TAMK UNIVERSITY OF APPLIED SCIENCE
Environmental Engineering

Final Thesis

Yang Chenxi

PROMOTING ECO-DRY TOILET USE IN RURAL AREA OF KUNMING MUNICIPALITY

Supervisor Senior Lecturer Eeva-Liisa Viskari
Commissioned by TAMK University of Applied Science
Kunming Institute of Environmental Science

Tampere 2008

TAMK University of Applied Science
Environmental Engineering

Yang Chenxi	Promoting eco-dry toilet use in rural area of Kunming Municipality
Final Thesis	40 pages and 18 pages appendices
Supervisor	Senior Lecturer Eeva-Liisa Viskari
Commissioned by	TAMK University of Applied Science Kunming Institute of Environmental Science
March 2008	
Keywords	Eco-Dry Toilet, Popularization, Construction, Rural Area, Education, Eco-Sanitation System, Kunming Municipality, Dian Lake drainage basin

ABSTRACT

For drinking water source protection and prevention of pollution of Dian Lake, the government of Kunming municipality decided to build 100000 private eco-dry toilets in rural area starting in 2005 and each level of government has been advocating this popularization project. By the year 2007, 60000 eco-dry toilets had been built. However, after construction such dry toilets were found to be seldomly utilized in reality, nearly 90% toilets remained unused, therefore a project was formed to go over the problem and find the solution.

After the visit of several villages in Kunming municipality and some interviews with the villagers, we found out the reasons for such low usage rate. A village was selected for an experimental unit in order to promote the utilization by solving the problems of the dry toilets. Thirteen families were chosen in Shu Jie Village, A Ziying Town in Song Ming County, and those 13 dry toilets represented the

problems in general. A fixing plan was made according to the problems, fixing team of 7 persons was assigned to fix the dry toilets, give instructions on usage, offer technical information and conduct feedback research.

Through investigation and dry toilet repairing, the solution has been provided by the fixing team. But the technical problem is subject to further improvement.

LIST OF ABBREVIATIONS

Organizations

KIES	Kunming Institute of Environmental Science
TAMK	TAMK University of Applied Science

Technologies

EDT	Eco-Dry Toilet (Private)
ODT	Old Dry Toilet (Traditional Dry Toilet)

Currency

100RMB	~ 10EUR (€)

TABLE OF CONTENTS

FOREWORD

During this Project I got a lot of help - such as technical support, project operation support and final thesis work - so I would like to express my gratitude to the following people:

Kunming Municipality Environmental Protection Bureau:
Mr. Gao Zhigan (Secretary of the Communist party committee)
Kunming Municipality Eco-Dry Toilet Office:
Mr. Fan Yi
Ms. Duan Lianping
Kunming Institute of Environmental Science (KIES):
Mr. Zhi Guoqiang (Director of Ecological Center)
Mr. Liu Shuzhi (Vice- director of Ecological Center)
Mr. Pu Limin (Senior Environmental Engineer)
Mr. Zhou Dekun (Senior Environmental Engineer)
Mr. Yang Hongfu (Project Manager)
A Ziying Environmental Protection Station (Song Ming County)
Mr. Li Qingbo (Superintendent)
Tampere Polytechnic (TAMK), Environmental Engineering (FINLAND)
Ms. Marjukka Dyer (Head of Environmental Engineering)
Ms. Eeva-Liisa Viskari (Senior Lecturer in Environmental Engineering)
Ms. Cuihong Jin-Muranen (Project Coordinator)
Kunming University of Technology, (College of Environmental Science)
Mr. Zhang Dehua (Vice-Secretary of the Communist party committee)
Mr. Tian Senlin (Head of College of Environmental Science)
And 6 Second year Students in college of Environmental science
(Yang Zhi, Yang Caijie, Xiao Wei, Liu Shihua, Sun Jing and Sun Lu)
Especially thanks my partner:
Miss. Ma Wenting (TAMK)
Mr. Miikka Ristkari (TAMK)

The readers of this final thesis should also check the final thesis of Miikka Ristkari, titled *"Sanitation in Rural China: Waste Management and Hygiene Management in Kunming Municipality, Yunnan Province"*, and the final thesis of Ma Wenting, titled *"The Kunming Dianchi Lake basin rural area dry toilet utilization situation survey and study"*.

Tampere March 2008
Yang Chenxi

1. INTRODUCTION

1.1 The Situation of Eco-dry Toilet in Kunming Municipality

The primary intention of Kunming government was environmental protection and pollution prevention of Dian Lake and controlling the non-point sources of pollution in Dian Lake drainage basin. There are about 0.7million people, 400km^2 farmland and 0.1 million livestock in Dian Lake area. The rural non-point source pollution in Dian Lake pollution accounts for 40% of the total nutrient load, and also 20% pollution because of old toilets (Figure 1-1).

