. Around 1997 they got road connection to Kuching city centre, electricity and gravity fed water distribution. 10 years ago people went swimming in the river, but the water quality has turned drastically worse the last years. People are even reluctant to catch fish in the river close to their village.

6.1.2 Danu

Danu is a village consisting of 56 households (11 are un-inhabitant) 40 km from Kuching.

This village also has road connection to the city, but no electricity even tough situated 20 km closer to the city centre than Sadir. When reaching the parking lot in Danu, one has to cross the big river by walking over an extension bridge to enter the village. Before reaching Danu, the river has already been polluted by villages upstream together with chemical fertilizers and pesticides from palm oil production. The inhabitants are mainly farmers, having cocoa, banana, cultivating black pepper and tapping rubber. The land is more fertile than in Sadir and they also receive more fertilizers from the government. The reason for this is partly due to the crops they cultivate (no fertilizers are received for the paddy) and partly because the organization of the village (the "strong men" in Danu know how to apply for subsidies / know the right people). The mean income is 500-799 MYR per month (= 785-1254 NOK), while two of the 30 respondents had a family income of less than 299 MYR/month (469 NOK).

Figure 6.2: The extension bridge before entering the village on the left hand side

The priorities for development in Danu are getting electricity and good roads in the village. Another problem this village faces is flooding during December/January. The last years of flooding were in 2002, 2003 and 2004.

Historic development of Danu

The people in Danu also used to take their bath and wash their clothes in the river. People living close to a stream went there instead because the water was cleaner. Water used for cooking was mostly collected rainwater, but also taken from the river. In the 1970's, people used squatting toilets, as shown in figure 6.3, or practiced open defecation.

Figure 6.3: Old squatting toilet

In the early 1980's, they got the sanitary system they have now (presented in chapter 6.4), but they had open "septic tanks" with a simple lid as a cover. Subsidies for cement to make septic tanks were given in 1986.

In the 1970's Danu received pipelines made of steel for the gravity fed water distribution. After having problems with rust, they received new PVC pipelines in the 1990's. Nowadays, they are applying for poly-pipes because the existing pipelines are easily broken, especially during flooding.

When people started to use more chemical fertilizers instead of burned soil, the river got less fish which also was smaller in size. Yearly, since the 1990's, the fishery department and also NGOs such as the Lion Club have put fish into the river. The fish die however within a short time after being set out in the river because of pollution (Ringang, pers. comm.).

Danu obtained road connection to the neighbouring village, Bengoh, only 10 years ago. Earlier, people in Danu used to take a 45 minutes boat trip to Bengoh where there was road connection to the city. The extension bride was made in 2003. Before that year they had to take a boat to the other side of the river before they could drive to the city.

6.1.3 Simuti

Simuti consists of 44 households and is situated 65 km from Kuching. They received electricity and road connection to Kuching city centre the same year as Sadir (1997). Simuti has only a small stream running through their village, but people are worried about their children who might be playing in the dirty water. Another concern is that this polluted water goes to a bigger stream which used to be the drinking source for the farmers. Every September/October, during burning of the paddy fields (rice fields), people drink this water even though they know it is heavily polluted. Many people get diarrhea during this time period. The inhabitants are mainly farmers like in Sadir, having rice, vegetables and fruits for their own use. A minority of the inhabitants practice rubber tapping and black pepper farming. 22 of the 30 respondents had a family income on less than 299 MYR/month (= 469 NOK).

People in Simuti originally came from Sadir. With the population growth, they are facing a space problem and are therefore hoping to move their village to a different place.

6.2 Who are the respondents?

When conducting interviews, it is important to get a representative sample. There were no register of the inhabitants in this village, and drawing for example every 10^{th} or every 40^{th} person of a list to be a respondent was therefore not possible. The respondents were simply chosen by visiting all parts of the village, interviewing one person in each household. Because people were working long hours in the field or being busy taking care of small children,

interviews had to be conducted when people had time. Nevertheless, by conducting interviews both during morning, mid day and the afternoon, it was possible to talk to both housewives and the people working long hours in the field. To get the views on sanitary issues from different people, men and women from all age groups were asked to participate. 40,5 % of the households were covered in Sadir, 53,6 % in Danu and 68,2 % in Simuti (30 interviews in each village). The age and gender distribution among the respondents are showed in the table below:

Table 6.1: Age and gender distribution among the respondents

	SADIR		DANU		SIMUTI		SUM
Age	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	
20-30	2	4	1	2	3	4	**16**
31-40	3	3	0	3	4	4	**17**
41-50	3	2	4	1	3	5	**18**
51-60	5	4	4	4	3	2	**22**
61-70	2	1	4	4	1	0	**12**
71-80	0	1	2	1	1	0	**5**
SUM	**15**	**15**	**15**	**15**	**15**	**15**	**90**

As shown in figure 6.4, there were no big differences in the education level between the villages. After completing primary school, another six years of schooling (form 1 through form 6), has to be completed before students can enter university.

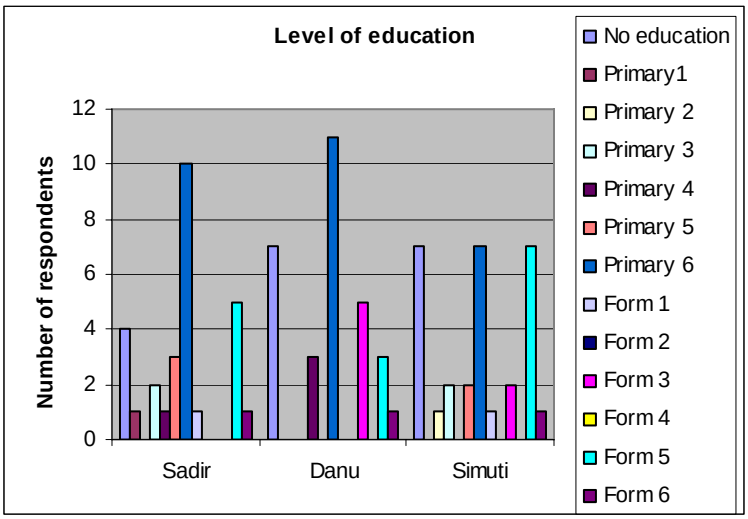


Figure 6.4: The respondent's education level

The graph below shows the income level in the three villages. If first comparing Sadir and Danu, one can see that people in Danu were slightly better off economically. In the third village visited to conduct this study, Simuti, a clear majority of the people had a family income on less than 299 MYR/month (= 469 NOK).

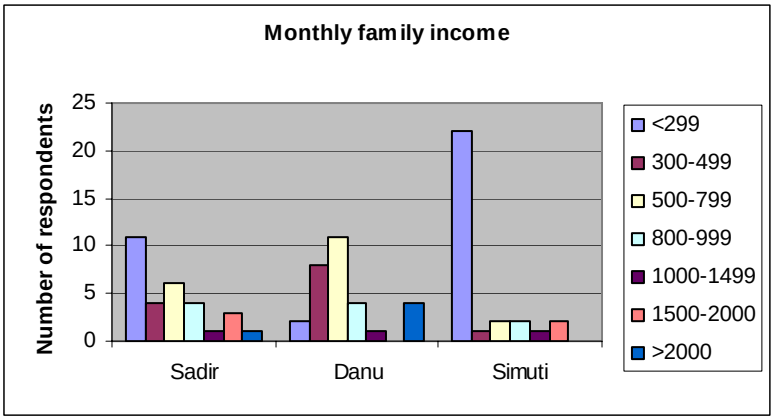


Figure 6.5: The respondent's income level in MYR (1 MYR = 1,57 NOK)

Two focus groups were conducted in each village; one with "the women" and one with "the strong men". In Sadir, there was an additional focus group with the young women as well as one with the students going to the Padawan School (where ecological toilets has been implemented). Preferably, there would be about five people in each focus group, but in Simuti there were as many as 12 people in the women's focus group (they all insisted on participating). The people in the focus groups were elected by the translators who tried to find homogenous groups in order to minimize power issues. Because the participants were elected by the translators and also because all the information I received was through the translators, the focus groups have received less attention.

6.3 Sources of error

Cultural differences / outsider

This study was done in a culture very distant from Norway. There might have been cultural differences and norms which I did not pick up and could therefore have misunderstood the reason behind attitudes and answers. Many conversations with the translators did clear up a few misunderstandings.

Translators

People talked Bidayuh in the three visited villages. When translation is needed, a lot of information will naturally be lost. I talked a lot with the translators pointing out how important direct translation is. If the translators would have interpreted the respondents' answers, the information would have been misleading. The need of translators was one reason why I chose to base my study on structured interviews. The sources of error due to misunderstanding and leading questions are minimized when questions are standardized.

Having one translator helping me in all three villages would have been the optimal solution. This was not possible and I therefore had two different interpreters. The translators might have had different wording on the questions, leading the respondents to answer in a certain way. I was most concerned about this issue, especially because very similar answers were given in the two villages where I had translator A, while the answers in the village with translator B was quite different. In all three villages I did however a few interviews in English, and I got the same results as the translators.

During the focus groups, direct translation was most challenging since this tended to halt the discussions. Due to this reason, translation would often come after more than one person had said his/her opinion. This way, it was easier to get discussions going. I was careful to see who participated and ask for the all people's views. When conclusions seemed to be drawn, I was careful to ask whether or not all agreed. The statements drawn from the focus groups are based on what the translators said, and as mentioned in the previous chapter, the focus groups have therefore received less attention.

Responding accordingly to what the interviewer "want to hear"

The translators did either live or knew well the villages where they helped to carry out the interviews. They could therefore have had an influence on the respondents which I might not have noticed. The translators could on the other hand explain some attitudes and norms that I probably would not have understood otherwise.

The fact that I was present might also have made a difference. Although underlining that this was only a study, it was clear that some of the respondents were hoping for implementation of this composting toilet and might have answered the questions accordingly.

Talking with each other

This study was carried out in three small villages. It was well known that I was doing a study on their sanitary system, and it is most likely that most of the people had heard about the questions I would pose before actually conducting the interview. People might therefore have been formed by other people's views.

Misunderstanding

The respondents gave their opinion about the composting toilet based on the explanation of a picture. An opinion should have been based on being familiar with this ecological system, but this was not possible in this study. Good explanations and communication with the translators was therefore crucial to diminish this source of error.

Tendencies in the answers

There was a strong tendency among the respondents to answer either 1 (agree) or 5 (disagree) without making much notice to the alternatives 2 (mostly agree) or 4 (slightly disagree). In cases where the respondents were uncertain, they would however use response category 3 (neutral).

6.4 Today's sanitary system

In the previous chapter, the villages' history and old sanitary systems was briefly described. This chapter, answering this thesis' first objective, will explain the existing sanitary systems in the three villages to see how they work and where the wastewater is led.

Sadir

The sanitary systems in Sadir are mainly squatting toilets. The majority have plastic bowls, but a variety exists; some have porcelain bowls and a minority have sitting toilets where the flush seldom work.

Figure 6.6: Squatting toilet

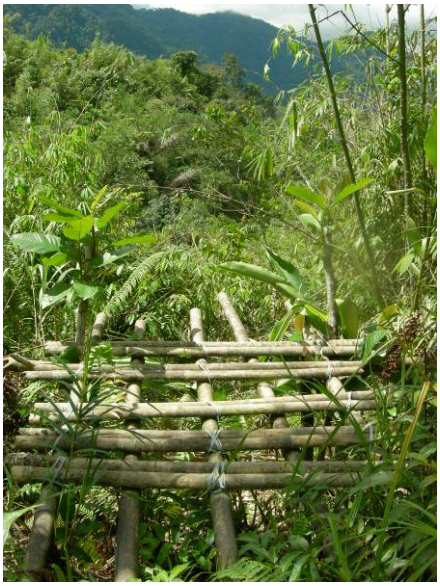
Figure 6.7: Sitting toilet

From the toilet, a pipeline goes to a septic tank. Most people have concrete tanks which are sealed under. Some of the septic tanks are divided into two chambers. The excreta are 'held back' in the first chamber. When the fist chamber is full, the water will enter the second chamber. When the second chamber is full, the overflow is lead away by pipelines to the soil or directly to the river.

Figure 6.8: Waste water led to a stream

Figure 6.9: Septic tank

People complain about mosquitoes and smell both due to the overflow and cracks in the septic tanks. Some people have received subsidized septic tanks from the government which are made of plastic and not sealed under. The overflow is also here, lead to the soil or to the river.



Some people do not have septic tanks at all and the human waste is led directly to the river.

