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Feasibility of compost latrines and private sector participation in building and operating compost latrines in urban primary schools.

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Feasibility of compost latrines and private sector participation in building and operating compost latrines in urban primary schools.

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Abstract

This research was conducted in Blantyre Urban in Malawi to identify potential markets for human compost and to assess the feasibility of ecological sanitation and private sector participation in building and operating compost latrines in primary schools.

In this research, urban farmers, landscape managers and nursery owners were asked to indicate their willingness to pay for human compost. The research revealed that over 70% of urban farmers and tree/flower nursery owners are willing to use human compost and to pay MK350 to MK500 per 50kg bag of human compost.

Although there are potential buyers of human compost in Blantyre Urban, the study has shown that it is highly unlikely that entrepreneurs would be motivated to build and operate compost latrines in primary schools because of high investment cost and low returns.

The maintenance of latrines in primary schools is under the responsibility of school management committees. However, due to lack of funding, the school management committees are unable to maintain damaged latrines or to build extra latrines. Due to lack of funding for maintenance, 512 flush toilets have been abandoned and 27 pit latrines can't be fully utilised. The failure of school management committees to maintain damaged latrines or to build extra latrines has resulted into a widespread shortage of latrines in primary schools such that over 120 pupils use a single toilet.

Building and operating compost latrines was found to be more profitable to schools than to entrepreneurs because schools receive support for building and operating school latrines. Ecological sanitation could offer urban primary schools an opportunity to improve school sanitation and to generate income by selling human compost.

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Finally, I wish to thank Miss Memory Chafulumira and Miss Suzen Koreya - my two most dedicated research assistants - for assisting me in conducting household interviews. Thank you girls; you eased my work.

“In my distress I cried out to the Lord; yes I prayed to my God for help. He heard me from His sanctuary; my cry reached His ears.” Psalm 18:6

List of acronyms

ADB	Asian Development Bank
CCOD	Centre for Community Development
DSS	Direct School Support
FAO	Food and Agriculture Organisation
GOM	Government of Malawi
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
IFPRI	International Food Policy Research Institute
IRC	International Water and Sanitation Centre
Kg	Kilogram
MK	Malawi Kwacha
NGO	Non Governmental Organisation
NPV	Net Present Value
NSOM	National Statistics Office of Malawi
OECD	Organisation for Economic Co-operation and Development
PTA	Parents Teachers Association
SMC	School Management Committee
TV	Television
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNICEF	United Nations Children's Fund
UNDP	United Nations Development Programme
WHO	World Health Organisation
WSP	Water and Sanitation Programme
WTP	Willingness to pay

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Chapter One: Introduction and literature review

1.0 Introduction

It is estimated that 2.5 billion people worldwide do not have access to improved sanitation and 22% of these people live in Sub-Saharan Africa (UNICEF and WHO, 2008). Ambition to address this problem is reflected under the Millennium Development Goal Number 7, target number 10 which was set out to halve the proportion of people living without sustainable access to safe drinking water and basic sanitation by the year 2015 (UNDP, 2005). This ambition was also highlighted at the World Summit on Sustainable Development (WSSD) held in 2002 where action to improve sanitation in public institutions especially schools was emphasized (United Nations, 2002)

Although there has been ambition to improve sanitation in public institutions especially schools, many schools still do not have adequate sanitation facilities and do not have access to adequate funds for maintaining damaged toilets let alone building new ones to cope with rising school populations. As a result, many schools suffer from nonexistent or insufficient water supply, sanitation and hand washing facilities (Snel et al, 2001).

One of the solutions currently being promoted to improve sanitation in schools is ecological sanitation. Ecological sanitation has three fundamental principles: preventing pollution rather than attempting to control it after pollution; sanitising urine and faeces; and using the safe products after treatment for agricultural production (Esrey et al, 2000). It is believed that the adoption of ecological sanitation in schools could significantly contribute to improving sanitation in the schools. It is also believed that ecological sanitation could contribute to reducing poverty in communities as it offers business opportunities for construction and operation of sanitary facilities and marketing of fertilizer products (WASTE, 2006).

In urban areas, the success of ecological sanitation to improve school sanitation and to offer business opportunities to entrepreneurs interested in building and operating sanitary facilities in schools would depend on the acceptance of urban residents to use human compost and the availability of a profitable market for human compost. Currently, there is limited information in Malawi about the attitude of urban residents towards human compost. There is also limited information about the potential benefits of operating compost latrines.

1.1 Aims

This research was conducted in Blantyre Urban in Malawi (see appendix 6, 7a, 7b) to answer three fundamental questions: (1) Is there a market for human compost in Blantyre Urban? (2) Would private enterprises benefit financially from building composting latrines in schools, operating the composting latrines and selling human compost? (3) What would be the benefits of composting latrines to the schools?

1.2 Objectives

- (1) To assess access to sanitation in primary schools.
- (2) To identify potential markets for human compost in urban areas.
- (3) Assess the willingness to pay for human compost.
- (4) To analyse the financial benefits of investing in composting latrines.

The research was conducted in three phases. The first phase centered on access to sanitation in urban primary schools. The second phase focused on the attitude of urban farmers towards human compost and their willingness to pay for processed human compost. The third phase centered on the willingness of landscape managers and nursery owners to use human compost and to pay for human compost.

This research report has five chapters. The first chapter (introduction and literature review) has covered background information about sanitation in primary schools, urban agriculture, soil fertility in Malawi, ecological sanitation and private sector participation in providing sanitation services. The second chapter has covered the methodology that was used in this research. Chapter three has covered all the research results. The last chapter has covered the conclusion, discussion and recommendations.

1.3 Literature review

1.3.1 Status of school Sanitation

Sanitation is defined as the provision of facilities and services for the safe disposal of human faeces. UNICEF and WHO (2008) have classified sanitation into two categories: improved sanitation and unimproved sanitation. The key distinction between these categories is effectiveness in separating excreta from human contact. Improved sanitation facilities¹ ensure hygienic separation of human excreta from human contact and unimproved sanitation facilities² do not ensure hygienic separation of human excreta from human contact.

UNICEF and WHO (2008) reported that 46% of Malawians had access to improved sanitation in 1990 and in 2006, 60% of Malawians had access to improved sanitation. Although household sanitation improved between 1990 and 2006, access to sanitation in schools remains very poor.

Reporting on the status of school sanitation in Malawi, Abrahams (2002) indicated that the latrine to student ratio is only 1 to over 100 and in many schools, the sanitation facilities are vandalized and are in poor sanitary condition. These observations are confirmed by Snel et al (2001) and IRC (2007) who reported that many schools in developing countries have broken and dirty water supply and sanitation facilities. In these circumstances, Abrahams (2002) reported that children particularly the young and the disabled stop using the facilities, others revert to open defecation, some girls use latrines belonging to households close to the schools while others stop going to school.

According to IRC (2007) schools can play their part in preventing diarrhoeal diseases through the construction and proper use of water and sanitation facilities as well as hygiene education. According to the United Nations (2002),

¹ Flush toilet, piped sewer system, septic tank, pit latrine with slab, composting toilet

² Pit latrines without slab, bucket latrines

improving sanitation in schools should be a priority as schools offer an opportunity for pupils to acquire knowledge about sanitation which they can transfer to their communities. However, lack of finance for building, operating and maintaining latrines is a major obstacle to improving sanitation in schools (IRC, 2007).

The status of sanitation in schools could be improved by adopting ecological sanitation. There are several reasons that justify ecological sanitation in schools: Firstly, the conventional sewerage system requires relatively high maintenance and operational costs and water must be available all the time (Esrey et al, 2000). Secondly, thousands of pit latrines get abandoned when they fill up. When latrines fill up, new resources (financial, labor, time, land) for building new latrines must be secured. The practice of building and abandoning when full is expensive and wasteful (Oxfam, 2009). Thirdly, urban areas in Malawi frequently experience water cuts that last for a number of days (Banda, 2008). When there is no water supply, schools with only flush and forget toilets are left without any form of sanitation. Furthermore, ecological sanitation creates opportunities for local entrepreneurs interested in selling fertilizer products (WASTE, 2006).

1.3.2 Urban agriculture

In urban agriculture, ecological sanitation could be a source of cheap organic fertilizer. Urban agriculture is defined as the the growing of food and non-food plant and tree crops and the raising of livestock (e.g., cattle, fowl and fish) both within the city limits and on the fringe, in peri-urban areas (Esrey et al, 2000). Urban agriculture is a strategy that households adopt to improve household food security and income and it is a vital strategy considering the rising population and unemployment in Blantyre City.

Blantyre City is the second largest city in Malawi with a population of 661,444 and annual population growth rate of 2.8% (NSOM, 2008). In 2007, urban

unemployment in Malawi was at 9.4% and it is expected to rise to 16.9% by 2015 (GOM, 2008). With this increase in urban population and rising unemployment, urban agriculture is a vital strategy for coping with rising unemployment levels and risk of food insecurity.

To avoid the risk of household food insecurity in urban areas, the growth in urban population must be matched with food supply and income generation opportunities (Binns, et al 1998). There are a number of contributions that urban agriculture makes to the economy of an urban household. Urban agriculture is a significant source of food for urban households (Garrett, 2000). Urban agriculture has the potential to improve household nutrition as it provides fresh locally produced food crops that provide micronutrients in poor people's food (Maxwell et al, 2000; Egal et al, 2001). Urban agriculture also increases household income (Howorth et al, 2003)

1.3.3 Soil fertility

The contribution of urban agriculture to household food security and income is however undermined by a decline in soil fertility and soil organic matter (Sanchez, 2002). Buresh et al (1997) associates the decline in soil organic matter and soil fertility to continuous cropping and poor soil management practices.