Figure 1-1 Old Toilet (Traditional Dry Toilet)

In 2002, KIES engineer got the eco-dry toilet technology from Guang Xi province. Zhong He village was chosen from 3 villages as the tested to see how new toilets are working. After six months, the testing was successful.

In 2005, the government of Kunming municipality started to popularize a new toilet—Eco-dry toilet in the whole rural area of the municipality. Till the end of 2006, 66000 Eco-dry toilets were built in rural area of Kunming municipality. However, the user percentage of the new toilets remained quite low.

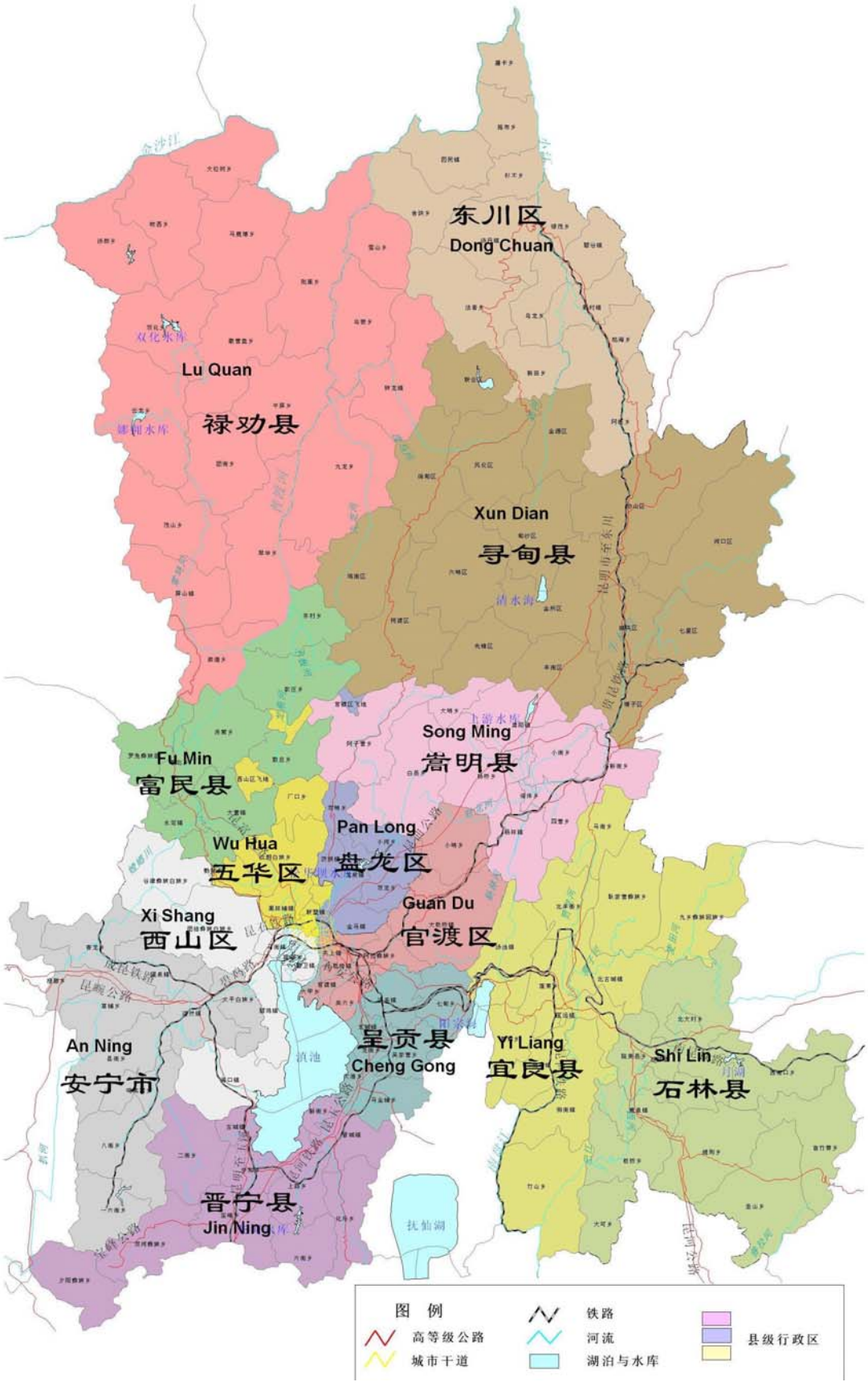


Figure 1-2 Map of Kunming Municipality [6]

1.2 The Amount and Distribution of Eco-Dry Toilet in Kunming

From 2005 to 2006, the private dry toilets constructed totaled 53806 in rural area, and public dry toilets constructed totaled 215. In the beginning of 2007 the construction project was stopped by the government, because the new toilet usage was too low.