When going to the paddy field, people practice open defecation or lay bamboo over a hole. The waste in the hole is not covered.

Figure 6.10: Open defecation, practiced in the field

Danu

In Danu there is a variety of sitting and squatting toilets made out of plastic and porcelain. Only a few of the installed flushing systems work because sand and leaves block the pipelines. There are a few more people with tiles on the bathroom floor than in Sadir.

Figure 6.11: Squatting toilet

Figure 6.12: Sitting toilet

From the toilets, pipelines go to the septic tanks. The septic tanks are, unlike the tanks in Sadir, not sealed under. When the septic tanks are full, the overflow goes to the drainage system, to the streams or to the soil. Only three people in Danu do not have septic tanks and everybody complained about one toilet in the centre of the village from where the excreta could be seen in the drainage system. Some of the people have a filter in the overflow pipeline which is supposed to reduce the smell from the overflow and kill flies and mosquitoes trying to enter the septic tank. This filter was given from the medical department in the 1990's, and since it should be changed every year, the effect of this filter in the year of 2008 is therefore questionable. When going to the field, they practice open defecation.

Figure 6.13 Filter which is put in the overflow pipeline
(the pen is included in the picture to show the size of the filter)

Figure 6.14 Septic tank (the pot is put on top of the aeration pipe to diminish the smell)

Simuti

In Simuti, the sanitary system is similar to what they have in Sadir, although the conditions in terms of pollution and visual appearance are a bit worse in Simuti. More people had the floor in the toilets made out of bamboo and some people shared toilet with neighbouring families.


Figure 6.15 and 6.16: Squatting toilets

6.5 People's satisfaction with today's sanitary system

The second objective of this thesis was to see whether or not people were satisfied with their sanitary system and to see if they considered blackwater contamination to be a problem.

A number of questions were posed about the existing sanitary system including whether or not there were problems with:

- visual appearance
- smell
- pollution
- negative health consequences

Visual appearance

In Sadir and Simuti, a majority were not satisfied with the visual appearance of their sanitary system, 73,3 % and 80 % respectively. In Danu, only 23,3 % were not satisfied.

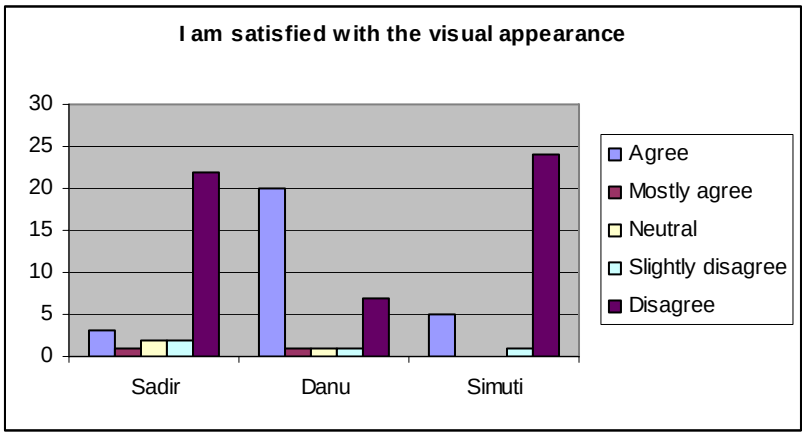


Figure 6.17: The respondent's satisfaction with the visual appearance of their toilet

Smell

In Sadir and Simuti, 80 % and 46,7 % respectively meant there were problems with smell due to their sanitary system. In Danu on the other hand, only 13,4 % said there were inconveniences with smell, while 83,4 % said they had no such problem. These views are showed in figure 6.18:

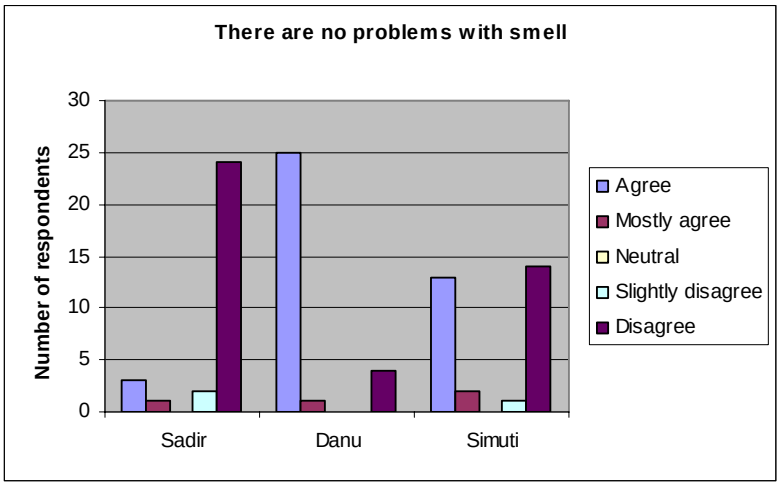


Figure 6.18: Whether or not people meant there were problems with smell due to the existing sanitary system

In the first visited village, Sadir, most people complained about the smell and the mosquitoes due to the leaking septic tanks. One septic tank close to the pathway in the "centre" of the village was always mentioned as the "worst case". A woman said that she always had arguments with her husband about their smelly septic tank even though he made a new septic tank in 2006. This respondent wanted to have longer pipelines from the overflow to lead the wastewater to the river. This way, she said, the smell and the mosquito problem would diminish.

In Danu, one woman said she was embarrassed because her septic tank (which was located next to the pathway in the village) was smelly. Almost all respondents in this village however, said that their sanitary system had no problem with smell, but blamed one man's lack of septic tank both for terrible smell and malaria problems.

In a focus group, it became clear that Danu was not free from sanitary problems either. It was explained how some people flush out their septic tank to get rid of the smell:
"At night-time they use the hose. They put the water inside the septic tank and then all the things will come out through the overflow. From there it goes to the drain and from the drain goes to the stream and finally to the river".
Some people obviously had problems with smell from the septic tanks and handled it their way. The fact that only four of the 30 respondents in Danu stated that there were such problems could be because there simply was little smell, but also because people talked less about blackwater pollution problems in this village. This phenomenon will be discussed later in this chapter.

In Simuti, the third visited village, 46,7% meant there were problems with smell from their septic tanks. Why people were more satisfied here than in Sadir is difficult to answer. One explanation might be that the overflow pipelines were lead further away from the houses.

Pollution
The responses to the question about pollution due to the existing sanitary system had similar patterns as the questions about visual appearance and smell. The pollution question had however even stronger tendencies for dissatisfaction in Sadir and Simuti, where as many as 93,4 % meant that the blackwater polluted the river. The view was more split in Danu where 43,3 % meant that there were pollution from their septic tanks.

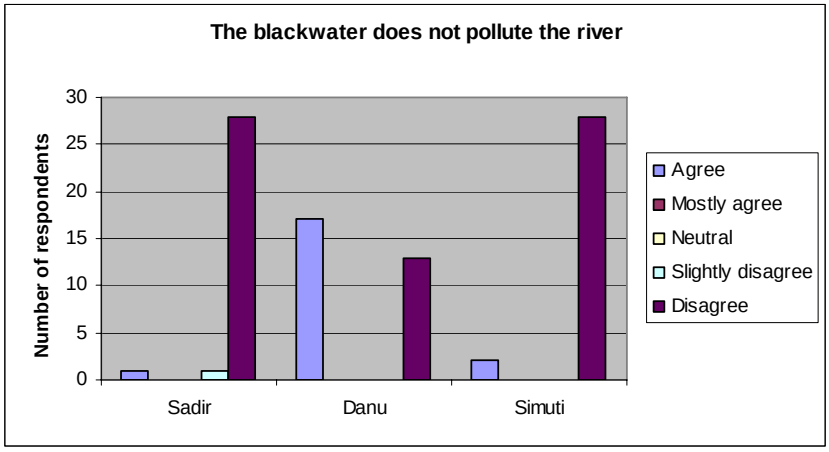


Figure 6.19: Whether or not the existing sanitary system polluted the river

The seriousness of the blackwater pollution was, as shown, viewed extremely different in the three villages. During one focus group in Sadir and both focus groups in Simuti, people said that if they had more money, they would spend it both on a new sanitary system and their children's education. These answers were noted, but with caution. The respondents knew this research was about their sanitary system, and even though they knew it was only a survey, they might have hoped for implementation and answered accordingly. They argued however that there was no need for beautiful houses if they were in poor health conditions. In Sadir and Simuti, they had already had several village meetings about possibilities for changing their existing sanitary system. This underlines that they had discussed these issues long before this study was conducted and felt that this was a problem needed to be solved.

In Danu, people seemed more confused about some of the posed questions. This might have been because they did not see any problems with their sanitary system and had therefore not thought about these issues before. During one focus group in Danu it was stated that there were no problems with the septic tanks:
"The blackwater goes first to the soil, so it is clean when it enters the river".
When discussing pollution problems in focus groups in Danu, the blackwater was not even mentioned before I posed direct questions. They were more concerned about the generators, rubbish, chemicals and dead animals. When I insisted on talking about the overflow from the septic tank, this answer was however given later in the same focus group:

"Everybody wants a proper septic tank[3]*, but they need 2000 MYR (= 3140 NOK) for that, and they would use those 2000 MYR for something else. The blackwater pollution is not so serious in Danu. It is a problem, but not serious".*

In the following graph, it becomes clear that the seriousness of the blackwater pollution is viewed extremely different in the villages.

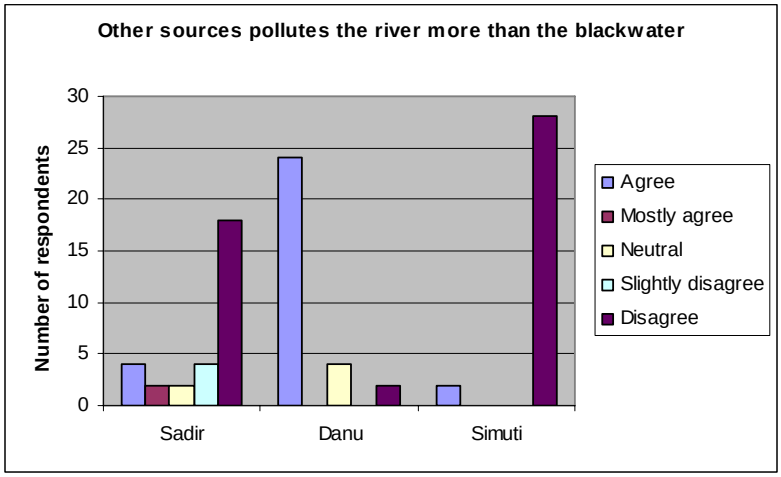


Figure 6.20: Whether or not people meant that other sources polluted the river more than the blackwater

There can be many explanations to why people felt that the blackwater pollution was less problematic in Danu. People might think that the overflow from the septic tanks does not pollute the river because it does not pass directly through the village. One explanation can therefore be the physical location of the rivers in relation to the villages. The river passing Danu was rather big (see figure 6.2) and already polluted upstream from palm oil production. People meant that agriculture products such as fertilizers and pesticides together with dead animals and batteries were the real pollution sources. A big dam project under construction upriver was also causing a lot of concern.

In Sadir on the other hand, the river is smaller and passes through the village. 60 % of the respondents in Sadir meant that the blackwater was the most severe pollution problem. Those who answered otherwise felt that the garbage and dead animals was a bigger problem than the blackwater.

[3] A "proper septic tank" was explained as a tank which is divided into two or three chambers. The excreta would be held back in the first chamber. When the fist chamber was filled up, the wastewater would enter the second chamber. This way, the wastewater would stay longer inside the tank and not be so heavily polluted when going to the overflow.

In Simuti, 28 of the 30 respondents meant that the blackwater was the most serious pollution source. The remaining two respondents answered that the most serious pollution problem was garbage and animal dung. Although there is no river in this village, people were afraid of their children playing in the small streams. They meant that these streams polluted the rivers downstream heavily where some people went fishing and swimming.

The responses to the question about whether or not the sanitary system caused health problems had extremely similar pattern to the question about whether or not the sanitary systems caused pollution (showed in figure 6.19). This pattern shows that people were very aware of the negative health consequences that pollution might cause.