The decline in soil organic matter and soil fertility limits food production and threatens the food security of farmers (Sanchez, 2002). Maintaining and improving the levels of organic matter in soils is therefore fundamental to maintaining soil fertility and ensuring sustainable agricultural production (Katyal et al, 2001).

A number of organic matter based technologies³ have been promoted in Malawi to maintain soil fertility (Nalivata, 2007). However, the adoption of these technologies is minimal because they take productive land out of production, they are labor intensive and animals are scarce (Ajayi et al, 2007).

In Malawi, farmers are unable to apply adequate amounts of inorganic fertilizer. Reporting on the use of fertilizer, Snapp et al, (1998) and Ikkerra et al (2001) reported that inorganic fertilizer is very expensive for most farmers. Agricultural surveys conducted in 2002 and 2003 revealed that only 1/3 of smallholder farmers could afford to buy fertilizer and that only the wealthiest of those could afford more than one 50kg bag of fertilizer (Levy et al, 2004).

1.3.4 Composting

To maintain and improve the levels of organic matter in soils, farmers in Malawi are supported and encouraged to make compost and use it in their gardens. Farmers are encouraged to use compost as it is considered to be a viable means of maintaining and improving soil organic matter and soil fertility (Ouédraogo et al, 2001).

A number of writers have highlighted the benefits of compost in soils. Glover et al (2000) explained that adding compost to soil makes the soil more suitable to crop production as the compost builds up organic matter which then reduces the bulk density of the soil. Commenting on the effects of compost, Ouédraogo et al (2001) indicated that compost improves the capacity of soil to hold water and fertilizers. The capacity of the soil to hold water ensures that soil moisture is available to plants over a longer period and the capacity to hold fertilizer ensures that when fertilizer is applied to the soil, it is prevented from leaching and being washed away with surface water. Nalivata (2007) explained that compost is source of mineral forms of Nitrogen, Phosphorus and Potassium and

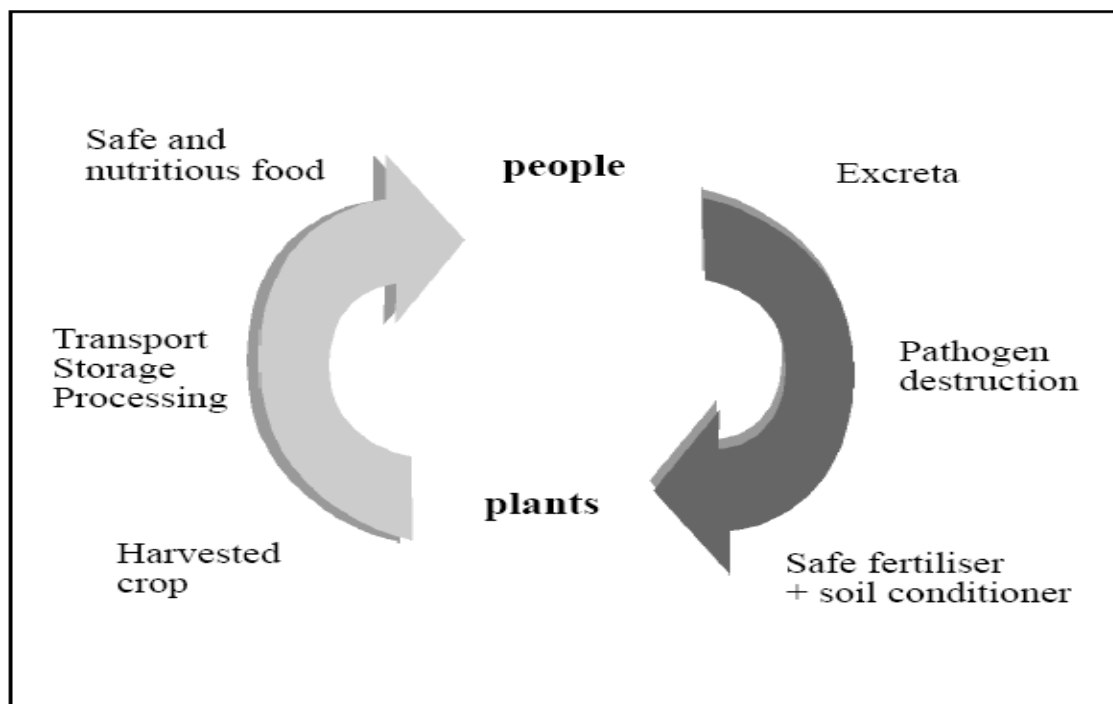
³ Agroforestry (growing leguminous crops or woody shrubs and using biomass as organic fertiliser), retaining crop residues, using animal manure.

it may include micronutrients necessary for plant growth such as Zinc, Boron, Manganese and Copper. Reporting on the importance of compost in soils, Keeling et al (2001) indicated that better crop yields are realized when both inorganic fertilizers and compost are applied to the soil.

1.3.5 Ecological sanitation

Access to compost in urban areas could be improved by promoting ecological sanitation. The purpose of ecological sanitation is to close the nutrient loop between sanitation and agriculture as illustrated on figure 1.

Figure 1. Closed loop diagram of ecological sanitation



From Esrey et al 2000

Closing the nutrient loop between sanitation and agriculture and recycling organic materials contributes to improving soil structure and water retention capacity of the soil and the nutrients in excreta can partly replace the demand for chemical fertilizer (UNESCO; GTZ, 2006). Commenting on the significance of ecological sanitation, Morgan (2007) reported that ecological sanitation is a

potential alternative source of cheaper fertilizer for urban farmers. According to Esrey et al (2000), ecological sanitation attempts to solve some of society's problems of infectious diseases, environmental degradation and pollution and the need to recover and recycle nutrients for plant growth. Esrey et al (2000) further reported that ecological sanitation is relevant in the context of urban agriculture and poverty reduction as households can improve food production and reduce food costs.

Sugden (2003) explained three types of ecological sanitation latrines used in Malawi: arborloo, Fossa alterna and the Skyloo. An Arborloo consists of a shallow pit with a movable slab and superstructure. Soil or ash is added to the pit after each use. When full, the slab and superstructure are moved to another pit and a tree is planted on the filled pit. The Fossa alterna is similar to the arborloo but has two shallow pits. The pits are used alternately. When one pit is full, it is sealed and left to mature and the next pit is put into use. When the second pit is full, it is sealed and the contents of the first pit are then emptied and applied on a garden. The Skyloo is similar to the Fossa alterna in its operation except that the superstructure and the squat slab are constructed above ground level and faeces drop through a squat hole into twin vaults below the raised superstructure

1.3.6 Private sector participation

The participation of entrepreneurs in the water and sanitation sector is considered to be one of the solutions of improving access to water and sanitation (OECD, 2007). The participation of entrepreneurs in providing water and sanitation services is justified by the inability of the public sector to ensure adequate sanitation services to existing users or keep up with the ever increasing demand for new services (Lee et al, 2003). Since the public sector alone cannot provide adequate sanitation, Sansom (2006) argues that the formal and informal private enterprises have a role to play. Lee et al (2003) further explains that one of the viable options available to governments to

provide water supply and sanitation to the public is to increase the participation of the private sector.

It is believed that ecological sanitation offers entrepreneurs an opportunity to invest in building, maintaining and operating compost latrines and generate income from processing and selling compost (WASTE, 2006). This research was therefore set out to investigate whether ecological sanitation could offer profitable business opportunities to entrepreneurs in Blantyre urban.

Although the financial, economical and environmental benefits of ecological sanitation can be justified, the expansion of this technology may be hindered by aesthetic aspects such as smell, and appearance or cultural beliefs (Dragert, 2004; Schonning et al, 2004). This research was set out to assess whether urban farmers would accept to use human compost and be willing to pay for human compost.

1.3.7 Research Background

Primary schools have inadequate sanitation facilities due to lack of funding for building, and maintaining latrines. On the other hand, farmers are unable to maintain soil fertility because inorganic fertilizer is expensive and application of organic matter is limited. Failure to maintain soil fertility threatens the food security status of urban residents. It is believed that ecological sanitation and private sector participation could contribute to overcoming these problems. The feasibility of ecological sanitation and private sector participation in providing sanitation services in schools is the focus of this research.

Chapter Two: Methodology

2.0 Background

According to Neuman (2003) social science research is concerned with answering three fundamentally different questions: exploratory, descriptive and explanatory. This was mainly an exploratory and explanatory type of research which was undertaken to answer the following questions: (1) Is there a market for human compost in urban areas? (2) Would private enterprises benefit financially from building composting latrines in schools, operating the composting latrines and selling human compost? (3) What would be the benefits of composting latrines to the schools?

The research was conducted in three phases. The first phase focused on the status of sanitation services in primary schools. The second phase of the research focused on urban agriculture and urban farmers. Urban farmers were selected to be interviewed because they were considered as potential users and buyers of human compost. This phase of the research therefore centered on the attitude and willingness of urban farmers to use human compost and to pay for processed human compost.

The third phase focused on nursery owners and landscape managers. These were considered as alternative potential buyers of human compost. This stage centered on common practices in maintaining flowers, trees and grass lawns and the attitude of nursery owners and landscape managers towards using human compost and paying for processed human compost.

2.1 Data collection

2.1.1 Interviews

The data was collected mainly through semi structured interviews. A semi structured interview has pre determined questions but the order of the questions can be altered if the interviewer deems necessary. Semi structured interviews were chosen as the main method of collecting data as they are flexible and allow the interviewer to omit or add questions as the interview progresses (Robson, 2002). Semi structured interviews were used to collect qualitative data from urban farmers, school head teachers, nursery owners and landscape managers.

2.1.2 Sample of urban schools

Blantyre Urban has a total of fifty six primary schools. The Blantyre Urban District Education Office has grouped these schools into six zones (see appendix 7a and 7b). From all the six zones, forty schools (see appendix 1) were randomly selected from the list of schools that was provided by the Blantyre Urban District Education Office. At the selected schools, a total of fifty six head teachers were interviewed by one person using a semi structured questionnaire (appendix 4).