Table 1-1 Amounts of private dry toilets in Kunming Municipality (Stat. 2007)

County (District)	Amount of dry toilet
Shi Lin	255
Jin Ning	9011
Guan Du	19423
Yi Liang	798
Song Ming (*Sample County*)	10283
Wu Hua	1200
Cheng Gong	1966
Dong Chuan	665
An Ning	300
Lu Quan	5309
Xi Shan	2375
Pan Long	2221
Total	**53806**

The government focused on private toilet construction in this popularization project. The public dry toilet construction is a supplement, only for few towns which are located in the Dian lake region. Please see table 1-2.

Table 1-2 Amounts of public dry toilets in Kunming Municipality

Town (District)	Amount of public dry toilet
Xun Dian	2
Xi Shang	11
Song Ming	70
Guan Du	132
Total	**215**

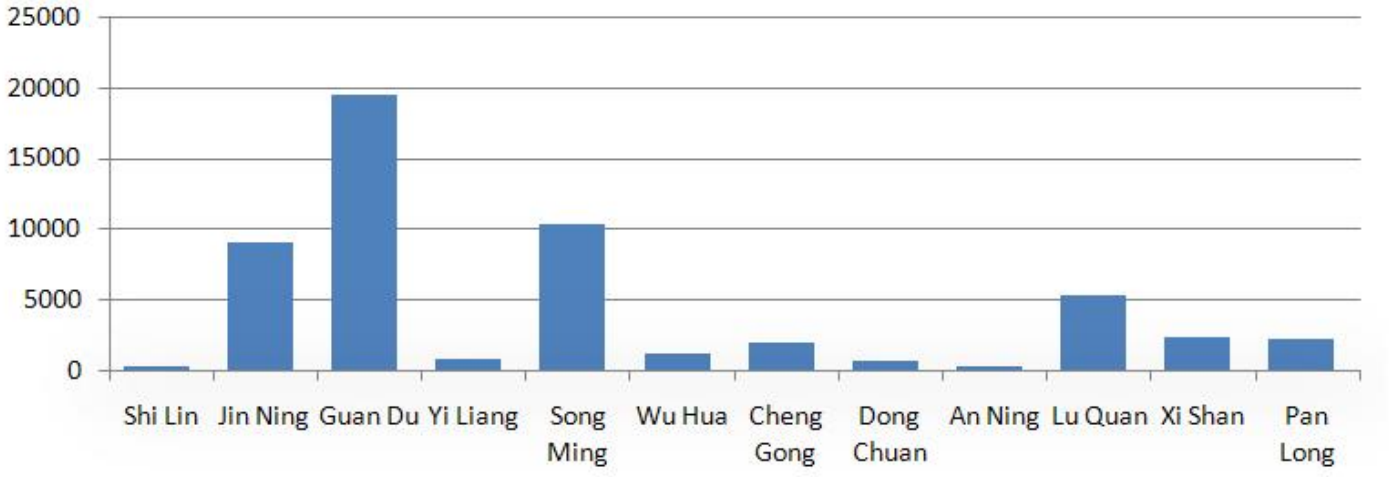


Figure 1-3 the distribution of dry toilet in Kunming Municipality

The Jin Ning County, the Guan Du District and the Song Ming County belong to Dian Lake drainage basin (Figure 1-4). That is why most dry toilets were built in those counties and districts in Kunming Municipality.