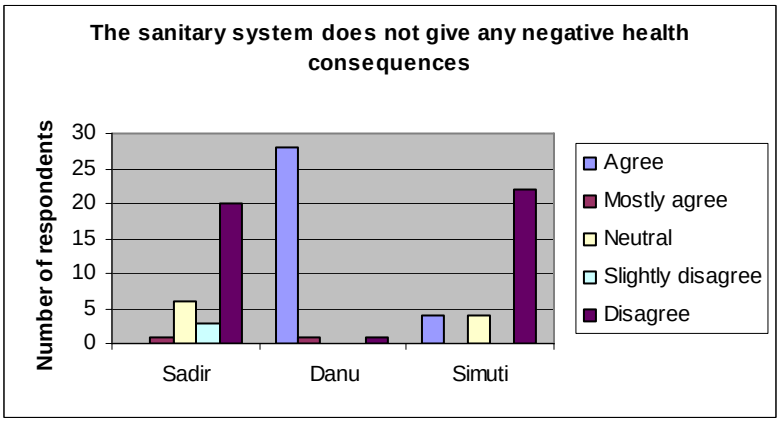


Figure 6.21: Whether or not people meant that the existing sanitary system caused negative health consequences

Another interesting issue was the great variation between these villages in how much they talked to each other about blackwater pollution problems.

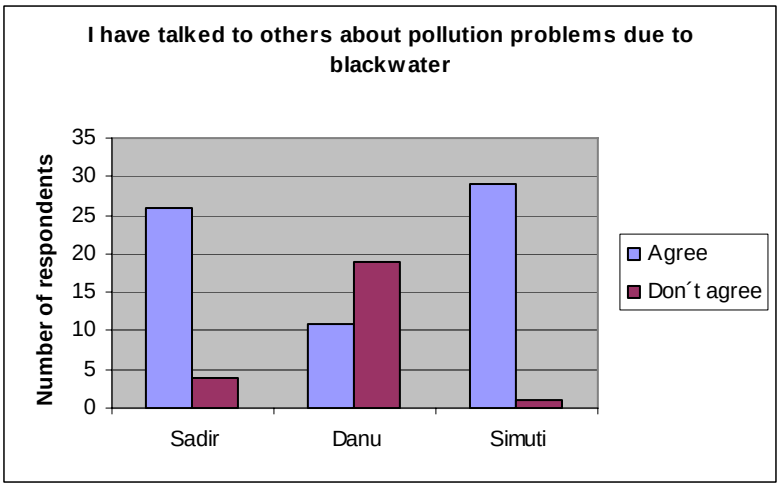


Figure 6.22: Whether or not people talked to each other about blackwater pollution

It makes sense that people who do not believe there exist a blackwater pollution problem do not talk about this issue. There are however other interesting elements to be discussed concerning this matter. During the interviews in Danu, very few respondents said that they talked to others about blackwater pollution. Admitting to complain about other people's sanitary system could cause personal conflicts. This was the reason why people said that *"it is better not to talk too much"*. A majority of the respondents did mention one person's lack of septic tank while at the same time saying that they never talked about blackwater pollution. When realizing these contradictory answers, I went back to all the people I had already interviewed and asked again if they had ever talked about blackwater pollution problems with their closest family members. Three respondents changed their answer and admitted having talked about these issues. These answers might therefore only show how open people were to admit talking about these issues and not the actual number of people discussing pollution.

The second objective in this study was to see whether or not people were satisfied with their sanitary system and if they considered the blackwater contamination as a problem. The three villages had, as shown, quite different views. In chapter 7, the reasons for the differences between apparently similar villages will further be discussed. Following, the third objective will be presented.

6.6 What influence people's wish to install compost toilets?

The third objective of this study was to get knowledge about how willing people were to change their existing sanitary systems to a compost toilet and establish what influence these attitudes.

As noted, there were distinctive differences between the three villages in their view of the present sanitary systems. Similar differences appeared when asking about the willingness to install compost toilets.

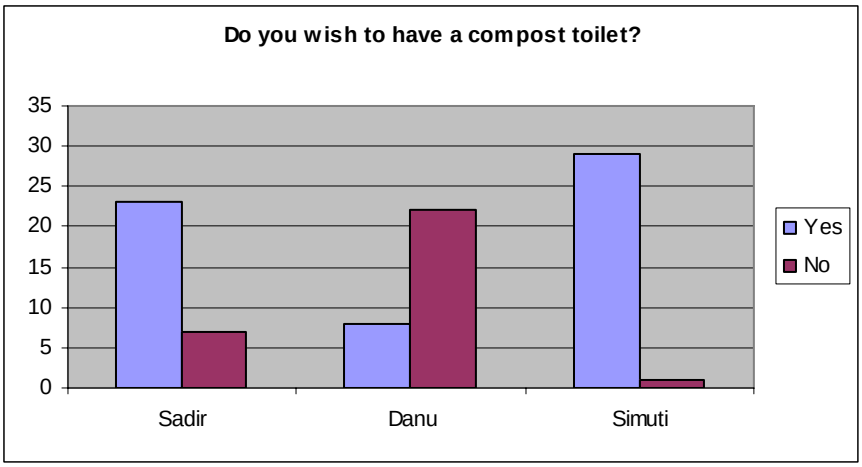


Figure 6.23: Whether or not people wanted to install compost toilets

In Sadir and Simuti, as many as 76,7% and 96,7% respectively wanted to have compost toilets instead of today's system. Only 26,7% had the same wish in Danu. There was a clear difference in people's responses based on which village they came from.

In Danu, where only 8 respondents wanted to have a compost system, several respondents said that they would have liked to have the compost toilet at the field where they were not so concerned about the hygiene.

When presenting the pictures of the composting toilet to the respondents, the reactions were very different. In Sadir and Simuti, most people liked the composting system (especially the sitting toilet). *"Quite nice system"*. They were however a bit concerned about whether or not they could clean the toilet since it was a dry system. In Danu on the other hand, some people laughed about the idea of a waterless system. One respondent said: *"that system does not exist any more"*. He further explained that the flushing system was what everybody wanted nowadays (the modern one), while the composting system was only used "in the old days".

What makes people react so different to the same sanitary option? The model used to explain why some people wished to install compost toilets, while others were quite reluctant, was presented in figure 3.4. How the analysis is carried out based on this model will be reported in detail. First, however, I will argue why the "perceived behavioural control" will not be directly analyzed:

Perceived behavioural control

Perceived behavioural control will shortly be discussed, although not taken directly into the statistical analysis. The reason for this is that the goal of this study is to look at willingness to change to composting toilets if investments would come from outsiders. It was quite clear that most people in these villages did not have the capital to change their sanitary system. If such a project would be realized however, it would be important to know people's attitude towards these toilets.

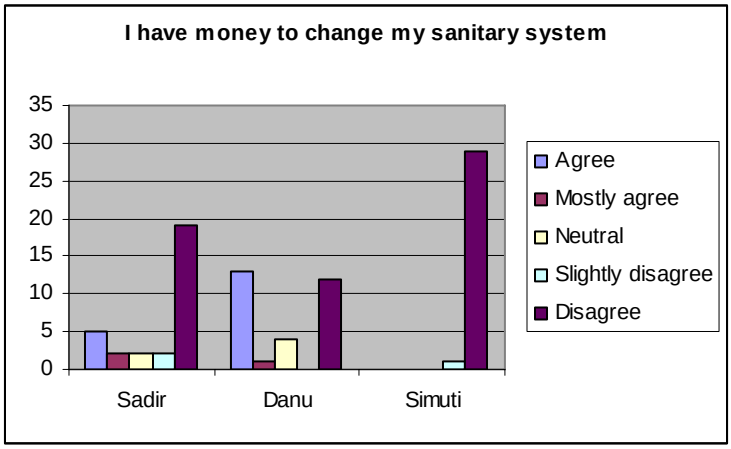


Figure 6.24: Whether or not people felt they had money to install compost toilets

Figure 6.28 shows whether or not people felt they had money to change their sanitary system. The actual family income was presented in figure 6.5 and verifies their answers.

6.6.1 From questions to variables

The questions chosen to be included in the model are the ones giving the best explanation for the respondent's beliefs, attitudes and village characteristics such as norms.

The boxes presented on the next page, are taken from the model which is used in this thesis. Reasons for choosing these 12 factors will be explained.

1. Belief that the implementation of compost system would have positive effects on the river quality
2. Belief about the hygiene when introducing a compost toilet

- Beliefs about outcomes of the composting system:
  - river quality
  - hygiene

3. Attitude towards existing sanitary system
4. Attitude towards river pollution
5. How severe people believe that the blackwater pollution is
6. Belief that people have been sick due to polluted water
7. Willingness to use blackwater as fertilizer

- Attitudes:
  - Attitudes towards existing system:
    - Problems with smell / visual appearance
    - Pollution
  - Attitudes towards pollution
    - How serious the blackwater pollution is
    - Attitudes towards using blackwater as fertilizer

8. Cases of diarrhea
9. Cases of skin rash

- Health:
  - Diarrhea
  - Skin rash

10. Whether or not people would change their sanitary system regardless of what their neighbours do
11. Whether or not people talk about pollution problems
12. Village variable

- Characteristics of the village:
  - Norms
  - Village

Some of these 12 factors are based on more than one question. The reason for this is that a few questions were worded more or less the same, but asked different places in the questionnaire. This was a way to see whether or not the respondents were answering randomly if being confused by the questions. If the answers to similar questions would have varied greatly, I would have had to consider eliminating them.

Questions that were concerning the same issues were put together on a theoretical background. Putting together questions needed to be handled carefully because where respondents answered '1' on one question and '5' on the other, the average of these answers would have given an un-correct 'neutral' answer.

Beliefs about the outcomes of the composting system

1. Belief that the implementation of compost system would have positive effects on the river quality. This factor is made from two variables:
    - I believe that the implementation of a compost toilet that treated all the blackwater would have positive impacts on the water quality in the rivers close to the village.
    - I believe that there would be positive effects on the water quality in the rivers if all changed their sanitary system.

The people answering "agree" to the first question, answered almost without exception likewise to the second question.

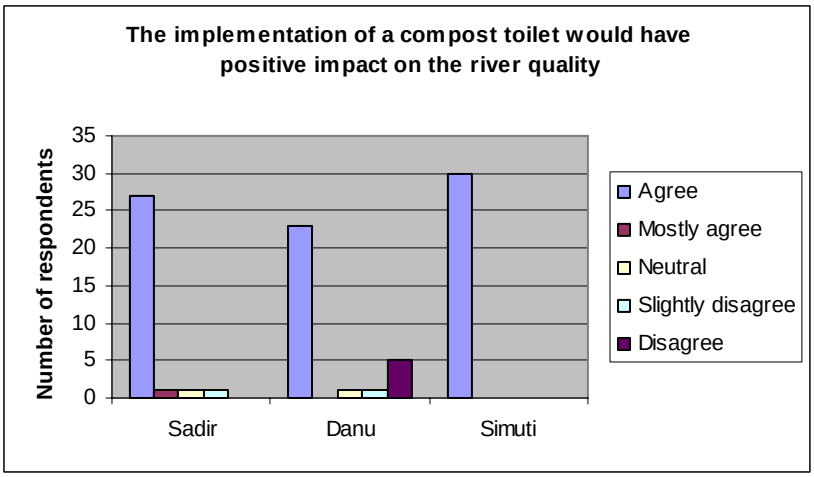


Figure 6.25: Whether or not people believe that the implementation of a compost toilet would have positive impact on the river quality

2. Belief about the hygiene when introducing a compost toilet. This variable consists of two statements:
    - I believe that the implementation of a compost toilet that treated all the blackwater would have positive impacts on the hygiene in the bathroom.
    - I believe that people would be less sick if a compost toilet that treated all the blackwater would be implemented.

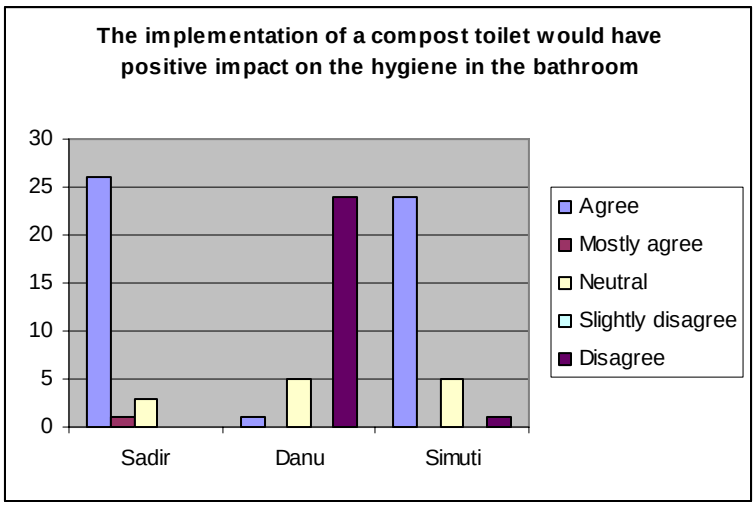


Figure 6.26: Whether or not people believed that the implementation of a compost toilet would have positive impact on the hygiene in the bathroom

People had very different views concerning this issue. In Sadir, one respondent said that she believed the composting system would be less smelly because today's system would sometimes be blocked. With a composting system on the other hand, where no water or pipelines would be needed, she believed there would be no problems with blockage and therefore more hygienically. Most people (in all villages) that wanted to install a composting system said they preferred the sitting toilet. The reason for this was that the waste would not be seen when using the toilet. It is puzzling however that the views were so different in Danu where most people meant that a composting system would cause more smell and mosquito problems. The differences between the three villages will be discussed further in chapter 7.