2.1.3 Selection of urban farmers

The locations for the household interviews were selected based on the school zones as demarcated by The Blantyre Urban District Education Office. Urban farmers within the school zones were selected as respondents in this research because they were considered as potential beneficiaries of compost that may be produced from composting latrines in primary schools. From all the six school zones, one hundred and fifty two (152) urban farmers were interviewed at their homes using a semi structured questionnaire (see appendix 3). As there was no existing register or list of all the urban farmers in the zones, it was

not possible to accurately and adequately identify urban farmers in order to draw a random sample. Urban farmers were therefore sampled using snowball sampling. This is a non probability sampling that is used when it is difficult to identify respondents and it works by asking identified individuals to identify other individuals who would be likely candidates (Bernard, 2002). Table 1 shows how the interviews were distributed.

Table 1. Distribution of household interviews

Zone Number	Name of Zone	Sample Size	Sample percentage
1	Bangwe	20	13%
2	Chilomoni	27	18%
3	Limbe	24	16%
4	Ndirande	32	21%
5	Nkolokoti	28	18%
6	Zingwangwa	21	14%
Total	6	152	100

Training of interviewers: The household interviews were conducted by a team of two research assistants. These assistants were trained for two days and the training focused on ecological sanitation and on interpretation of the questionnaire. The questionnaire was written in English but the interviews were conducted in Chichewa (local language). The training therefore allowed the research assistants to orient themselves with the questionnaire and to use the same language when conducting the interviews. The training was conducted to reduce biases that are introduced when interviews are conducted by more than one person (Bernard, 2002).

2.1.4 Selection of nursery owners and landscape managers

Nursery owners and landscape managers were interviewed by one person using a semi structured questionnaire (appendix 5). The questionnaire had two main themes. The first theme concentrated on common practices in caring for flowers, flower trees, and grass lawns. The second theme concentrated on

expenditure on compost and willingness to use human compost and to pay for human compost processed in schools.

Information about the locations of nurseries and nursery owners was collected from the Blantyre City Assembly, telephone book and by word of mouth. A total of fourteen (14) nursery owners were identified using these methods. Landscape managers were identified by visiting business premises that had well maintained flower gardens and grass lawns and a total of sixteen landscape managers were identified and interviewed.

2.1.5 Direct observations and triangulation

Direct observations: Other than conducting interviews, additional information was collected through direct observations. These observations provided a means of checking information provided through interviews and gathering additional data (Robson, 2002). When making observations, pictures were also taken using a digital camera. The pictures illustrate common practices in managing nurseries and grass lawns and status of latrines in primary schools.

Triangulation of interviews: Information collected through the interviews was triangulated with information collected from the District Education Office and from Blantyre City Assembly. This was done to cross-check information that was collected from through the interviews.

2.1.6 Willingness to pay (WTP)

To understand the attitude of urban farmers and nursery owners towards human compost and to assess the potential market for human compost, urban farmers and nursery owners were asked about their willingness to pay for compost. WTP is the maximum amount an individual or a household is willing

to pay for a good or service. According to Wedgwood et al (2003), there are three ways of estimating WTP: (1) Observe prices that people pay for goods in a market, (2) Observe individual expenditure of money to obtain goods, (3) Ask people directly what they are willing to pay for goods or services in the future. In this research, urban farmers, nursery owners and landscape managers were directly asked to indicate the maximum amount they were willing to pay for a 50 kilogram bag of human compost.

2.2 Data analysis

2.2.1 Analysis of qualitative data

The research collected both qualitative and quantitative data. The analysis of the qualitative data involved coding the answers provided into groups of similar answers. According to Neuman (2003), coding is an essential part of analytical process in qualitative research because it frees the researcher from getting entangled in the raw data. As the main purpose of the research was to explore attitudes towards using human compost, the coding of the data was designed to identify different attitudes and reasons for holding specific attitude towards human compost. Coding was done through reading field notes several times and recording similar answers. The researcher employed the use of SPSS for windows version 16 to process and analyse frequencies.

2.2.2 Financial analysis

Net Present Value (NPV) (see appendix 8, 10, 11) was used to assess the financial benefits of investing in compost latrines in primary schools. The NPV of a project expresses the difference between the discounted present value of the future benefits and the discounted present value of future costs (Gittinger, 1982). A positive NPV for a given project shows that the project benefits are greater than its costs and a negative NPV shows that the project costs are greater than the benefits (Campbell et al, 2003). In the calculation of NPV,

three different discount rates (8%, 10% and 12%) were used. Using these rates is common practice when calculating NPV (ADB, 1997; WSP 2009).

The average WTP and the most frequently mentioned price (mode) obtained from the household and nursery surveys were the prices that were used to calculate NPV. Secondary data (see appendix 9) was used to estimate figures for calculating the quantity of human compost that could be produced per year at a school.

Three scenarios were considered in calculating NPV (see appendix 10, 11). The first scenario considered the effect of including the initial investment cost and operational cost on NPV. This scenario illustrates the benefits that entrepreneurs would gain if they were to build and operate compost latrines in primary schools. In the second scenario, only operating costs were taken into account. This scenario illustrates the benefits that entrepreneurs would gain if they were to only operate compost latrines in schools. In the third scenario, investment cost, and wages for toilet attendant were excluded from the calculation of NPV. This scenario illustrates the benefits that schools through the school management committee would gain if compost latrines were built in schools. This scenario was considered because schools receive support for building latrines and the Blantyre City Assembly employs and pays the wages of school toilet attendants.

2.3 Research limitations

The management of flowers and grass lawns in Blantyre City is done by mainly three major landscaping firms (Lily of the valley, Panthuzi and MK investment). This eased the work of the researcher as the information collected from these organisations represented information about the management of flower gardens and grass lawns in many business premises in Blantyre. However, this reduced the sample size and meant that the information about landscape management and attitude towards using human compost was collected from very few individuals.

Interviews in schools were conducted without prior arrangement with school head-teachers and school management committees. Information in some schools was therefore collected from deputy head-teachers and teachers who were present on the day of the visit. The deputy head-teachers and the teachers may not have had thorough knowledge about the schools or about school sanitation. Since visits were unannounced, it was not possible to meet members of the school management committees.

Household interviews were conducted with the help of two research assistants. Although these assistants were trained; using two research assistants may have affected the results of the interview as two different people may not probe or ask questions in a similar manner.