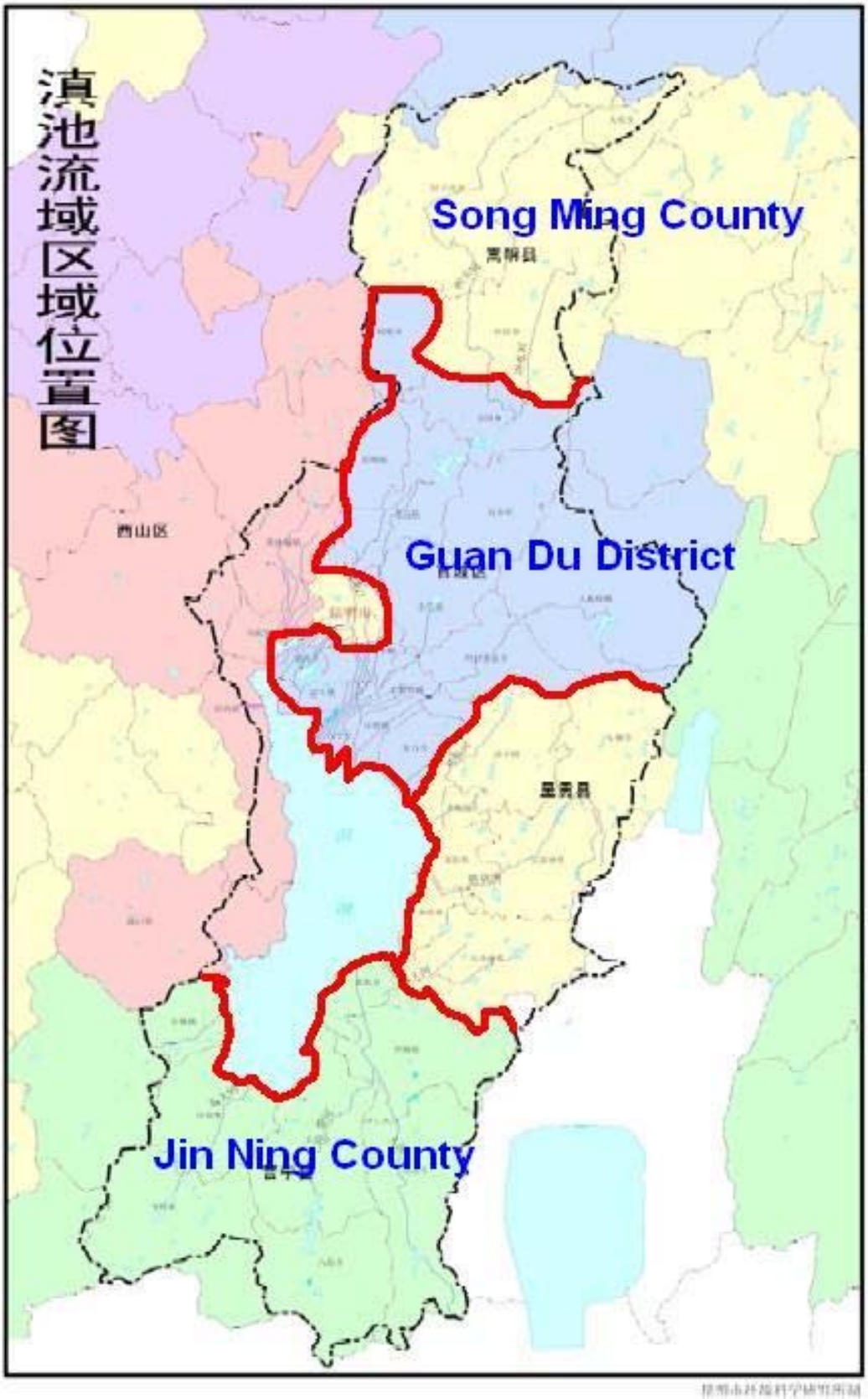


Figure 1-4 Map of Dian Lake Drainage Basin [6]

1.3 The types of Eco-Dry Toilet in popularization project

There are two types of private dry toilets in this popularization project. One is made of plastic and wooden board, it can be move easily and allows quick installation, but the superstructure is weak. The cost is about 1200RMB ~1500RMB, it's only used primarily in Jing Ning county (Figure 1-5). And another model is made form concrete and brick. It's hard but not easy to construct. The cost is about 800RMB ~1000RMB (Figure 1-6).

Figure 1-5 Transferable EDT

Figure 1-6 Normal EDT

During field visits in Guan Du district and found a nice public dry toilet, the cost

of which was about 100’000RMB (Figure 1-9).

The Principle of Normal Eco-Dry Toilet

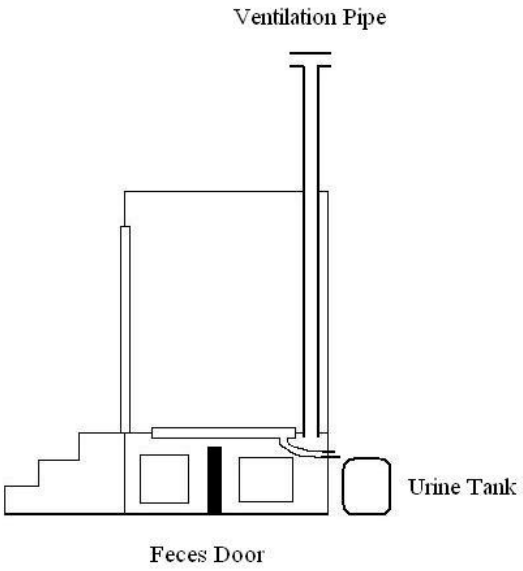


Figure 1-7 Section show of Normal EDT

As figure 1-7 shows, there are two faeces rooms under the urine-separating pan. When one faeces room is almost full, the pan is turned to use the other one. The urine tank lies outside. Urine pipe leads the urine to a container.