Attitudes towards existing system

3. Satisfaction with the existing sanitary system is based on the presented statements:
    - I am satisfied with the visual appearance of the sanitary system
    - There are no problems with smell
    - The sanitary system does not give any negative health consequences
    - The blackwater does not pollute the river

One statement; "it gets the waste water away in a satisfying way" confused some of the respondents. It was obvious that some believed that the blackwater was a pollution source, which they confirmed in the last statement on the list presented above. They plotted however that the waste water was taken away in a satisfying way, because as some of the respondents said; *"We have no choice"*. The second statement not taken into the statistical analysis is the question concerning whether or not the toilet was clean. *"It is clean when we clean it"* was the comment to this statement.

By putting together four statements into one factor, I assume that all the statements have the same importance. On the negative side, this might give the wrong picture because one person could have been unsatisfied with the sanitary system even though only answering negatively to one of the questions. I chose however to make one factor because the answers to these questions followed the same pattern (in other words, the people who answered 1 or 2 to one statement, normally answered likewise to the other statements). When putting together these four questions, I got a more total picture of people's attitude towards their existing sanitary system.

4. Attitude towards river pollution
    - I go swimming in all the rivers in the village

Many questions helped getting an overview over people's attitudes towards the river pollution. The gravity fed water supply is not included in the model because this water source came from the mountain and would not be affected by the sanitary system. The responses to some of the questions were almost 100% "agree" or "disagree" and would therefore not give extra information in the quantitative analysis. People were very much aware of which parts of

the rivers that was polluted and almost nobody believed that all the rivers were clean. The question best fitted to indicate whether or not people felt that their river was polluted was therefore whether or not they would go swimming in all rivers close to their village.

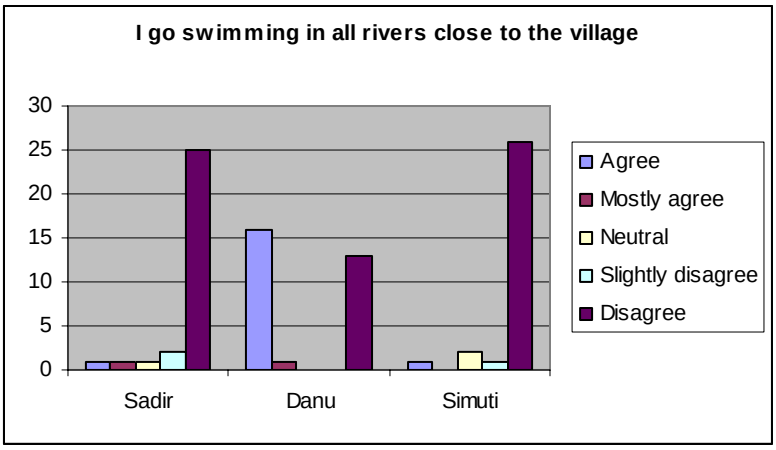


Figure 6.27: Whether or not people went swimming in all rivers close to their village

5. How severe people believe that the blackwater pollution is, was based on one statement:

- Other factors than the sanitation systems are more important when dealing with water quality (showed in figure 6.20)

As already mentioned, people were very clear about which pollution sources they believed were the worst in their village. Most people in Sadir and Simuti meant that the blackwater was the most severe pollution source, while 24 of the respondents in Danu meant for certain that other sources polluted more. In fact, blackwater pollution did not seem to be a concern (except the smell and mosquito problem due to one person's lack of septic tank).

6. Willingness to use blackwater as fertilizer

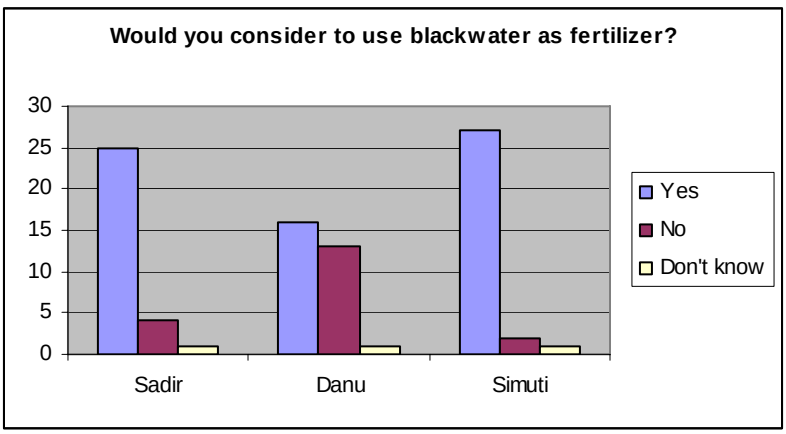


Figure 6.28: Whether or not people would be willing to use blackwater as fertilizer

Graph 6.28 shows people who wanted to use urine as fertilizer. Of the 68 respondents who said they wished to use blackwater as fertilizer, 29 wanted only to use urine.

7. The belief that people have been sick due to polluted water

- I have never been sick due to polluted water

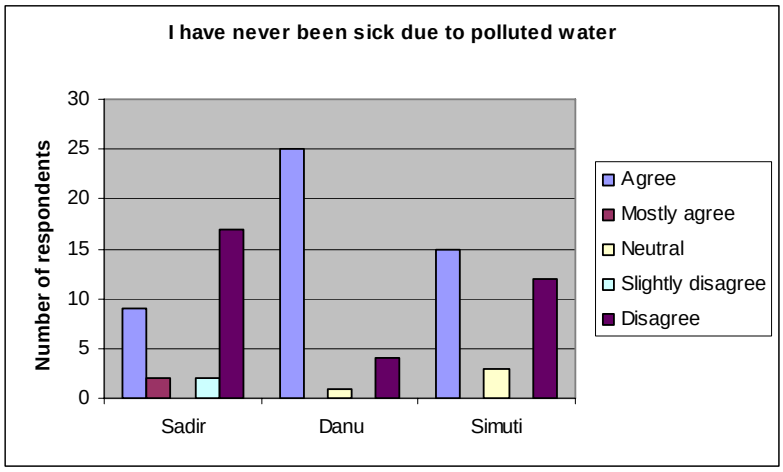


Figure 6.29: Whether or not people believed that they had been sick due to polluted water

An interesting issue is that in Sadir and Simuti, 28 of the respondents in each of these villages were certain that the blackwater polluted the river (shown in figure 6.19). 20 and 22 of the respondents in Sadir and Simuti respectively, were also certain that the existing sanitary system caused negative health consequences. Fewer respondents (17 and 12 respectively) did however believe that they themselves had been sick because of water pollution. Although believing that the blackwater pollution had negative consequences, people were not certain what kind of illness pollution would give. Several respondents pointed out that they did know what the cause was when being sick.

In Sadir and Simuti, people said that a cholera outbreak had occurred in the area in the late 1970's. There was however disagreements about how many people that died (the number varied from 5 to12). Severe health problems might however affect people's attitudes towards pollution problems.

8. How often people have diarrhea

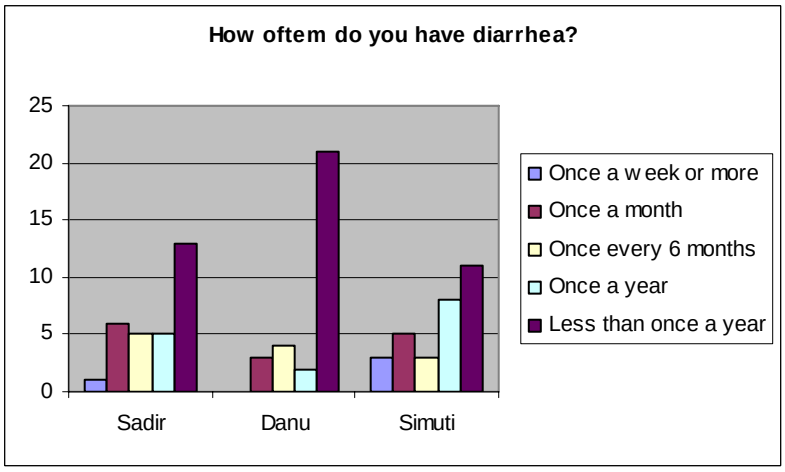


Figure 6.30: How often people have diarrhea

Every year, during burning of the paddy field in September/October, people suffer from diarrhea in Simuti. People linked this to drinking from the small polluted streams, which the farmers did when being away from the village for such a long time. Even though they were certain about this cause, they were quite unclear about why the diarrhea spread to so many people in the village.

9. How often people have skin rash

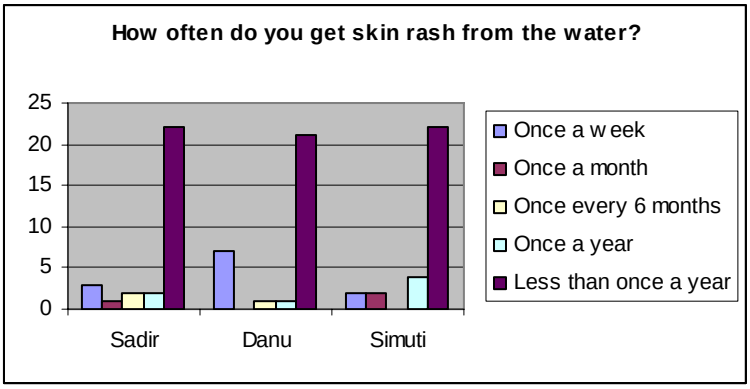


Figure 6.31: How often people have skin rash due to the water

In all three villages more than 20 of the 30 respondents stated that they never got skin rash from the water. An explanation for this might be that people did not swim where they meant that the water was polluted. They would swim in the water falls they believed had clean water or simply take their bath using the gravity fed water supply. In Danu, there were more people

than in the other two villages who said that they were bothered with skin rash whenever going to the river. The blackwater was not used as an explanation for this, but rather "water allergy".

Characteristics of the village

The next two variables concern the villages' norms.

10. Whether or not people would change their sanitary system regardless of what their neighbours do

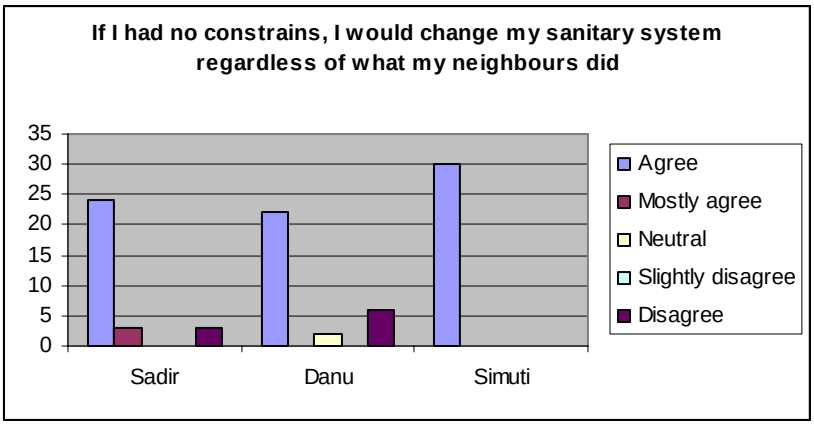


Figure 6.32: Whether or not people would change their sanitary system regardless of what their neighbours did

It seemed as if people did not care about their neighbours' opinions. In Sadir, several respondents said they would gladly be the first to install composting toilets. In Simuti, many said they would be glad to get compost toilets to become role models for others to follow. It might therefore be incorrect to say that people did not care about their neighbours' opinions. In all three villages it became clear that people felt uncomfortable showing their toilets to visitors if they were not satisfied with its appearance. Other people's opinions did matter, and people wished to have toilets they could be proud of.