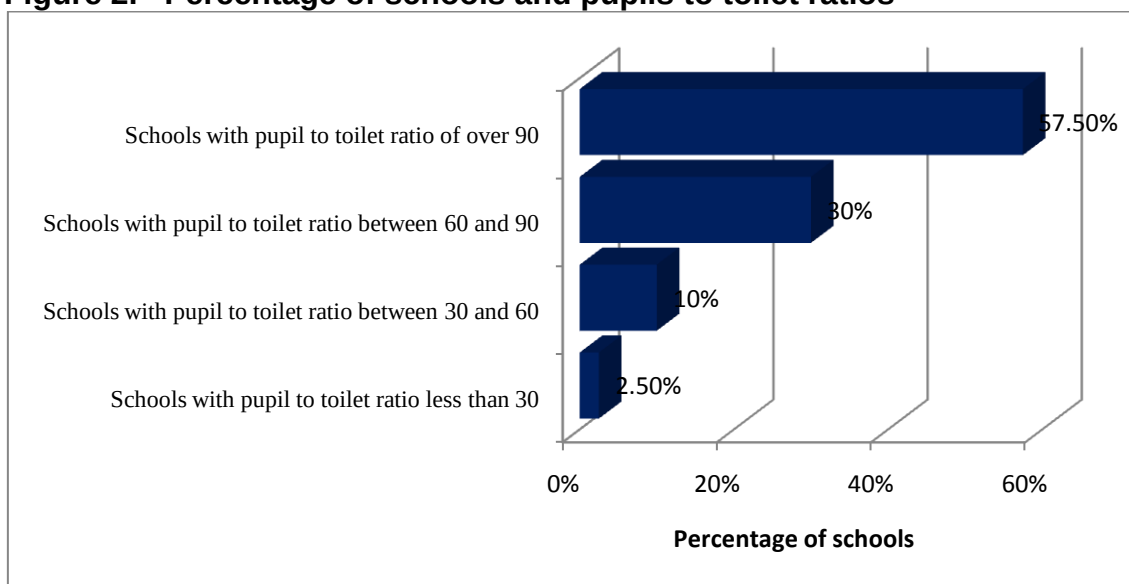
Chapter Three: Research Results

3.1 School sanitation

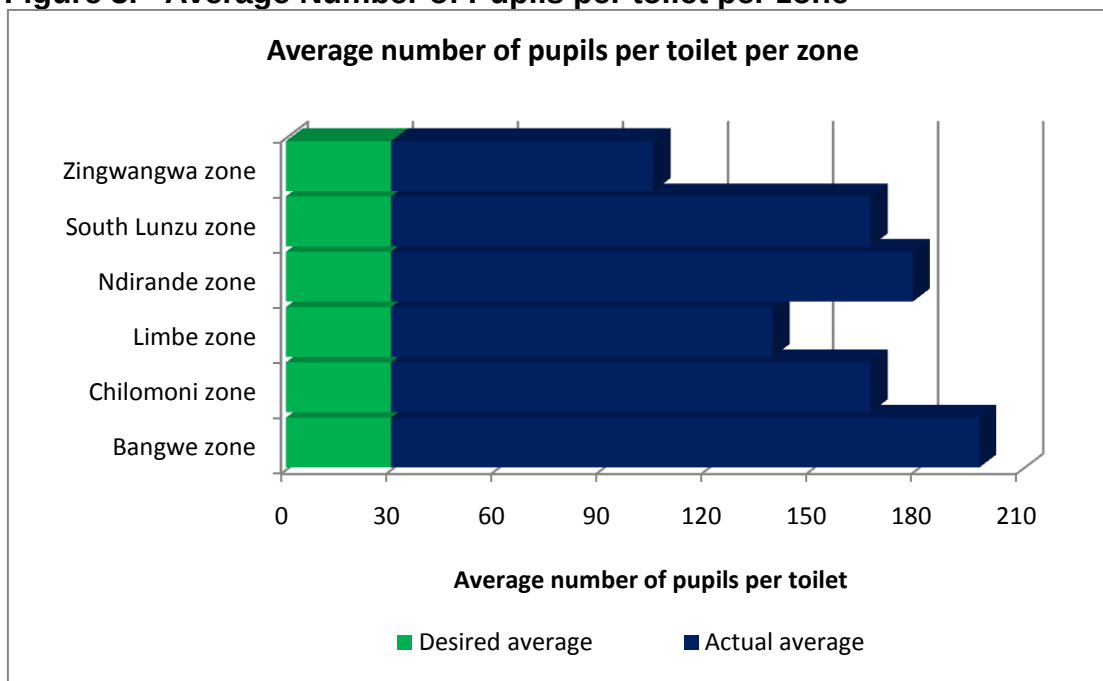
3.1.1 Access to sanitation

The ratio of pupils per toilet ranged from 19 to 407 and the average number of pupils per toilet was 129. This average is far higher than the recommended average of 30 pupils per toilet. Figure 2 shows that in most schools, the number of pupils per toilet is over 30 and in only one school (2.5%), the number of pupils using a single toilet is less than 30.

Figure 2. Percentage of schools and pupils to toilet ratios



The problem of lack of toilets exists in all the school zones in Blantyre Urban as illustrated on figure 3 which shows the desired number of pupils per toilet and the actual average number of pupils per toilet per zone.

Figure 3. Average Number of Pupils per toilet per zone

3.1.2 Maintenance of latrines

Maintenance of broken and damaged latrines is the responsibility of School Management Committees (SMCs) and Parents Teachers Associations (PTAs). Each school has a SMC and a PTA. With support from Blantyre District Education Office, SMCs and the PTAs collect funds from pupils/parents and secure external funding for building and maintenance of latrines from companies, churches and non-profit organizations. Although there are management structures responsible for maintaining school latrines, there are many damaged latrines that are not being maintained.

A total of 27 pit latrines were found to be damaged and are in need of maintenance. Out of these latrines, 4 pit latrines are full and need to be emptied. In one of the schools, there are 14 pit latrines that are not safe for use (there are cracks on the slabs that pose risk of falling in) and the school management committee tried to stop pupils from using the unsafe toilets but

due to lack of latrines, pupils still use the damaged latrines. Most pit latrines had their doors broken and stolen. Apart from causing privacy and safety problems, damaged pit latrines are still being used by the pupils.

Figure 4. Damaged pit latrines still being used by pupils



Picture taken at Nkolokoti Primary school – Blantyre Urban

The number of flush toilets that have been damaged, vandalized and abandoned far exceeds the number of damaged pit latrines. A total of 512 flush toilets were found damaged, vandalized and out of use. Most of these flush toilets have no cisterns, the pipes and the toilet seats were stolen and in some cases the sewerage net work is blocked such that the toilets cannot be flushed. In an effort to prevent theft, some schools have welded metal sheets around the cisterns and fixed padlocks on the cisterns.

The disadvantage with the flush toilets is that once vandalized, pupils can no longer use them while the pit latrines although they also get vandalized (doors get stolen), pupils still access them. The head-teachers in 20 schools out of the 22 schools that have broken and vandalized flush toilets explained that they

lack the resources to maintain the toilets. This view was explained well by one of the head teachers from one of these schools, who said,

“We got a quotation for the maintenance of the damaged toilets but we felt that it was going to be much cheaper to build pit latrines than to rehabilitate the damaged flush toilets.”

(Mrs. Kaumbe, school interview No. 3, appendix 1)

Figure 5. Damaged flush toilet used as a storage room



Picture taken at Misesa Primary School – Blantyre Urban

3.1.3 Access to finance for maintenance of school latrines

Schools depend on parent/pupil contribution for all maintenance and rehabilitation work. On average, pupils are paying MK160⁴ per year. Since the introduction of free primary school education, although all the students are required to pay school fund, some students do not pay at all and the school management committees are not mandated to force the pupils to pay the school fund. In some cases, the teachers may withhold examination results to force the pupils/parents to pay the school fund. On average, only 60% of the

⁴ 1 US\$ = MK 140

students do pay their school fund. The money that School Management Committees collect is used for a range of school activities: paying security guards, paying cleaners, printing, transport to hospital for injured pupils, transport for teachers to school related meetings and functions and rehabilitation of school buildings. According to the head teachers, maintenance, rehabilitation and building extra toilets from school funds alone is inconceivable as the money they collect is spent on these other activities such that once all the activities have been paid for, the school is left with no extra funds. Maintenance and building extra toilets is therefore not being considered as a top priority.

Schools also receive DSS (Direct Support to Schools) from donors (DFID, World Bank). Schools receive MK72, 000 to MK122, 000 depending on school population. This money is meant for acquiring learning materials and for school maintenance activities. However, none of the schools visited maintained or managed to build school latrines from DSS.

Out of the schools that need resources to maintain broken and vandalized toilets, only three (3) schools are in a position to do so. One of the schools managed to maintain and rehabilitate all (33) of its broken flush toilets. This school was in a position to do so because it is connected to the Catholic Church and the head teacher has friends outside Malawi who assisted the school. This was explained very well by a head teacher from the school, who said,

“We could not have managed to rehabilitate all these toilets from school funds alone because the rehabilitation of these toilets was very costly such that the money we collect from pupils could not have been sufficient. I have friends from outside Malawi that assisted us.”

(School head teacher, interview No.32, appendix 1)

Another school confirmed that it would manage to rehabilitate all nine (9) broken and vandalized toilets because the school is able to raise extra funds from renting out school buildings to churches and institutions that offer evening classes. This was confirmed by the head teacher at the school, who said,

“From school funds alone we can’t manage to rehabilitate the broken toilets but due to our advantageous location, we are able to rent out our school buildings to churches and institutions that offer evening classes here.”

(School head teacher, interview No.7, appendix 1)

The third school that managed to maintain all its broken flush toilets was able to do so because it received support from Water for People (NGO providing water and sanitation services) after struggling for so many years to maintain the toilets.

Without external support to the schools the existing school management structures are failing to raise funds for maintaining broken toilets let alone building extra toilets. As a result flush toilets are now being turned into storage rooms for broken chairs and books. In other schools, buildings that used to be toilets have been turned into classrooms or the roofing is being removed to be used for other purposes.

3.1.4 Cleaning of school latrines

Cleaning of school latrines is the responsibility of Blantyre City Assembly. The Blantyre City Assembly is responsible for employing cleaners and assigning them to all the schools in Blantyre Urban. The cleaners are paid by the Blantyre City Assembly and they receive MK3000 per month. Although cleaning is the responsibility of Blantyre City assembly, there are schools that had to employ their own cleaners because of failure of the City assembly to send cleaners to

some schools. Table 2 shows the proportion of schools with Blantyre City Assembly cleaners.

Table 2. Proportion of schools with Blantyre City Assembly cleaners

Employer of toilet cleaner	Number of schools
Blantyre City Assembly	21
School management committee	17
Both Blantyre City Assembly and SMC	2

Cleaning in primary schools is regular and through visiting the toilets, it was observed that in most schools (38) the latrines are cleaned regularly as there was no faecal matter on the floors or on the walls of the latrines.

3.1.5 Benefits of composting latrines

Under this theme, head teachers were asked whether they would accept composting latrines in the schools. The idea of composting latrines and private toilet operators appealed to all the schools except one. According to the head teachers, composting latrines would be additional to the already existing latrines and thereby reduce the ratio of pupils per toilet. In schools where there is land for agriculture (24 schools), the head teachers felt that some of the compost could be used at the schools. There was one school that declined the idea of composting latrines (St Pius Girls Primary School). This school has both pit latrines and flush toilets and the head teacher at this school indicated that there are enough toilets at the school such that additional toilets would not be required. In schools with flush toilets only (8 schools), the idea of composting latrines also appealed to the head teachers because of the opportunity to cut water bills.

Figure 6. Pupils urinating outside a toilet

Picture taken at Nkolokoti Primary School – Blantyre Urban

3.2 Urban agriculture

3.2.1 Use of fertilizer, compost and sludge

Urban farmers produce predominantly maize, vegetables and beans. Maize, the staple food in Malawi is the major crop which they produce and on average they produced 25 bags (50kg bags) of maize per hectare last season (2007 to 2008).

Comparing the use of fertiliser to the use of compost, urban farmers used mainly fertiliser. The use of fertiliser may have been boosted by the Government's fertiliser subsidy programme which most of the urban farmers benefited either directly or indirectly. Local leaders were responsible for identifying beneficiaries of coupons and farmers that had direct access to the coupons were buying fertiliser at MK800.00 per 50kg bag of fertiliser (both 23:21:0 and Urea). Other farmers did not have direct access to coupons but they were still able to pay less than the full market price (MK10, 000.00) of

fertiliser as there were some individuals who had direct access to coupons and they were selling the coupons to those that did not have any direct access. There were other individuals who instead of selling the coupons they had; they purchased fertilizer and were selling the fertilizer instead.

On the use of fertiliser, not all farmers applied fertiliser and not all the farmers applied all the needed two types of fertiliser (23:21:0 and Urea). As can be seen on the Table 3 below, most (79%) farmers used both the 23:21:0 and the Urea and 12% used only one type of fertiliser (either 23:21:0 or Urea). Out of the farmers that applied one type of fertiliser, most (78%) of them applied Urea and fewer (28%) applied 23:21:0.

Table 3. Proportion of households using fertiliser

Category	Frequency	Percentage
Applied both types of fertiliser	121	79
Applied one type of fertiliser only	18	12
Did not apply any fertiliser at all	13	9
Total	152	100

Urban farmers that did not apply any type of fertiliser were fewer (9%). The failure to apply any type of fertiliser may have affected their food production as the average production per hectare of these farmers was much lower compared to the production of farmers that applied all the types of fertiliser or to those that applied one type of fertiliser only as can be seen on table 4.

Table 4. Use of fertiliser and maize production

Category	Mean maize production per hectare (in bags)	Standard Deviation
Applied both types of fertiliser	27	21
Applied one type of fertiliser only	25	24
Did not apply any fertiliser at all	14	10

Urban farmers rarely use compost. Only 18% (27) urban farmers applied compost in their gardens. Even for urban farmers that did not apply any type of fertiliser, very few (3 out of 13) applied compost. The type of compost used

included: plant waste, chicken manure, animal manure and dry sludge as can be seen on table 5.

Table 5. Proportion of households using compost

Category	Frequency	Percentage
Chicken Manure	11	41
Animal Manure	3	11
Plant waste	3	11
Sewerage	10	37
Total	27	100

There are three main reasons why use of compost was rare: very few raise chickens and animals, production of compost from plant waste is labor intensive, there was no space to make compost and the distance to the sewerage plant where dry sludge could be collected was prohibitive for many households.

Chicken manure and dry sludge from the sewerage plants are the two most common types of compost being used in urban areas (see table 5). Chicken manure is used by both households that raise chickens and households that do not raise chickens. Those that do not raise chickens buy the chicken manure and the price of chicken manure ranges from MK100 to MK150 per 50 kg bag. The difference in the use of these two types of compost is that users of chicken manure are not restricted to one particular locality but are found in all the zones. On the other hand, users of dry sludge are concentrated in the areas that are very close to the sewerage plant in Blantyre City hence the use of dry sludge is restricted and the restricting factor is distance not price as dry sludge from the sewerage is free of charge.

Urban farmers that collect dry sludge do so in the months of July, August, September and October. Usually there is not enough dry sludge to satisfy the demand and farmers fight over the compost. This was expressed clearly by the Plant Operator at Blantyre Sewerage, who said,

“People around this sewerage depend on this compost. They collect all the sludge. The demand is high than the supply such that some people come and go back without any manure.”

(Mr. Mmadi, Plant Operator, Blantyre Sewerage)

According to the plant operator, sludge is not released for collection every year. Therefore in some years, farmers have no opportunity to collect the sludge. However, for the past three years, farmers have been able to collect the sludge.

3.2.2 Knowledge and attitude about human compost

There was limited knowledge about composting latrines in all the zones. Only 24% (37) had some previous knowledge and 76% (115) did not have any knowledge at all. Farmers that had knowledge about composting latrines acquired this knowledge through the radio, newspapers, TV and through the word of mouth. Most people also learn about human compost and composting latrines through the CCOD low cost housing project in Blantyre-Limbe where composting latrines were built for the project beneficiaries.

Despite having no knowledge or limited knowledge about composting latrines, most (97%) urban farmers were willing to use the compost in their gardens as can be seen on table 6. Acceptance to use human compost may be boosted by knowledge about using sludge from sewerage plants. In Blantyre City, many primary schools around 1980's used to send pupils to sewerage plants to collect sludge to be used in flower gardens.

Table 6. Proportion of households willing to use human compost

Category	Frequency	Percentage
Urban farmers willing to use compost	147	97
Urban farmers not willing to use compost	5	3
Total	152	100

Only 3% of farmers indicated that they could not use the compost produced from a composting latrine. There were two main reasons that made some urban farmers to refuse the idea of using human compost. Some farmers indicated that they may not be comfortable to eat food produced by using human compost. This was expressed clearly by one of the urban farmers, who said,

“My children would refuse to use this compost in our garden and I would not be happy to eat the food because I would be thinking about the compost.”

(Mrs. Chilalire, urban farmer, South Lunzu zone)

Other urban farmers declined the idea of using human compost because they felt that human compost is dirty and disgusting. One of the urban farmers had this to say,

“Those are very dirty things which I cannot even dare to use. Its better I should apply cattle manure.” ***(Mrs. Mtungama, urban farmer, Bangwe zone)***

3.2.3 Household’s willingness to pay for human compost

Under this theme, urban farmers were asked two major questions: whether they would be willing to use human compost and whether they would be willing to pay for a 50 kg bag of human compost. Before farmers were asked these questions, the process of making compost from an ecological latrine (skyloo) was clearly explained and pictures of a skyloo toilet were shown to the respondents.

When asked about their willingness to pay for processed and packaged compost, not all urban farmers that indicated desire to use the compost indicated willingness to pay for the compost. Table 7 shows the proportion of farmers willing and not willing to pay for human compost. Many farmers (79%)

are willing to pay for human compost. Some farmers 11% (16) indicated that they would not be willing to pay for the human compost and 7% (11) did not know whether they would pay or not.

Table 7. Proportion of households willing to pay for human compost

Category	Frequency	Percentage
Willing to pay for human compost	120	79
Not willing to pay for human compost	16	11
Don't know	11	7
Not willing to use human compost	5	3
Total	152	100

Willingness to use compost from ecosan latrines was not restricted to urban farmers that did not apply any fertiliser at all or to farmers that applied one type of fertiliser only. All groups of farmers, including those that applied two types of fertiliser indicated that they would be willing to pay for human compost. The main reason given for the desire to pay for human compost is the price of fertiliser which is considered to be very expensive. The human compost is seen as an alternative to the more expensive fertiliser. This was the sentiment of one of the residents, who said,

“Last season I did not apply fertiliser; if this manure were available I would have gone for it.”

(Mrs. Khwinimbe, resident, Bangwe zone)

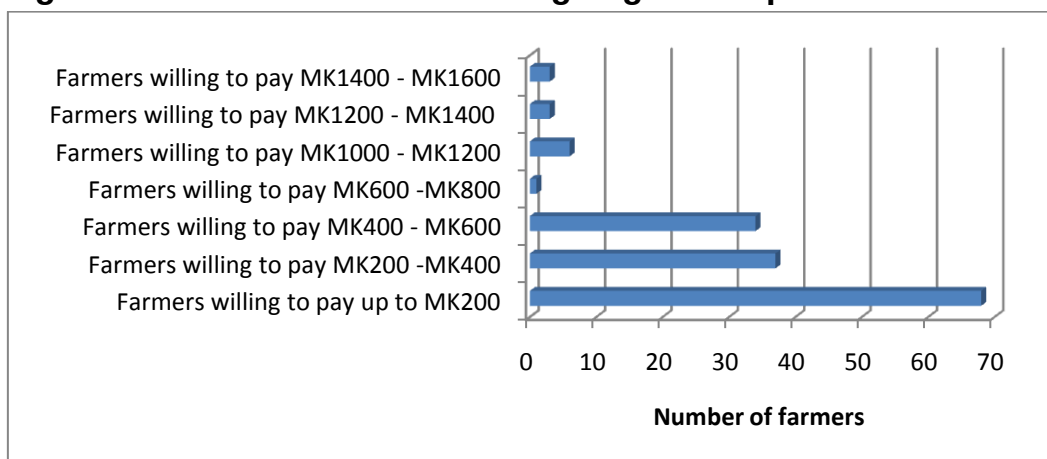
Urban farmers indicated various prices for human compost as can be seen on table 8. The most frequently mentioned price was MK500, the minimum price was MK20 and the maximum price was MK1500.

Table 8. Prices offered for human compost

Statistic	Value
Mean	MK351
Mode	MK500
Median	MK250
Minimum	MK20
Maximum	MK1500

As can be seen on figure 7, most urban farmers were willing to pay between MK200 and MK600 for a 50kg bag of human compost. Very few farmers were willing to pay above MK800.

Figure 7. Prices offered for a 50kg bag of compost



3.3 Results of landscape and nursery interviews

3.3.1 Management of green grass

One of the common practices in the management of green grass at business premises involves spreading top black soil over the green grass. The top soil is spread on the grass to cover exposed grass roots and to revitalize its growth. This practice is done usually once a year around the months of June and July.

The top soil is dug by transporters from vacant land within Blantyre City. The soil itself is usually collected free of charge but business premises pay for transport of the soil and the transport cost ranges from MK 7000 to MK 8000 for a 7 tonne lorry and MK10, 000 to MK 15, 000 for a 10 tonne lorry.

Figure 8. Heap of top soil before being spread on green grass



Picture taken outside a bank in Blantyre City

Other than covering green grass with top soil, green grass is also covered with dry tobacco stems and leaves. It is believed that once the tobacco stems decompose, it is utilised by the grass and the effect is that the grass regains its green color. Tobacco stems are applied once a year. The dry tobacco stems and leaves are collected free of charge from the tobacco auction floors.

Use of tobacco stems has a few shortfalls. At one of the hotels in Blantyre, the use of tobacco stems on the grass lawn has been stopped because residents were complaining about the smell of tobacco. The other problem is that the effect of tobacco stems takes longer to be noticed as the stems have to decompose first before its growth effect can be seen.

3.3.2 Management of flowers and trees

Management of flower gardens at business premises involves adding compost from plant waste on the flower beds. The compost that is used on flower beds is usually made by the gardeners within the business premises. The compost is made from fallen leaves, weeds, dry grass and flower cuttings.