11. Whether or not people talk about blackwater pollution problems (figure 6.22).

Whether or not people talked about blackwater pollution problems, or admitting to talk about it was shortly discussed in section 6.5.

12. The last variable used in the statistical analysis is the “village” variable.

This variable consists of all the differences between the villages such as physical variation. Variable 10 and 11 treat the norms in the villages. There are however other factors differentiating the villages from each other, such as for example the location of the river. The distance from each septic tank to the river was not measured. The size of the river and whether or not there are villages upstream polluting the river, is however important to consider and will therefore be a part of the “village” variable.

6.6.2 Regression analysis

The variables used in the regression analysis have now been presented. From the multicollinearity test in appendix 4a, one can however see that it might be problematic to run the analysis with all the variables. The reason for this is that the Condition Index is as high as 43,2 and Model Dimention number 14 have two values higher than 0,50. There is however no clear rules about when variables need to be excluded due to multicollinearity (Field 2005). We see however that caution needs to be taken.

The logistic regression with all the variables from the theoretical model is shown in appendix 5a. With as many as 16 variables and only 90 respondents, the insignificant variables might cause disturbances in the model and the variables with the highest P-values should therefore be excluded from the model (Sandberg, pers. comm.). Two variables were removed (whether or not people want to use blackwater as fertilizer (BlwFertilizer) and whether or not they believe that they have been sick due to polluted water (Nsick). The result from this reduced logistic regression is found in table 6.2.

Table 6.2: Logistic regression table (includes all the variables from the theoretic model except whether or not people want to use blackwater as fertilizer and whether or not they believe that they have been sick due to polluted water).

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	3,18957	7,78836	0,41	0,682			
BelORivR	-0,911679	0,882452	-1,03	0,302	0,40	0,07	2,27
BeliOutR	5,49510	3,51895	1,56	0,118	243,49	0,25	240923,60
Att.Present	0,915706	0,894176	1,02	0,306	2,50	0,43	14,42
Swimming	-1,86891	1,27308	-1,47	0,142	0,15	0,01	1,87
OtherF	-3,17810	1,53859	-2,07	0,039	0,04	0,00	0,85
DiarRev	3,56467	1,68817	2,11	0,035	35,33	1,29	966,31
SkinRev	2,70890	1,39002	1,95	0,051	15,01	0,98	228,91
ReglessR	2,18007	1,21540	1,79	0,073	8,85	0,82	95,80
TalkPoll	6,65610	3,38149	1,97	0,049	777,51	1,03	587615,97
Sadir	-9,19020	6,30829	-1,46	0,145	0,00	0,00	23,90
Danu	-11,6279	6,00325	-1,94	0,053	0,00	0,00	1,15
Gender	3,14606	2,14667	1,47	0,143	23,24	0,35	1561,70
Income	-1,50670	0,782670	-1,93	0,054	0,22	0,05	1,03
Age	-4,54138	2,53417	-1,79	0,073	0,01	0,00	1,53

Log-Likelihood = -11,341
Test that all slopes are zero: G = 91,892, DF = 14, P-Value = 0,000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	29,1554	74	1,000
Deviance	22,6810	74	1,000
Hosmer-Lemeshow	1,4090	8	0,994

Predictor explanations:

BelORivR: Belief that a composting toilet would have positive effects on the river quality
BeliOut: Belief that a composting toilet would have positive effects on the hygiene
Att.Present: Attitude towards present system
Swimming: Whether or not people swam in all rivers close to their village
OtherF: Whether or not other factors than blackwater was the most severe pollution source
DiarRev: Whether or not people had diarrhea
SkinRev: Whether or not people had skin rash
ReglessR: Whether or not people wished to change to a compost toilet regardless of what their neighbours did
TalkPoll: Whether or not people talked to others about pollution problems due to blackwater
Sadir: Village variable
Danu: Village variable
Gender
Income
Age

(Some of the respondents' answers were reversed (meaning that value 1 would get value 5, value 2 would get value 4 and visa versa. The reason for this was to get more logic signs in the regression table. The variable names of these "reversed variables" ends on R or Rev).

With a Hosmer-Lemeshow P-value of 0,994, we could conclude that we have a good model. Caution needs however to be taken due to possible disturbances because of multicollinearity. The multicollinearity test is shown in appendix 4b. The Condition Index of 40,5 should preferably have been lower, but none of the Model Dimensions have more than one value over 0,50. Due to the uncertainty of the stability of the model, the logistic regression was run several times, each time taking out the variable with the highest P-value. By doing this, I could hold an eye on all variables, noting if they would change dramatically when excluding some variables. The model proved to be quite stable. No other variables became significant. Two variables became insignificant however when only 9 and 10 variables were left in the logistic regression table (see appendix 5c and 5d). These variables were whether or not people got skin rash from the water (SkinRev) and whether or not people wanted to install composting toilets regardless of what their neighbours did (ReglessR). When running multicollinearity tests on the same variables as used in the logistic regression tables, it is obvious that the variables influence each other. When looking at the histograms, this would however be expected.

The remaining six significant variables proves to be stable and will be given most attention in explaining what effects people in their willingness to install composting toilets (see appendix 5d). These variables were significant in all the tests and when running a multicollinearity test only on these values, the Condition Index is below 15 (see appendix 4d).

Based on the results from the logistic regression in table 6.2, each variable will now be discussed in relation with the hypothesis stated in chapter 4. Because all the variables in the model are included, an α-value of 0,10 will be accepted. This means that in 10% of the cases, H_0 might be rejected even if H_0 is true.

H_0: There is no connection between the independent and the dependent variable.
H_1: There is a connection between the independent and the dependent variable.

A type 1 error (rejecting the H_0 hypothesis even if is H_0 is true) is a more serious error than a type 2 error (accepting the H_0 hypothesis if is H_1 is true). An α-value of 0,10 will however be accepted because as many as 14 variables are used. As already mentioned, many insignificant variables might cause disturbances in the model. In the logistic regression table with only significant values, all P-values are below 0,02.

Beliefs

- Hypothesis 1

  People who believe that a composting toilet will make the river cleaner are more willing to have a compost toilet than the people who do not believe it will have any positive effect on the environment.

This variable was not significant and we can therefore not state that there is a relationship between this independent variable and people's wish to install composting toilets.

The reason why this variable is not significant might be because almost everybody in the three villages answered similar (see figure 6.25). A majority of the respondents in all three villages answered that a compost toilet would have positive effect on the river quality. This can therefore not explain people's wish to have composting toilets. The answers to this question do not follow the same tendency as the answers to all other questions, meaning that people in Danu often had different opinions than people in Sadir and Simuti. When conducting the interviews, people in Sadir and Simuti seemed certain about their answers. They felt that blackwater pollution was problematic in their villages. In Danu on the other hand, a majority of the respondents answered that other sources than blackwater was a more severe pollution source (see figure 6.20). This also became apparent in the focus groups when people talked about generators, chemicals and dead animals as pollution sources. Blackwater issues were simply discussed after I brought up the topic. All of these other answers support the theory that in Danu, the respondents might have been confused by the question concerning whether or not the installation of composting toilets would have positive effects on the river quality. Some might have answered that they thought a composting toilet would not pollute the river, but at the same time not believing that this would have any effect on the river quality. Another explanation could be that people did believe that the blackwater polluted the river, but that they did not want to admit it when direct questions were posed. This only becomes speculation however and will not be further discussed.

Attitudes

- Hypothesis 2

  People who are not satisfied with their sanitary system are more willing to change to a compost toilet than the people who are satisfied with the present system.

The variable "attitude towards the existing sanitary system" is not significant and we can therefore not state that there is a relationship between this variable and the dependent variable. This variable was put together by four different statements. The regression analysis was run again with all four questions separated to see whether or not the result would be different, but neither of the statements turned out to be significant. It would have been interesting to run an analysis, not looking at people's satisfaction, but whether or not people had tiles on the floor and whether or not they had plastic or porcelain bowls. The reason for this is that no pattern could be seen in the visual appearance of the toilet and the answers people gave. As an outsider, it would be difficult to distinguish what might be looked upon as a "nice" toilet and a "not so nice toilet". When comparing people's attitude towards composting toilets with the actual appearance of their toilets, I could not see any trend. A record of each household's toilet should have been kept, but this was unfortunately not done.

Figure 6.33 and 6.34: Examples of toilets in houses where people wanted to have a composting system (more examples are showed in appendix 6a)


Figure 6.35 and 6.36: Examples of toilets in houses where people did not want to have a composting system (more examples are shown in appendix 6b)

Lack of significance between the variable "attitude towards present sanitary system" and the wish to install a compost toilet might be because some people believed that a composting system would make matters worse than today's situation. People might have been unsatisfied with today's system and wanted a new toilet, but not a composting system.

- Hypothesis 3

  People who believe that the river is heavily polluted and that blackwater is a main contributor to this, are more willing to have a compost toilet than people who do not worry about pollution problems.

The river pollution variable (Swimming) is not significant and we can therefore not say that there is a relationship between river pollution and the will to have compost toilet. People were very aware of which parts of the river that was polluted and what caused this. The second variable trying to answer hypothesis 3, might therefore give a better indication of people's attitudes towards the severity of blackwater pollution. This variable was whether or not other sources polluted the river more than what the blackwater did. In all three villages people seemed very certain about their answer. As shown on in figure 6.20, most people in Sadir and Simuti were concerned about blackwater pollution. Only a minority felt that garbage was a greater pollution source. In Danu, the results were quite different. 24 of 30 respondents meant that blackwater was not the most serious pollution source. In fact, many did not feel that blackwater was a pollution threat whatsoever.

Due to these responses, it therefore makes sense that this variable (OtherF) is significant (on a 5 % level). It must be noted that this variable is negatively correlated with the dependent variable. Logically, we would have expected a positive correlation with the dependent variable. In other words, logic assume that people who believe that blackwater pollution is the most serious pollution source are more willing to have a compost toilet than people who do not think of blackwater as a problem. When running the logistic regression with only this variable as the independent variable however, the coefficient became positive. This indicates that if only looking at this variable, it is positively correlated with whether or not people want to install compost toilets. (All other independent variables were run separately, but no other variable changed their positive sign to a negative one, or visa versa).

Table 6.3: Logistic regression table with only OtherF as the dependent variable

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	-0,907471	0,462845	-1,96	0,050			
OtherF	0,504562	0,132951	3,80	0,000	1,66	1,28	2,15

Log-Likelihood = -49,280
Test that all slopes are zero: G = 16,013, DF = 1, P-Value = 0,000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	2,86425	3	0,413
Deviance	2,71675	3	0,437
Hosmer-Lemeshow	1,67753	1	0,195

- Hypothesis 4

  People who are sick or believe that their sanitary system cause negative health consequences, are more willing to change to a compost toilet than the people who do not think that there are any problems caused by their present system.

One cannot say that people who believe that they have been sick due to polluted water are more willing to install compost toilets than people who do not believe that they have been sick due to these reasons.

People who have problems with diarrhea on the other hand, are more willing to have a compost toilet than people than people who do not suffer from this. This variable has a P-value of 0,035.

The variable concerning how often people get skin rash due to the water has a P-value of 0,051 and is therefore significant. This means that there is a relationship between this variable and the dependent variable. I will however be very careful to give this variable much importance. The reason for this is that when reducing the variables in the logistic regression, this variable becomes, as described earlier in this chapter, insignificant (see appendix 5c). Multicollinearity might be the reason for this, and the result can therefore not be trusted.

- Hypothesis 5

  People who wish to use fertilizer from blackwater are more willing to have a compost toilet than the ones who do not want to use blackwater as fertilizer.

The fertilizer variable is not significant and we can therefore not say that there is a relationship between people's wish to use blackwater as fertilizer and the will to have compost toilet.

One might expect that people who needed free fertilizers would be more willing to have a compost toilet. In Simuti, one person said that they used to have black pepper, but due to lack of fertilizer it was impossible to continue with this production. This insignificant result indicates however that getting fertilizer is not the most important reason for wanting to install a compost toilet. Some people (in all villages) used urine / or had used it earlier in their garden or on the field. Nobody used it actively, meaning that it was used only at a few plants close to the hut they had at the field. Even though wanting to have more fertilizer people might have been:

- Sceptical to use blackwater as fertilizer
- Not knowing what impact this would have on their agricultural products
- Being sceptical to how to transport these products to the field safely

Characteristics of the village (norms and physical appearance)

- Hypothesis 6

  People who are not reluctant to talk about sanitation are more willing to have a compost toilet than people who looks at sanitation as taboo.