Figure 9. Gardener showing a compost heap

3.3.3 Management of nurseries

Nursery owners use predominantly top soil, chicken manure and compost from plant waste to grow trees and flowers. The chicken manure is purchased from poultry farms within Blantyre City at MK100 to MK150 per 50 kg bag. The plant waste compost is processed by the nursery owners themselves by mixing plant waste with top soil. The top soil which they use is collected from empty spaces within the nursery site.

Some (4) nursery owners and business premises have used dry sludge before to grow flowers and trees but currently, none of the interviewed nurseries and business premises are using dry sludge. Opinion about the use of dry sludge to grow flowers and trees was mixed. One (1) nursery owner believes that chicken manure is better than dry sludge because it does not damage the plants while others (3) believe that dry sludge is more powerful and good for flowers and flower trees than chicken manure. This was expressed clearly by one of the nursery owners, who said,

“Chicken manure can burn your flowers and its growth effect on the flowers and trees does not last long so you have to apply it on flowers and trees more frequently but dry sludge has a longer growth effect and you can apply it on your trees and flowers once a year.”
(Mr. Mbewe, interview No.4, appendix 2)

Figure 10. Nursery owner and a compost heap

Nursery owners that have experienced the growth effect of dry sludge on trees and flowers are willing to continue using the dry sludge but they are unable to do so because the availability of dry sludge at the sewerage plants is very irregular.

3.3.4 Attitude of landscape managers towards human manure

When asked about use of human manure, most (11) nursery owners indicated that they would be willing to buy the human compost and the price that was offered ranged from MK100 to MK 300 per 50kg bag.

As for management of landscape at business premises, only 3 out of the 16 managers of landscape at business premises indicated that they would be willing to buy human compost and use it on grass, trees and flowers. The price that was offered was matched with the price that they pay for top soil and it ranged from MK7000 to MK9000 per 7 tone lorry.

Most (13) managers of landscape at business premises were very concerned about the risk of smell and diseases from the human compost and declined to

use the compost. This was expressed clearly by one of the premises manager, who said,

“This is a business place and we receive so many visitors and we do not want our customers to stop coming to this hotel because of smell.” (Mr. Nganga, interview No. 8, appendix 2)

These sentiments were confirmed by one of the nursery owners who was very skeptical about using human compost on flowers and trees for fear of smell and risk of diseases that the human compost may pose to his customers. This nursery owner said,

“We believe that the compost we make ourselves is safer and our customers can go home and remove the plants from the tubes and plant them somewhere else without any risk of smell and disease from the compost in the flower tubes.”

(Mr. Karim, interview No.16, appendix 2)

Figure 11. Grass covered by top black soil



Picture taken outside a bank in Blantyre City

3.4 Financial analysis of school compost latrines

The average price for human compost as indicated by urban farmers was MK350 per 50 kg bag and the most frequently mentioned price was MK500 per 50 kg bag. These were the prices that were used to calculate NPV. The effect of inflation on prices was not considered. All the assumptions and figures used in the calculation of the NPV are on appendix 9.

The average number of pupils per school is 2500. Approximately, 135 bags of compost can be sold per year (see appendix 8). Building 16 compost latrines (Fossa alterna type, 8 cubicles for boys and 8 cubicles for girls) would cost approximately MK700, 000⁵ (US\$2500). Table 9 shows that The Net Present Value of the investment is negative at the average price of human compost (MK350 per 50 kg bag) and when the initial investment cost is taken into account. (see appendix 10)

Table 9. Net Present Value @ MK350 per 50kg bag of human compost

Discount rate	Initial investment cost taken into account	Initial investment cost not taken into account	Initial investment cost and wages for toilet attendant not taken into account
8%	-668,222.50	31,777.50	239,947.50
10%	-674,018.88	25,981.13	218,882.63
12%	-679,085.45	20,914.55	200,469.95

When the initial investment cost is not taken into account, the NPV is positive indicating that the investment is profitable. The investment is even more profitable when the investment cost and the wages of a toilet cleaner are not taken into account.

Table 10 shows that the results of the financial analysis improve when a higher price is charged but NPV remains negative when the initial investment cost is taken into account when calculating NPV. (see appendix 11)

⁵ MK700,000 = US\$2500 (1US\$=140MK)

Table 10. Net Present Value @ MK500 per 50kg bag of human compost

Discount rate	Scenario 1. Initial investment cost, and operating cost taken into account	Scenario 2. Initial investment cost excluded from calculating NPV	Scenario 3 Initial investment cost and wages for toilet attendant not taken into account
8%	-532,345.00	167,655.00	375,825.00
10%	-549,592.75	150,407.25	343,308.75
12%	-564,668.90	135,331.10	314,886.50

Chapter 4: Discussion, conclusion and recommendations

4.1 Discussion

This study has revealed that there is a widespread shortage of latrines in urban primary schools and that the school management committees are failing to raise funds for maintaining damaged latrines or building extra latrines to cope with rising school populations. Currently, schools depend on school funds and DSS (Direct School Support) for all school expenses. However, the funds raised through these sources are inadequate for all school activities and they are not being directed towards the maintenance of school latrines or building extra latrines.

It is believed that adoption of composting latrines can significantly improve sanitation in schools. The adoption of composting latrines in schools however, raises a number of questions: Who will be responsible for building and operating the composting latrines? What would the compost be used for? These questions could be answered by linking school sanitation to urban agriculture, tree/flower nurseries and landscape management.

This research has revealed that the use of human compost for the production of food, trees and flowers is not considered as an alien concept. For a long time, the residents of Blantyre Urban have been applying dry sludge in maize gardens, flower gardens and grass lawns. The idea of using human compost however met some resistance from few farmers, nursery owners and landscape managers. Few urban farmers feared that human compost would smell and they expressed that they would not be comfortable to eat food produced with human compost. Some nursery owners were skeptical about using compost because of risk of smell and exposing customers and employees to disease causing pathogens. Landscape managers feared that the compost would smell and stop customers from visiting their business premises. Although there was some resistance in using human compost, most urban farmers and nursery

owners accepted the idea of using human compost and most of them were willing to pay for human compost processed and supplied from schools.

Compost in urban areas is in short supply and many urban farmers and nursery owners are willing to alternatively use human compost. Urban farmers and nursery owners are willing to pay MK350 per 50kg bag of human compost. This price competes very well with the prices of animal and chicken manure (MK100 to MK200 per 50kg bag). The willingness of urban farmers and nursery owners to use and to pay for human compost indicates that there is a market for human compost in Blantyre urban. Human compost can therefore be supplied from primary schools.

Although human compost can be supplied from schools, it is highly unlikely that private enterprise would invest in this business. Private enterprises may not be motivated to participate in building and operating compost latrines and sell human compost because of high initial investment cost and low returns.

When the initial building cost is taken into account when assessing the benefits of investing in composting latrines; investing in composting latrines appears to be worthless. When the initial investment cost is not taken into account when assessing the benefits of investing in composting latrines; operating composting latrines appears to be worthwhile. Thus private operators may be motivated to only operate already built composting latrines but not to build them as well. Allowing private entrepreneurs to only operate compost latrines may not assist schools to generate income and access private finance. Schools through the school management committees would benefit significantly from compost latrines if the school management committees took the responsibility of operating and selling human compost as a way of generating income for the school.

4.2 Conclusion

In Blantyre city, urban farmers do not make their own compost from plant and household waste and very few use chicken manure or dry sludge. Use of inorganic fertilizer is also minimal due to high fertilizer prices. Most urban farmers desire to use compost but they are unable to do so because the locations where they can access compost are scattered and very far from places of residence.

In urban areas, there is a market for human compost as most urban farmers and nursery owners are willing to pay competitive prices for it. Although there is a market for compost, it is very unlikely that private enterprises would invest in building and operating compost latrines because of high investment costs and low returns.

Although private enterprises may not be motivated to invest in compost latrines in schools, schools should still be assisted to invest in compost latrines. Compost latrines are more profitable to schools than to private operators. When funding is available and decisions to build new latrines are to be made, schools should consider building composting latrines as composting latrines would assist schools to generate income and improve the supply of compost.

4.3 Recommendations

Ecosan pilot project in urban schools: Blantyre District Education Office in coordination with Blantyre City Assembly and other organizations involved in promoting sanitation must implement ecological sanitation pilot projects in selected schools. These pilot projects will be used to train schools and school management committees about ecological sanitation.

Promoting use of human compost: Blantyre District Education Office in coordination with Blantyre City Assembly and other organizations involved in promoting sanitation must promote the use of human compost through awareness campaigns and demonstration plots in urban communities.

Further research: There is a need to assess the effect of human compost on growth of grass, trees and flowers. This research would be useful in encouraging landscape managers and nursery owners to adopt human compost.