This variable (TalkPoll) is significant at a 5 % level, which means that it is one of the most important variables in explaining whether or not people want to install compost toilets. Although it might be expected to influence the dependent variable, it is interesting that this is one of the most important explanation variables. Even though these three villages were located in the same area, differences in how much people talked about these issues were noticeable. This result will be further analyzed in the discussion chapter.

- Hypothesis 7

  People who are not concerned about having the same sanitary system as their neighbours are more willing to change to a compost toilet than the people who wish to have the same system as their neighbours.

The variable "whether or not people would install composting toilet regardless of what their neighbours did" was significant (at a 10% level). Caution must however be taken in giving this variable much importance since it became insignificant when reducing the variables in the logistic regression. Only 9 out of 90 respondents stated that they wished to have the same sanitary system as their neighbours. In Simuti, nobody said it mattered to have the same system as their neighbours. In fact, several said that they gladly would be the first to install this type of toilet so that they could be a "role model" for others to follow. In the next chapter these results will be further discussed.

Village

When conducting interviews, the differences between the villages was the most obvious difference for explaining whether or not people wanted to install compost toilets. Danu was significant in the regression model, while Sadir was not. This would be expected because people in Sadir and Simuti gave quite similar answers to all questions, while Danu was the village which stood out from these views. In next chapter, more focus will be given to why there were such big differences between these seemingly similar villages.

Control variables

The control variables “income” and “age” were significant (at 10% level).

People with higher income were less willing to install compost toilet. This might be because they had already repaired the toilet or the septic tank if they felt there were any problems. When having more money, they might also have had in mind that a new sanitary system would cost them money. In Sadir and Simuti on the other hand, most people were very clear about that they would not have money for such an installation. Even though they knew this was only a study, they might have hoped for an installation and answered accordingly.

The significant level at 10 % indicates that younger people are more willing to change their sanitary system to a compost toilet.

7. Discussion

As seen from the results, there were quite clear differences between these three villages. The first observed difference was that while a majority of the people in Sadir and Simuti were not satisfied with their existing sanitary system, most people in Danu did not believe that there were any problems with either smell or pollution. This difference was quite clear despite the fact that their sanitary systems were similar. In Danu there were however more people with sitting toilets and tiles on the bathroom floor. Yet, as an outsider, it was difficult to see any clear pattern in what made people satisfied with their toilet. Despite small visual variance, the biggest difference between the sanitary systems was that in Danu most septic tanks were not sealed under. They believed that because of this, the water would infiltrate through the soil and the septic tank would not be filled up so fast. It is questionable however how well the water infiltrates through the soil if a layer of sludge is created at the bottom of the tanks (Jenssen, pers. comm.). This hypothesis gets strengthened when taking into consideration some of the responses given during interviews in Danu.

"When it is raining, there is always overflow".
"There is overflow, but it does not go to the river".
"The tank is full, so there is always overflow coming out".
"The tank is not full, but it smells sometimes from the overflow during dry season".

Even though there many people obviously knew that overflow came from their septic tanks, a majority did not find this very problematic. Other factors were of more concern, such as lack of electricity, rubbish and chemicals. Some of the people who wished to renew their toilet, did however not want a composting system because they did not want a waterless system.

"Everybody should have flushing toilets".

If flushing toilets would have been installed in these villages, while keeping the same septic tanks, pollution would increase. The reason for this is that if even more water would be used for flushing, the septic tanks would be filled up much faster, leaving less retention time for the waste water in the tanks. It is therefore of great concern that these people want the "modern" flushing toilet (Jenssen, pers. comm.).

There seemed to be quite different views concerning pollution and sanitary conditions between the three villages, so what influence people's willingness to install composting toilets? In the regression model, the significant variables were:

- Whether or not they talked to others about pollution problems due to blackwater
- How often they had diarrhea
- Whether or not they felt that blackwater was the most severe pollution source in their village
- Income level (people with lower income were more willing to install compost toilets)
- Age (younger people were more willing to install compost toilets)
- In which village people lived

Before going into further detail about these variables, I will discuss why not more of the variables became significant despite clear differences between the villages. Almost all histograms presented show that a majority of the respondents in Sadir and Simuti were not satisfied with today's system and concerned about blackwater pollution. Most people in these two villages wished to install composting toilets. In Danu on the other hand, the trend was different; most people were not concerned about blackwater pollution and did not want to install composting toilets. One explanation for few significant variables despite the clear pattern in the histograms might be due to the small sample size. This can clearly be seen when looking at the responses obtained in Simuti where only one respondent did not want to install a composting toilet. If the respondents in Simuti had different opinions about pollution issues, this would not be of much importance in the regression analysis because 29 of the 30 respondents answered that they wished to install a compost toilet. The individual differences in Simuti can in other words not answer what influence people's wish to install composting toilets.

In the regression analysis, all villages were however put together, meaning that 30 respondents did not want to install a compost toilet. When looking at people's satisfaction with today's sanitary system (figures 6.17-6.21) and comparing this with people's willingness to install compost toilets (figure 6.23), it might be puzzling that this variable does not turn out to be significant. This indicates that the people who are not satisfied with their sanitary system are not necessarily the same people who wish to install composting toilets.

It might be argued that the small sample size makes the regression analysis very sensitive. All of the graphs show however strong tendencies and agreement between people living in the same villages. I will argue that due to this clearly observed agreement between people living in the same village, some variables do not become significant even though having an importance. Where people come from is however extremely important in explaining people's views on the different issues discussed in this thesis. This "village variable" includes all factors affecting people living in the same village. One important difference between the three villages is the location and size of the river. In Sadir and Simuti, no villages are found upstream which means that only the villagers themselves pollute the river. In Danu on the other hand, the river does not pass directly through the village and is already polluted from villages upstream.

Other factors than physical differences also differentiate the villages from each other. One of these factors is the norms developed in each village, but this is however treated separate from the "village variable" because there are individual differences in this variable. One of these norms is whether or not people talk with each other about pollution problems due to blackwater. This variable was significant in the regression analysis and shows that people who talk about blackwater pollution, are more willing to install composting toilets. It seems logical that people who are concerned about blackwater pollution problems are more open to talk with others about these issues. When being concerned about pollution due to sanitary systems and talking about this issue with others, it is also makes sense that these people are more willing to try "new" sanitary systems. Another explanation could however be that people become extra aware of pollution problems and more willing to try other sanitary systems if it is accepted to talk with others about these problems. During a focus group in Danu however, the woman stated that they did talk with each other about pollution, but not about the blackwater. This was because other sources, such as rubbish, were looked upon as more severe pollution problems.

This leads to another significant variable; whether or not people believed that other sources polluted more than the blackwater. It must yet be noted that this variable has a negative value in the regression analysis. This issue was treated in section 6.4 where it is shown that running the logistic regression analysis only with this variable, it gets a positive sign. People were very clear about what polluted the river. This was discussed in section 6.5 and shown in figure

6.20. People in Sadir and Simuti were concerned about blackwater pollution and meant that this was the main source for the river pollution. In Danu however, people were most concerned about the generators causing noise and pollution in addition to being expensive. They had applied three times for electricity and this was obvious their greatest concern.

In the model used to describe what influences people's willingness to install composting toilets, arrows are drawn between most of the independent variables. Although not statistically measuring the connection between the different variables, the multicollinearity test confirms that there are connections between the independent variables. Conclusions about which variables that influence each other can however not be drawn on this basis. One example of possible connections between the independent variables will however now be mentioned. From which village a person comes from might influence that person's health. This might be due to a polluted river. A polluted river might be a result of low income amongst villagers because it will then be more difficult to repair for example septic tanks causing pollution. Health problems such as diarrhea, might influence people's attitudes towards the sanitary system and pollution problems. This again might lead people to look for alternative solutions, developing beliefs about the outcomes of possible solutions. This example shows one possible linkage between the independent variables.

From open defecation to pour flush toilets

In the literature review, we saw that it is difficult to get people to use latrines instead of practicing open defecation. These difficulties do not apply to people in Sadir, Danu and Simuti. During the interviews, some people laughed when they were asked if they wished to follow tradition. *"Nooo"* was often the answer, while one respondent stated that tradition was *"very smelly, very dirty"*. After having received plastic bowls and cement from the government, almost everybody had installed pour flush toilets and septic tanks within a few months. With the population growth, there are still some people who do not have septic tanks, but through several conversations it most certainly seemed like everybody preferred to use toilets than to practice open defecation.

In Sadir, Danu and Simuti, having a "good toilet" (one that looks nice and does not smell or pollute) was looked upon both as a personal- and a collective good. People felt better using a nice toilet and did not feel shame when having visitors. In addition to this personal gain, a "good toilet" would not cause pollution. In Simuti, some respondents pointed out during

interviews that they would gladly be the first to install a compost toilet to be a role model that others could follow.

Some people felt disgusted by the thought of using a waterless system and did not want a composting toilet (mostly people in Danu). One can argue that these people reasoned by the logic of the "prisoner's dilemma" theory. Because they did not see the personal gain by installing a composting toilet, they would gain most by not cooperating if everybody else got the system which did not pollute. Another explanation is that they simply did not believe there were any pollution problems due to their sanitary system. Even though not being satisfied with the existing toilet, some might have felt that a dry system would only make matters worse.

When discussing whether or not people acted from the reasoning behind the "prisoner's dilemma", it is interesting to examine the problems concerning the garbage disposal in the villages. In Sadir, a dumping ground for all garbage had been installed with infiltration ponds. This dumping ground was called a "white elephant project" (meaning failure project) because the dumping ground was so far away from people's houses that "nobody" took their trash to that place. Instead of using the dumping ground, they rather threw garbage in the river or in slopes. Even though they had many meetings trying to solve this problem, it was more or less socially accepted to throw the garbage into the river. When asking the respondents however, 12 out of 30 respondents said they went to the dumping ground. They thought this was the correct thing to do, but did not tell neighbours about it. It was better to *"mind their own business"*. Even though it was "accepted" to throw the garbage in the river, some people took the extra cost of going several times a week to the dumping ground. This underlines that people are not always trying to maximize their individual utility, but that there are other factors important when explaining human behaviour.

In Danu, the situation was quite different. In year 2000, garbage cans were given to the village and are now emptied twice a week. People remembered how garbage used to be thrown in slopes and taken away with the river during flood. After the introduction of the trash can disposal, it was socially unacceptable to throw the garbage in the slopes or to the river. There were however individuals only thinking at their personal cost of going to the trash cans and secretly threw the garbage to a slope when nobody would see it.

The garbage disposal in these two villages shows different institutions but also individual variation. In Sadir, most people threw garbage into the river since this was almost accepted behaviour. Some individual stuck however to their beliefs and went to the waste disposal every week. In Danu, it was on the other hand unaccepted to throw waste into nature. Most people followed the rules, but in this village one can clearly notice when some individuals only think of individual benefit and secretly throws waste into nature. People's actions can in other words be explained both due to personal as well as institutional differences.

This example shows how "humans both influence and are influenced by the institutions" (Vatn 2005, p.25). After having conducted interviews in Sadir, people told me that similar results would be found in any other village in the area, meaning that a majority would be aware of the pollution problem and wanting to install compost toilets, but did not have enough money to buy the necessary equipment. Nevertheless, the results came out quite different in Danu than in Sadir and Simuti.

Involvement

In this study, I can not say anything about whether or not the actual implementation of compost toilets would be successful or not. I can however argue that willingness for this solution together with involvement of the local people is crucial for positive results. Previous studies show that the involvement of local people is fundamental for the success of projects. In the work towards reaching full sanitation coverage in Bihar, India (as discussed in the literature review), the local women were most engaged. They saw the necessity for installing toilets and worked hard to reach this goal.

Installation of composting toilets would most probably be more successful in Sadir and Simuti than in Danu. The reason for this is that most people expressed their discontent with today's situation and had for a long time wished for a better sanitary system. During a focus group in Sadir, the young women discussed possible solutions for getting a better sanitary system. They did not know about many possible solutions, but discussed having the same type of infiltration ponds at the outlet of each septic tank as was made at the solid waste disposal. Lack of space was an obvious obstacle. Another solution was connecting the pipelines from several households, so as to have one common septic tank with infiltration ponds to treat the overflow. This was a suggestion which had been discussed a few years ago. The plan was to connect the blackwater pipelines from the houses in the "centre" of the village, but due to

disagreements it was never carried out. Many were afraid that the pipelines might clog if they were to be stretched over long distances. *"But we must try"* was one of the women's comment. It was clear that they were willing to try different solutions because of discontent with today's system. They all liked the idea of installing compost toilets. To carry it out they said they needed one model to see how it worked so they could install likewise. The obstacle was, as repeated by almost all respondents, lack of money.

After a focus group with the strong men in Simuti, I was informed that they had cancelled a church meeting to be able to participate. This shows how important they believed this issue was. Also here, they had the idea of one common septic tank for the village with a pond infiltration system at the overflow outlet. In Simuti, people seemed even more eager to try composting toilets even though it was a dry system.

People in Danu on the other hand, did not think that the blackwater polluted much. 93 % did not believe that their sanitary system gave negative health consequences and 80 % meant that other sources than the blackwater polluted the river more. In Danu, their greatest concern was lack of electricity. The generators were expensive and extremely noisy as well as polluting. As in the example from the school in South Africa, where the implementation of an ecological toilet failed, people were not much engaged about the issue of sanitation (Austin 2003). When people do not see the need, it is normal that engagement is limited.

Since the inhabitants in Sadir and Simuti clearly wish to have a new sanitary system, why has it not been implemented? An obvious explanation is these people's lack of money. As a final point, I will discuss why it is difficult to get subsidies for adequate sanitary systems from the government.

In the Borneo Post, January 22nd during present year, it was stated that 'hanging' village latrines is a major source of pollutants in Sungai Mukah and Sungai Balingian rivers. Great concern was given to these rivers of Class III (polluted water which can be used for water supply only with advanced treatment) and Class IV (heavily polluted water which can only be used for irrigation). The Environment Assistant Minister Dr Abang Abdul Rauf Abang Zen stated that effort must "be taken to address the situation in the long run and it should start with educating the villagers on proper sanitation system with help from the Health Ministry" (Chan 2008). This underlines the apparent concern that safety from water pollution is still an

important topic to address after Kuching became a part of WHOs Healthy Cities initiative in 1994 (State Planning Unit Sarawak 2001).

When applying for subsidies to roads, electricity and pipelines to the gravity fed water system (to mention a few), the villagers in the Padawan area send their applications to the politician, James Dawos. Dawos is in charge of 157 villages (48 villages in the Padawan area) and gets more than 100 applications each year. There is no strategy plan or regulations for the funding, but it is based on "the needs" with a "first come, first served" practice. The urgency of the project is valued by James Dawos, and he will give funding to as many projects as possible.

Even though pollution problems seem to get political attention, implementation of environmentally friendly solutions might be most challenging. Many obstacles are faced and people with low income will often be dependent on financial support.

Would it be possible to get subsidies for ecological toilets in the villages? "No, because that is not the objective of the government. The objective of the government is to provide them with minimal sanitation standard. That's it" (Dawos, pers. comm.).

8. Conclusion

The objectives of this thesis were to look at the sanitary system in a rural area in Sarawak, Malaysia, to learn about people's perception of this system and to see whether or not they wanted to install composting toilets. Early in the field work it became apparent that there were different views in the three visited villages. Two villages were very concerned about the blackwater pollution and wanted to install composting toilets. The reason why they had not already changed their sanitary system was mainly due to lack of money. The respondents in the third village on the other hand, did not see many problems with the existing sanitary system and a majority did not want to install composting toilets. These differences were clear even though the villages were seemingly quite similar. The majority of the people in all three villages had pour flush toilets with the waste being led to septic tanks. When the septic tanks were full, the waste water would go through the overflow pipeline to the soil or to the river.

The variables which did affect people's willingness to install composting toilets were:

- Whether or not they talked to others about pollution problems due to blackwater
- How often they had diarrhea
- Whether or not they felt that blackwater was the most severe pollution source in their village
- Income level (people with lower income were more willing to install compost toilets)
- Age (younger people were more willing to install compost toilets)
- In which village people lived

Even though people in these three villages came from the same area, practicing the same traditions and language, different views about both pollution problems and their sanitary system had been developed. Physical characteristics of the villages, but also norms might affect people's concern about blackwater pollution. There were for instance quite clear differences in how much people talked about blackwater pollution. These differences are difficult for outsiders to notice. If wanting to implement ecological toilets, is crucial to involve the local people for the success of a project. Only the local people know their needs and what kind of projects that would work in their village.

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Appendix 1a: Recommended storage time for urine

Storage temperature	Storage time	Pathogens in the urine	Recommended Crops
4°C	>1 month	viruses, protozoa	food and fodder crops that are to be processed
4°C	>6 months	viruses	food and fodder crops that are to be processed, fodder crops d
20°C	>1 month	viruses	food and fodder crops that are to be processed, fodder crops d
20°C	>6 months	probably none	all crops e

(Jenssen et al. 2006e)

Appendix 1b: Recommended storage time for faeces

Treatment	Criteria	Comment
Storage (only treatment); Ambient temperature 2-20°C	1.5 years	Eliminates bacterial pathogens. Re-growth of *E coli* and *Salmonella* possible; will reduce viruses, and parasitic protozoa below risk levels. Some soil-borne ova may persist in low numbers
Storage (only treatment) Ambient temperature >20-35°C	> 1 YEAR	As above
Alkaline treatment (= pH >9)	pH >9 during > 6 months	If temperature >35°C and moisture <25%, Lower pH and/or wetter material will prolong the time for absolute elimination.

(Jenssen et al. 2006d)

Appendix 2: Questionnaire

(Some of the questions were changed from 1 to 5 and 2 to 4 (and visa versa) before running the logistic regression. The reason for this was to have logically signs. These reversed variables are coded with R or Rev at the end of the variable name).

Interview number: _____

1) Are you satisfied with the existing sanitary system?

Some statements will now follow, and you should on a scale from 1-5 say if you agree (1), mostly agree (2), neutral (3), slightly dis-agree (4) or don´t agree (5).

	Agree				Don´t agree
	1	2	3	4	5
It gets the waste water away in a satisfying way					
I am satisfied with the visual appearance of the sanitary system					
There are no problems with smell					
The toilet is clean					
The sanitary system does not give any negative health consequences					
The blackwater does not pollute the river.					

2) If not satisfied with the existing system, why have you not changed it?

	Agree				Don´t agree
	1	2	3	4	5
Do not see the need for a new system					
Too difficult to change the system					
Too costly to change the system					
Too time consuming to change the system					
Do not know how to change the system					
I want to follow tradition					
I want to have the same system as my neighbours					
I do not want to talk about/ deal with sanitation					

Are there other reasons to why you have not changed the present system?

_____

_____

3) How many toilets are in your household? _____

4) How many years have you had your current sanitary system(s)? Tick of one of the alternatives below:

1 year or less	☐
1-4 years	☐
5-10 years	☐
10-20 years	☐
More than 20 years	☐

5) Knowledge about other sanitary systems:

Do you agree or disagree with the following statements?

	Agree	**Don´t agree**
I know people who have talked about changing their sanitary system		
I have talked to others about pollution problems due to blackwater		
I have seen / heard about the system at the Padawan school		
I have seen / heard about other ecological sanitation systems		

6) I heard about other sanitary system(s) from:

	Yes	No
A family member studying at the Padawan school		
A family member who has not studied at the Padawan school		
Neighbours		
Friends		
The village's strong men		
A government servant		
NGO		
Researchers		
TV		

7) Do you believe that the implementation of a compost toilet that treated all the blackwater would have positive impacts on:

	Agree				Don´t agree
	1	**2**	**3**	**4**	**5**
The water quality in the rivers close to the village					
The hygiene in the bathroom					
People would get less sick					

8) Fill in how often you have diarrhea:

Once a week or more	☐
About once a month	☐
About once every six months	☐
Once a year	☐
Less than once a year	☐

9) Fill in how often you get skin rash from the water:

Once a week or more	☐
About once a month	☐
About once every six months	☐
Once a year	☐
Never/ Less than once a year	☐

10) Which factors would be important for you if you changed your sanitary system?

	Agree				Don´t agree
	1	2	3	4	5
The toilet is cleaner					
That the system produces fertilizers					
That the system produces biogas					
That the system has a nice design					
That the systems gives a cleaner river					
That the system does not smell					
That the system keeps the blackwater out of sight inside the bathroom					
That the system keeps the blackwater out of sight outside					
That the system will not demand much maintenance					
That the system will give me a higher status					
It is important that the system is not expensive					

11) Are time and money constraints for introducing new sanitary systems?

	Agree				Don´t agree
	1	2	3	4	5
I have money to change my sanitary system					
I have time to change my sanitary system					
I know how I can change my sanitary system					
If I had no constraints, I would have liked to change my sanitary system even though none of my neighbours changed their systems					

12) Do you believe that there is a blackwater contamination problem in this village?

	Agree				Don´t agree
	1	2	3	4	5
Have not thought about the problem					
The drinking supply has clean water					
All the rivers are clean					
I drink from all of the rivers in the neighborhood					
I drink only from the water source					
I go swimming in all the rivers in the village					
I go swimming in all the rivers in the village even if I have an open soar					
I have never been sick due to polluted water					
I don´t know anyone who have been sick due to polluted water					

13) State whether or not you use these different fertilizers for agriculture practices?

	Yes	No
Chemicals		
Kitchen waste		
Animal dung		
Blackwater		
Other organic waste		

14) Would you consider using fertilizers made from blackwater?

Yes	No	Don´t know

15) Would you consider using fertilizers made from blackwater if the prices on fertilizers increased?

Yes	No	Don´t know

16) Do you believe that new sanitation systems would have positive effects on the water quality in the rivers:

	Agree				Don´t agree
	1	2	3	4	5
If everybody in the village changed their sanitary systems					
People in villages upstream would also need to change their sanitation systems to improve the water quality					
Other factors than the sanitation systems are more important when dealing with water quality					

Gender (M / F): _____

Age: _____

I live in the village / other village / the city during week-days: _____

I live in the village / other village / the city during week-ends: _____

Marital status (Single/Married/Divorced): _____

Number of children: _____

Education: _____

Occupation: _____

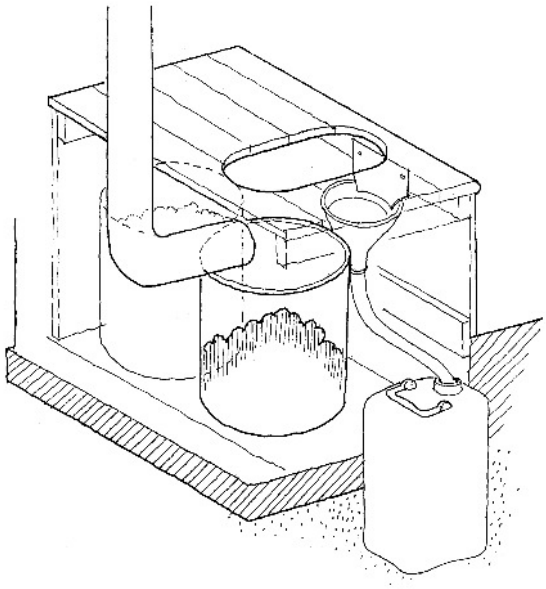
Number of people living in your house from Monday to Thursday: _____

Number of people living in your house from Friday to Sunday: _____

Monthly family income (MYR)		Monthly family expenses (MYR)	
Less than 299		Less than 299	
300 – 499		300-499	
500 – 799		500 – 799	
800 – 999		800 – 999	
1000 – 1499		1000 – 1499	
1500 – 2000		1500 – 2000	
More than 2000		More than 2000	

Appendix 3:

The compost toilets showed to the respondents



Appendix 4: Multicollinearity tests

a) Multicollinearity test with all variables from the theoretical modell.