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Appendices

Appendix 1 List of schools visited

<i>Interview No.</i>	<i>Date</i>	<i>Name of School</i>	<i>Zone</i>	<i>Interviewed person/s</i>	<i>Position</i>
1	08/06/09	Bangwe Catholic	Bangwe	Mrs. Potani	Head teacher
2	08/06/09	Bangwe CCAP		Mr. Lapuwa	Head teacher
3	16/06/09	Chigumula		Mr. Simika	Teacher
4	16/06/09	Chisombezi		Mrs. Gatoma	Teacher
5	16/06/09	Namatapa		Mr. J. Fight, T Malubali	Teachers
6	08/06/09	Naizi		Mr. Fumba	Head teacher
7	11/06/09	Chichiri	Limbe	H.P. Sikumbiri	Head teacher
8	11/06/09	Kanjedza		Mr. Cholasa	Head teacher
9	11/06/09	Limbe		Mrs. Akimu	Head teacher
12	11/06/09	Kizito		Mr. Awadi	Head teacher
11	16/06/09	Misesa		Mrs. Twalibu	Head teacher
12	11/06/09	St. Maria Goretti		Mrs. Nambozi	Head teacher
13	04/06/09	Chilomoni Catholic	Chilomoni	Mr. Chilombo	Head teacher
14	04/06/09	Chilomoni LEA		Mr. Chikaza	Head teacher
15	04/06/09	Lumbira		Mrs. Mbewe	Head teacher
16	04/06/09	Namiwawa		Mr. Idi	Head teacher
17	04/06/09	Sigerege		Mrs. Mkaka	Head teacher
18	09/06/09	Blantyre girls	Ndirande	Mr. Hawu	Head teacher
19	09/06/09	Chitsime		Mr. Nyirenda	Head teacher
20	09/06/09	HHI		Mrs. Njawala	Head teacher
21	09/06/09	Makata		Mrs. Nyirenda	Head teacher
22	15/06/09	Mbayani		Mr. Chimwala	Head teacher
23	09/06/09	Namalimwe		Mrs. Ntontholi	Head teacher

24	09/06/09	Ndirande LEA		Mr. Padambo	Head teacher
25	09/06/09	Ndirande Matope		Mrs. Mbekeyani, Mr. Makweya	Head teacher
26	09/06/09	Nyambadwe		Mrs. Mpasu	Head teacher
27	09/06/09	Ndirande Hill		Mrs. Mthura, Mr. Majoni	Head teachers
<i>Interview No.</i>	<i>Date</i>	<i>Name of School</i>	<i>Zone</i>	<i>Interviewed person/s</i>	<i>Position</i>
28	12/06/09	Catholic Institute	Zingwangwa	Mrs. Munthali, Mr. Ndala	Head teachers
29	12/06/09	Chimwankhunda		Mrs. Chiwaula, Mr. Mponda	Head teacher
30	11/06/09	Chitawira		Mr. Kantande	Head teacher
31	12/06/09	St. Pius Boys		Mrs. Kaumbe	Head teacher
32	12/06/09	St. Pius Girls		Ruth Malote	Head teacher
33	12/06/09	Zingwangwa		Mr. R. Misesa	Head teacher
34	12/06/09	Namasimba		Mrs. Madondolo	Head teacher
35	15/06/09	Chirimba	South Lunzu	Mrs. Seunda	Head teacher
36	15/06/09	Makalanga		Mrs. Kampeni, Mr. Kanjewe	Head teacher
37	15/06/09	Mthawira		Mr. Mpingasa	Head teacher
38	15/06/09	Namilango		Mr. Mkaka	Head teacher
39	15/06/09	Nanjiriri		Mrs. Wandale	Head teacher
40	15/06/09	Nkolokoti		Mr. Mponya, Mrs. Nyirenda	Head teachers

Appendix 2 Nursery owners and landscape managers interviewed.

Interview No.	Date	Persons interviewed	Position	Organisation/nature of business	Location
1	02/07/09	Mr. Nkhoma,	Assistant Director & supervisor	Bt City Assembly (landscaping, nursery)	Chichiri
2	02/07/09	Mr. Singano	Director	Flower and tree nursery	Mibawa
3	02/07/09	Mr. Gama	Director	Flower and tree nursery	Mibawa
4	02/07/09	Mr. Mbewe	Director	Flower and tree nursery	Mibawa
5	02/07/09	Mrs. M. Alex	Director	Flower and tree nursery	Mibawa
6	04/06/09	Mr. Benda	Landscape Manager	Mount Soche Hotel	Blantyre
7	04/06/09	Mr. Chikaza	Greens Manager	Blantyre Sports Club	Blantyre
8	05/06/09	Mr. Nganga	Maintenance Manager	Ryalls Hotel	Blantyre
9	05/06/09	Mr. D. Mwinga	Gardener	Old Mutual	Blantyre
10	05/06/09	Mr. Pichesi	Gardener	Inde Bank	Mandala
11	05/06/09	Mr. Sabili	Production Manager	Jamestar Nursery and landscaping	Bangwe
12	05/06/09	Mr. Bonongwe	Gardener	CFAO Ltd	Mandala
13	17/07/09	Mrs. C. Sailesi	Director	Flower and tree nursery	Chinyonga
14	17/07/09	Mr. S. Gauti	Director	Flower and tree nursery	Chinyonga
15	17/07/09	Mr. F. Chimimba	Director	Flower and tree nursery	Chinyonga
16	17/07/09	Mr. and Mrs. Karim	Directors	Kwacha Nursery	Chinyonga
17	20/07/09	Mr. Joe Nkwaila	Supervisor	Flower and tree nursery	Chinyonga
18	20/07/09	Mr. F. Chakanza	Director	Flower and tree nursery	Limbe
19	20/07/09	Mr. U. Matola	Director	Flower and tree nursery	Limbe
20	20/07/09	Crystal Hawken	Director	Crystal Florist (flower & tree nursery)	Blantyre
21	20/07/09	Mr. Mbetewa	Programme Officer	COPRED (tree nursery)	Chinyonga
22	23/07/09	Mr. Zulu	Landscape Manager	Peoples Trading Ltd	Chichiri
23	23/07/09	Mrs. Banda	Maintenance Manager	Mwaiwathu Private Clinic	Wenela

24	23/07/09	Mr. Maulidi	Gardener	Shire Highlands Hotel	Limbe
25	23/07/09	Mr. Jiya	Maintenance Manager	Reserve Bank of Malawi	Blantyre
26	23/07/09	Mrs. Kausile	Director	Lily of the valley (landscaping)	Blantyre
27	24/07/09	Mrs. Padambo	Director	MK investment (landscaping)	Blantyre
28	24/07/09	Mr. C. Walker	Director	Panthunzi- landscaping	Blantyre
29	24/07/09	Mr. Makwete	Director	Land Scapers (landscape and nursery)	Blantyre
30	24/07/09	Mrs. Chilenga	Director	Greenland Landscaping & Nursery	Chichiri

Appendix 3 Urban Household Questionnaire

Interview No.	
Township-Name	
Name – Household	
Household size	
Housing status	
Education	

Food production

1. Do you have a garden here in the city? How big? _____
2. How many bags of maize did you produce this season? _____
3. What did you apply in your garden to improve yields?

This season	Last season	Previous season

(a) If chemical fertiliser was used this season ask-

Type	Bags	Price/bag	Total Cost	Fraction of garden covered
Total				

(b) If compost was used this season ask-

Type	Source	Cost

Composting latrines

4. Have you ever heard of composting latrines? If no, explain/show pictures. _____
5. If the primary school was producing compost from the latrines, would you be willing to buy this compost? If no, why?

6. If yes, how much would you pay for a 50Kg bag? 7. Would you be willing to have a composting latrine? _____

Appendix 4 School Questionnaire

Access to sanitation

Name of school		
Enrolment		
	Pit latrines	Flushing toilets
# of latrines in use		
# of abandoned latrines		

(1) What is your comment about this number of available latrines?

(2) Who mainly cleans the latrines and how often?

Funding for sanitation services

(3) What are the main sources of funding for?

Activity	Source	Ease of access	Reliability
Cleaning?			
Maintenance?			
Building new latrines?			

(4) Do parents contribute to cleaning, maintenance and building costs? How much do they contribute per year?

Composting latrines

(5) Have you ever heard of composting latrines? *If no, explain and show pictures.*

(6) Would you be willing to have composting latrines at the school?

Land for agriculture

	Who is producing?	Land size (M ²)
Maize production		

Private sector participation

(7) What is your comment about private sector participation in building and operating school composting latrines?

Appendix 5 Nursery Questionnaire

Interview No.	
Township-Name	
Name of respondent	
Nature of business	

Production

1. What do you use in the garden to promote growth?

Trees	Flowers	Grass

(a) If chemical fertiliser was used this season ask-

Type	No. bags	Price/bag	Cost/year
<i>Total cost</i>			

(b) If compost was used this season ask-

Type	Source	Cost/year

Attitude about human compost

2. Have you ever heard of composting latrines? If no, explain/show pictures.

3. Would you be willing to buy compost produced in the surrounding schools to use on?

Grass?	Trees?	Flowers?

4. If yes, how much would you pay for a 50Kg bag of compost?

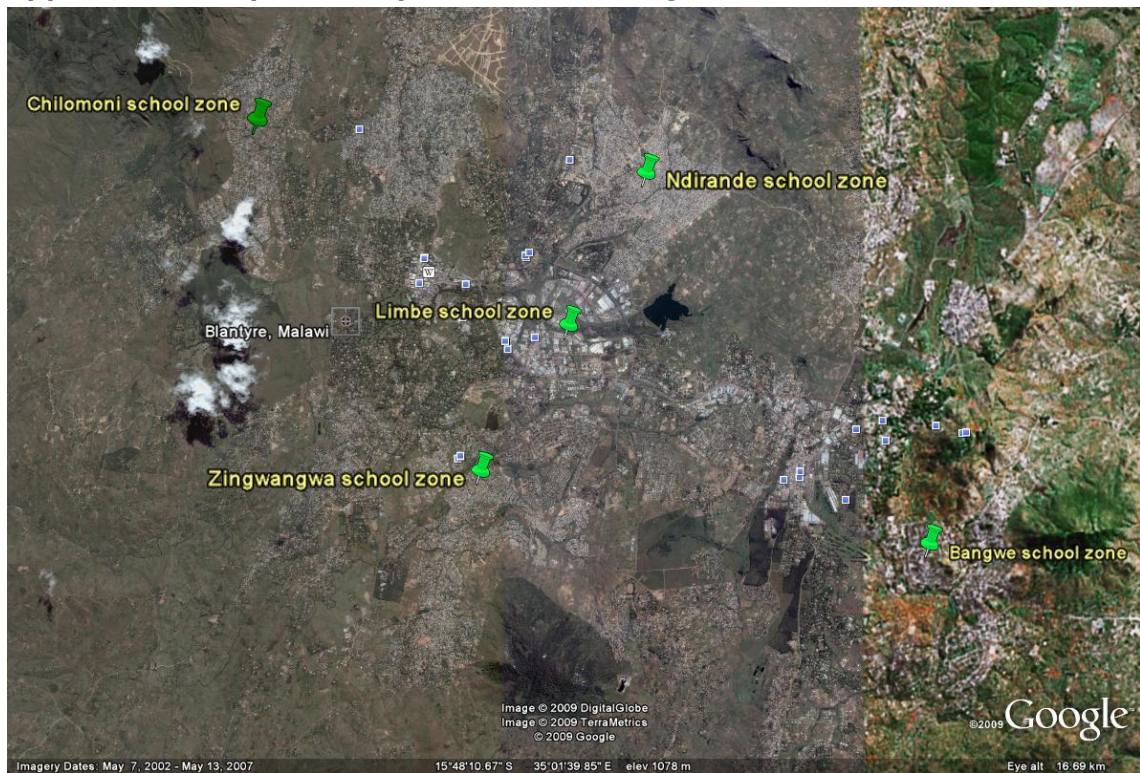
5. What is your comment about the use of this compost?

Grass?	Flowers?	Trees?

Appendix 6 Map showing location of Blantyre urban



Appendix 7b Map of Blantyre urban showing location of school zones



Appendix 8 Formula for calculating Present Value and Net Present Value

$$PV = \frac{FV}{(1+i)^t}$$

Where:

FV = Future value

PV = Present value

I = discount rate

t = year number

$(1+i)^t$ is known as the discount factor

$$NPV = \frac{FV_1}{(1+i)^1} + \frac{FV_2}{(1+i)^2} + \frac{FV_3}{(1+i)^3} + \dots + \frac{FV_n}{(1+i)^n}$$

(NPV is the summation of present values for each year from the beginning of the investment to the last year of investment)

Appendix 9 Investment cost and quantity of human compost

Production and value of compost per year		Assumptions and source of information
	Value	
Average number of pupils per school	2500	Average number of pupils in 40 schools visited
Proportion of pupils regularly defecating	750	(assuming 30% defecate at school per day) (Degrabriele et al, 2004) = 30% X2500
wet mass of faeces per day in (kg)	0.25	0.25 kg per person per day (Niwagaba, 2007)
Dry mass of faeces per day in (kg)	0.05	assuming 20% is dry mass (Niwagaba, 2007)
Total dry mass per day (kg)	37.50	(pupils defecating regularly) X (dry mass per day) = 750 X0.05 = 37.5
Total mass per 9 months (kg)	6750.00	(Total number of school days per year) X (dry mass per day) = 37.5X 180 = 6750
Number of 50 kg bags per year	135.00	6750/50= 135
Money generated per year using average price of compost (MK350) per 50 kg bag	47,250.00	135 X 350
Money generated per year using the most frequently mentioned price mode (MK500 per 50 kg bag)	67,500.00	135 X 500
Investment and operational costs		
initial investment cost for building 16 latrines - Fossa altera	700,000.00	Estimated from the cost of building 2 blocks of VIP latrines with each block having 8 cubicles (Degrabriele et al, 2004)
labour cost per 9 months	27,000.00	based on monthly wages for Blantyre City Assembly toilet cleaners (MK3000/month) -
Materials and transport per year	10,000.00	transport for collecting dry matter (sawdust and soil). Dry matter collected twice in 9 months)

Appendix 10. Net Present Value @ MK350 per 50kg bag

Scenerio 1. (investment cost taken into account in the calculation of NPV)												
		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Initial Investment cost (building)		700,000.00										
Wages for toilet attendant		27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00
Transport		10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
sales from compost sold @ MK350 per 50kg bag		0.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00
Total income		-737,000.00	10,250.00	10,250.00	10,250.00	10,250.00	10,250.00	10,250.00	10,250.00	10,250.00	10,250.00	10,250.00
Net Present Values (NPV)												
Net Present Value @ 8%	-668,222.50	-737,000.00	9,490.48	8,787.33	8,136.45	7,533.75	6,976.15	6,459.55	5,980.88	5,538.08	5,127.05	4,747.80
Net Present Value @ 10%	-674,018.88	-737,000.00	9,318.28	8,470.60	7,700.83	7,000.75	6,364.23	5,786.13	5,260.30	4,781.63	4,347.03	3,951.38
Net Present value @ 12%	-679,085.45	-737,000.00	9,152.23	8,171.30	7,295.95	6,513.88	5,815.85	5,192.65	4,636.08	4,139.98	3,696.15	3,300.50
Scenerio 2. (investment cost not taken into account in the calculation of NPV)												
		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Initial investment cost (building)		0.00										
wages for toilet attendant		27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00
transport		10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
sales from compost sold @ MK350 per 50kg bag		0.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00
Total income		-37,000.00	10,250.00	10,250.00	10,250.00	10,250.00	10,250.00	10,250.00	10,250.00	10,250.00	10,250.00	10,250.00
Net Present Values (NPV)												
Net Present Value @ 8%	31,777.50	-37,000.00	9,490.48	8,787.33	8,136.45	7,533.75	6,976.15	6,459.55	5,980.88	5,538.08	5,127.05	4,747.80
Net Present Value @ 10%	25,981.13	-37,000.00	9,318.28	8,470.60	7,700.83	7,000.75	6,364.23	5,786.13	5,260.30	4,781.63	4,347.03	3,951.38
Net Present value @ 12%	20,914.55	-37,000.00	9,152.23	8,171.30	7,295.95	6,513.88	5,815.85	5,192.65	4,636.08	4,139.98	3,696.15	3,300.50
Scenerio 3. (investment cost and wages of toilet attendant not taken into account in the calculation of NPV)												
		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Initial investment cost (building)		0.00										
wages for toilet attendant		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
transport		10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
sales from compost sold @ MK350 per 50kg bag		0.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00	47,250.00
Total income		-10,000.00	37,250.00	37,250.00	37,250.00	37,250.00	37,250.00	37,250.00	37,250.00	37,250.00	37,250.00	37,250.00
Net Present Value @ 8%	239,947.50	-10,000.00	34,489.78	31,934.43	29,569.05	27,378.75	25,352.35	23,474.95	21,735.38	20,126.18	18,632.45	17,254.20
Net Present Value @ 10%	218,882.63	-10,000.00	33,863.98	30,783.40	27,985.93	25,441.75	23,128.53	21,027.63	19,116.70	17,377.13	15,797.73	14,359.88
Net Present value @ 12%	200,469.95	-10,000.00	33,260.53	29,695.70	26,514.55	23,672.38	21,135.65	18,870.85	16,848.18	15,045.28	13,432.35	11,994.50

Appendix 11 Net Present Value @ MK500 per 50 kg bag of human compost

Scenario 1. (investment cost taken into account in the calculation of NPV)											
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Initial Investment cost (building)	700,000.00										
Wages for toilet attendant	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00
Transport	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
sales from compost sold @ MK350 per 50kg bag		67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00
Total income	-737,000.00	30,500.00	30,500.00	30,500.00	30,500.00	30,500.00	30,500.00	30,500.00	30,500.00	30,500.00	30,500.00
Net Present Values (NPV)											
Net Present Value @ 8%	-532,345.00	-737,000.00	28,239.95	26,147.65	24,210.90	22,417.50	20,758.30	19,221.10	17,796.75	16,479.15	15,256.10
Net Present Value @ 10%	-549,592.75	-737,000.00	27,727.55	25,205.20	22,914.65	20,831.50	18,937.45	17,217.25	15,652.60	14,228.25	12,935.05
Net Present value @ 12%	-564,668.90	-737,000.00	27,233.45	24,314.60	21,709.90	19,382.75	17,305.70	15,451.30	13,795.15	12,318.95	10,998.30
Scenario 2. (investment cost not taken into account in the calculation of NPV)											
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Initial investment cost (building)	0.00										
wages for toilet attendant	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00
transport	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
sales from compost sold @ MK350 per 50kg bag	0.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00
Total income	-37,000.00	30,500.00	30,500.00	30,500.00	30,500.00	30,500.00	30,500.00	30,500.00	30,500.00	30,500.00	30,500.00
Net Present Values (NPV)											
Net Present Value @ 8%	167,655.00	-37,000.00	28,239.95	26,147.65	24,210.90	22,417.50	20,758.30	19,221.10	17,796.75	16,479.15	15,256.10
Net Present Value @ 10%	150,407.25	-37,000.00	27,727.55	25,205.20	22,914.65	20,831.50	18,937.45	17,217.25	15,652.60	14,228.25	12,935.05
Net Present value @ 12%	135,331.10	-37,000.00	27,233.45	24,314.60	21,709.90	19,382.75	17,305.70	15,451.30	13,795.15	12,318.95	10,998.30
Scenario 3. (investment cost and wages of toilet attendant not taken into account in the calculation of NPV)											
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Initial investment cost (building)	0.00										
wages for toilet attendant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
transport	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
sales from compost sold @ MK350 per 50kg bag	0.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00	67,500.00
Total income	-10,000.00	57,500.00	57,500.00	57,500.00	57,500.00	57,500.00	57,500.00	57,500.00	57,500.00	57,500.00	57,500.00
Net Present Value @ 8%	375,825.00	-10,000.00	53,239.25	49,294.75	45,643.50	42,262.50	39,134.50	36,236.50	33,551.25	31,067.25	28,761.50
Net Present Value @ 10%	343,308.75	-10,000.00	52,273.25	47,518.00	43,199.75	39,272.50	35,701.75	32,458.75	29,509.00	26,823.75	24,385.75
Net Present value @ 12%	314,886.50	-10,000.00	51,341.75	45,839.00	40,928.50	36,541.25	32,625.50	29,129.50	26,007.25	23,224.25	20,734.50