Collinearity Diagnostics[a]

Mod	Dimens	genvalu	Condition Index	Variance Proportions																
				Constant	t.Prese	Sadir	Danu	TalkPol	elORiv	eliOutF	Nsick	DiarRev	SkinRev	egless	wimmin	wFertiliz	OtherF	Gender	ncome	Age
1	1	12,772	1,000	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00
	2	1,380	3,042	,00	,00	,04	,04	,00	,00	,00	,00	,00	,01	,00	,00	,00	,00	,01	,01	,00
	3	,617	4,551	,00	,00	,11	,00	,00	,00	,00	,00	,02	,06	,00	,00	,00	,00	,28	,03	,00
	4	,500	5,054	,00	,00	,32	,01	,01	,00	,00	,01	,00	,04	,00	,00	,01	,01	,14	,01	,00
	5	,330	6,222	,00	,00	,00	,01	,00	,00	,00	,05	,01	,49	,00	,01	,00	,01	,14	,00	,04
	6	,292	6,609	,00	,00	,01	,00	,03	,00	,00	,19	,06	,01	,00	,00	,08	,00	,10	,13	,04
	7	,240	7,288	,00	,00	,04	,01	,01	,00	,00	,06	,29	,03	,00	,01	,00	,00	,01	,26	,02
	8	,212	7,761	,00	,00	,08	,00	,02	,00	,00	,47	,20	,10	,00	,01	,01	,00	,05	,04	,03
	9	,202	7,960	,00	,00	,05	,02	,02	,00	,01	,08	,01	,04	,00	,04	,23	,02	,01	,12	,03
	10	,138	9,625	,00	,03	,01	,00	,26	,00	,00	,05	,19	,03	,03	,00	,05	,00	,04	,01	,17
	11	,106	10,980	,00	,01	,08	,21	,12	,00	,00	,01	,01	,04	,00	,08	,11	,08	,01	,07	,25
	12	,080	12,655	,00	,02	,00	,04	,11	,00	,01	,01	,02	,04	,05	,15	,00	,39	,04	,03	,16
	13	,055	15,191	,00	,11	,09	,08	,03	,00	,01	,00	,04	,01	,18	,20	,08	,33	,07	,03	,10
	14	,029	21,026	,00	,60	,11	,00	,01	,00	,03	,02	,04	,06	,55	,13	,04	,08	,00	,14	,08
	15	,024	23,015	,00	,10	,02	,01	,19	,21	,39	,03	,00	,00	,14	,33	,03	,02	,01	,00	,02
	16	,017	27,798	,02	,01	,02	,23	,15	,48	,55	,02	,06	,03	,00	,00	,35	,05	,00	,01	,05
	17	,007	43,226	,97	,11	,01	,35	,03	,30	,00	,00	,04	,02	,04	,04	,00	,02	,10	,11	,01

a. Dependent Variable: Compost

b) Multicollinnearity on the model used in this thesis

Collinearity Diagnostics[a]

Mod	Dimens	igenvalu	Condition Index	Variance Proportions Constant	tt.Preser	Sadir	Danu	TalkPoll	elORiv	BeliOutF	DiarRev	SkinRev	eglessF	wimmin	OtherF	Gender	Income	Age
1	1	11,250	1,000	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00	,00
	2	1,351	2,886	,00	,00	,04	,04	,00	,00	,00	,00	,00	,00	,00	,00	,01	,01	,00
	3	,616	4,272	,00	,00	,11	,00	,00	,00	,00	,02	,06	,00	,00	,00	,28	,03	,00
	4	,480	4,841	,00	,00	,36	,01	,01	,00	,00	,00	,05	,00	,00	,01	,18	,02	,00
	5	,320	5,927	,00	,00	,00	,02	,00	,00	,00	,01	,62	,00	,00	,00	,14	,00	,05
	6	,251	6,697	,00	,00	,05	,01	,04	,00	,00	,00	,02	,00	,00	,00	,09	,49	,08
	7	,229	7,004	,00	,00	,01	,00	,01	,00	,00	,60	,00	,01	,03	,01	,02	,00	,02
	8	,155	8,519	,00	,02	,03	,01	,51	,00	,00	,13	,01	,01	,02	,00	,04	,02	,09
	9	,118	9,760	,00	,02	,11	,16	,02	,00	,00	,01	,09	,04	,11	,02	,00	,10	,32
	10	,081	11,821	,00	,02	,00	,06	,17	,00	,02	,01	,04	,06	,13	,35	,04	,03	,18
	11	,062	13,484	,00	,06	,07	,14	,01	,00	,00	,01	,02	,22	,10	,47	,07	,02	,10
	12	,033	18,513	,00	,38	,20	,01	,05	,01	,12	,14	,06	,36	,35	,04	,02	,13	,09
	13	,026	20,849	,00	,36	,00	,01	,12	,02	,78	,00	,00	,03	,09	,05	,01	,04	,03
	14	,022	22,758	,02	,01	,00	,14	,01	,65	,07	,02	,00	,23	,13	,02	,00	,00	,03
	15	,007	40,519	,98	,12	,00	,39	,03	,32	,00	,04	,02	,04	,04	,03	,10	,11	,01

a. Dependent Variable: Compost

c) Multicollinearity test with the significant variables

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions								
				Constant	Danu	TalkPoll	DiarRev	OtherF	Income	Age	SkinRev	RegLessR
1	1	6,801	1,000	,00	,00	,00	,00	,00	,00	,00	,00	,00
	2	1,013	2,591	,00	,16	,02	,01	,01	,01	,00	,00	,00
	3	,369	4,293	,00	,00	,00	,01	,00	,12	,02	,67	,00
	4	,283	4,902	,00	,05	,00	,10	,00	,52	,11	,08	,00
	5	,203	5,783	,00	,02	,03	,80	,03	,12	,01	,01	,02
	6	,131	7,205	,00	,11	,21	,03	,12	,02	,43	,08	,07
	7	,125	7,379	,00	,39	,65	,02	,00	,04	,25	,06	,02
	8	,056	11,002	,01	,11	,04	,01	,70	,05	,01	,10	,46
	9	,018	19,224	,98	,17	,04	,02	,13	,12	,16	,00	,44

a. Dependent Variable: Compost

d) Multicollinearity test with the variables which always turn out significant

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions						
				(Constant)	Danu	TalkPoll	DiarRev	OtherF	Income	Age
1	1	5,234	1,000	,00	,00	,00	,01	,00	,01	,00
	2	1,004	2,283	,00	,17	,02	,01	,01	,01	,00
	3	,291	4,244	,00	,05	,01	,13	,00	,64	,06
	4	,197	5,152	,00	,01	,07	,82	,03	,09	,08
	5	,138	6,168	,00	,43	,20	,00	,01	,07	,65
	6	,109	6,924	,02	,00	,66	,01	,38	,00	,06
	7	,028	13,666	,98	,34	,03	,03	,56	,17	,15

a. Dependent Variable: Compost

Appendix 5: Logistic regression tables

5a) Logistic regression table with all variables from the theoretical model:

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	2,88171	26,2375	0,11	0,913			
BelORivR	-2,37366	2,63966	-0,90	0,369	0,09	0,00	16,45
BeliOutR	19,3450	17,6213	1,10	0,272	2,52021E+08	0,00	2,51762E+23
Att.Present	2,42636	2,13758	1,14	0,256	11,32	0,17	746,96
Swimming	-5,78153	4,76871	-1,21	0,225	0,00	0,00	35,34
OtherF	-6,88808	5,92403	-1,16	0,245	0,00	0,00	112,51
DiarRev	11,0732	10,7187	1,03	0,302	64422,22	0,00	8,57063E+13
SkinRev	8,10357	6,58906	1,23	0,219	3306,26	0,01	1,34295E+09
Nsick	-3,65693	4,09813	-0,89	0,372	0,03	0,00	79,47
BlwFertilizer	1,89458	4,57424	0,41	0,679	6,65	0,00	52056,75
ReglessR	4,65916	4,03255	1,16	0,248	105,55	0,04	285774,93
TalkPoll	10,8480	9,73372	1,11	0,265	51430,49	0,00	9,92490E+12
Sadir	-29,5367	27,9660	-1,06	0,291	0,00	0,00	9,49552E+10
Danu	-28,4245	27,5867	-1,03	0,303	0,00	0,00	1,37310E+11
Gender	8,67378	8,46007	1,03	0,305	5847,55	0,00	9,29677E+10
Income	-4,00125	4,64441	-0,86	0,389	0,02	0,00	164,32
Age	-11,9626	11,4799	-1,04	0,297	0,00	0,00	37720,60

Log-Likelihood = -8,257
Test that all slopes are zero: G = 98,059, DF = 16, P-Value = 0,000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	14,6279	73	1,000
Deviance	16,5138	73	1,000
Hosmer-Lemeshow	0,1440	8	1,000

5b) Logistic regression when ReglessR becomes insignificant

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	0,873329	4,70759	0,19	0,853			
BeliOutR	1,41620	0,995095	1,42	0,155	4,12	0,59	28,98
OtherF	-1,44567	0,615238	-2,35	0,019	0,24	0,07	0,79
DiarRev	2,48415	0,983123	2,53	0,012	11,99	1,75	82,36
SkinRev	1,15927	0,595510	1,95	0,052	3,19	0,99	10,24
ReglessR	0,680654	0,452493	1,50	0,133	1,98	0,81	4,79
TalkPoll	3,80665	1,56076	2,44	0,015	45,00	2,11	958,85
Sadir	-2,58646	2,38956	-1,08	0,279	0,08	0,00	8,14
Danu	-5,59900	2,58938	-2,16	0,031	0,00	0,00	0,59
Income	-0,869147	0,364586	-2,38	0,017	0,42	0,21	0,86
Age	-1,76296	0,673695	-2,62	0,009	0,17	0,05	0,64

Log-Likelihood = -14,002
Test that all slopes are zero: G = 86,568, DF = 10, P-Value = 0,000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	27,2495	77	1,000
Deviance	28,0044	77	1,000
Hosmer-Lemeshow	9,3121	8	0,317

5c) Logistic regression when SkinRev becomes insignificant

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	3,17967	4,60085	0,69	0,490			
BeliOutR	0,654514	0,634081	1,03	0,302	1,92	0,56	6,67
OtherF	-1,53835	0,641058	-2,40	0,016	0,21	0,06	0,75
DiarRev	2,45244	0,953487	2,57	0,010	11,62	1,79	75,28
SkinRev	1,14559	0,722827	1,58	0,113	3,14	0,76	12,97
ReglessR	0,627367	0,427175	1,47	0,142	1,87	0,81	4,33
TalkPoll	4,46389	1,56416	2,85	0,004	86,82	4,05	1862,45
Danu	-5,60021	2,76083	-2,03	0,043	0,00	0,00	0,83
Income	-0,995603	0,388570	-2,56	0,010	0,37	0,17	0,79
Age	-1,83018	0,631515	-2,90	0,004	0,16	0,05	0,55

Log-Likelihood = -14,651
Test that all slopes are zero: G = 85,270, DF = 9, P-Value = 0,000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	27,7213	78	1,000
Deviance	29,3022	78	1,000
Hosmer-Lemeshow	8,9725	8	0,345

5d) Logistic regression table only with the variables which are significant in the more complex model:

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	5,87544	3,94211	1,49	0,136			
OtherF	-1,47159	0,657542	-2,24	0,025	0,23	0,06	0,83
DiarRev	2,30441	0,849818	2,71	0,007	10,02	1,89	52,99
SkinRev	1,13302	0,740871	1,53	0,126	3,11	0,73	13,26
ReglessR	0,487382	0,383720	1,27	0,204	1,63	0,77	3,45
TalkPoll	4,21474	1,41042	2,99	0,003	67,68	4,26	1074,01
Danu	-6,81393	2,60788	-2,61	0,009	0,00	0,00	0,18
Income	-0,983547	0,371863	-2,64	0,008	0,37	0,18	0,78
Age	-1,61188	0,521387	-3,09	0,002	0,20	0,07	0,55

Log-Likelihood = -15,218
Test that all slopes are zero: G = 84,137, DF = 8, P-Value = 0,000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	28,6930	74	1,000
Deviance	27,6628	74	1,000
Hosmer-Lemeshow	6,8366	8	0,554

5e) Regression table with only significant values:

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	9,07186	3,41230	2,66	0,008			
Danu	-5,01449	2,03260	-2,47	0,014	0,01	0,00	0,36
TalkPoll	4,66884	1,41008	3,31	0,001	106,57	6,72	1690,19
DiarRev	1,54908	0,537103	2,88	0,004	4,71	1,64	13,49
OtherF	-1,30032	0,573616	-2,27	0,023	0,27	0,09	0,84
Income	-0,992421	0,344657	-2,88	0,004	0,37	0,19	0,73
Age	-1,53174	0,466846	-3,28	0,001	0,22	0,09	0,54

Log-Likelihood = -18,821
Test that all slopes are zero: G = 76,931, DF = 6, P-Value = 0,000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	39,5728	72	0,999
Deviance	34,8692	72	1,000
Hosmer-Lemeshow	2,6367	8	0,955

Appendix 6a: Pictures from households where people wanted composting toilets.






Appendix 6b: Pictures from households where people did <u>not</u> want composting toilets.