The Principle of Normal Eco-Dry Toilet

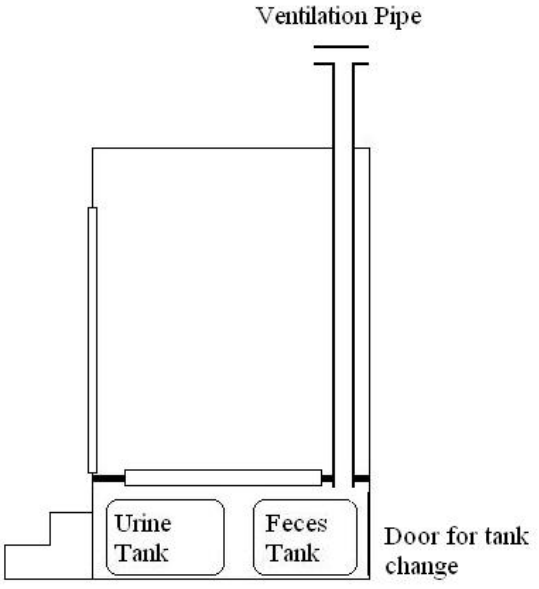


Figure 1-8 Section show of Transferable EDT

As figure 1-8 shows, there are two tanks in the base of EDT, one tank is for faeces collection and another is for urine collection. There is a small door in front of the toilet for tank changing and cleaning of the EDT.

Figure 1-9 Public Eco-Dry Toilet (Photo by Miikka Ristkari in Guan Du district)

1.4 The Promoting Eco-Dry Toilet Use Project Background and Aim

This project aimed at repairing some Eco-dry toilets for villager free of charge, to educate village people how to use the EDT, and to improve the number of EDT users. This repair project, tried to find the way or method to solve the problem of low user percentage.

There are five types of situation in villager families.

1. They have no private eco-dry toilet at home and they use traditional toilet
2. They have no private eco-dry toilet but use public eco-dry toilet and traditional toilet
3. They have private eco-dry toilet at home, but never use it
4. They have private eco-dry toilet, but they only used it for a short time, then stopped using
5. They have private eco-dry toilet, and use it very well;

- **The main focuses of this project were on types 3 and 4. Because those families have private eco-dry toilet, but they don't use it because of certain reasons. After repairing, they were to use the toilet and their experiences were to be monitored.**
- The second focus was on types 1 and 2. Aim: have them use the eco-dry toilet through education.
- The third focus was on type 5. Sampling was to be done from their eco-dry toilets and monitor them. (However, some problems occurred with the monitoring person and monitoring equipment, the work is be delayed)

1.5 Introduction the Project Sample Sites

According to Table 1-1, it can be seen that in 2005 and 2006, the bigger amounts of constructed new toilets were at Guan Du district (19423 units) and Song Ming County (10283 units). The main area of Guan Du district belongs to Dian Lake region. The western half of Song Ming County is not only in the Dian Lake region, but is also an important drinking water source (Song Hua reservoir region), and there are two rivers (Mu Yang river and Leng Shui river) in A Ziying Town in Song Ming County, which are going to Dian Lake. The Song Ming County is generally mountainous region.

Song Ming County [5]

Song Ming County is located in the north-east part of Kunming city and the capital is Song Yang town, which is 43 km away from Kunming city. The area is 1442 km^2 and the population is 340'000 total. Song Ming County governs 7 towns. In 2005 and 2006 built private eco-dry toilets 10283 total, and public eco-dry toilets 70 total. The details of toilet distribution in Song Ming County are in table 1-3.

Table 1-3. The amount of Eco-dry toilet constructed in Song Ming County (Stat. in 2007)

A Ziying Town (Village Group)	**2005**	**2006**	**Dian Yuan Town (Village Group)**	**2005**	**2006**
A Dalong	120	132	Nan Jieying	200	
Zhe Na	**116**	**167**	Bai Se	279	
Yan Fengshao	85		**Tuan Jie**	**241**	**89**
Duo Ge	130		Tuo Zhe	191	83
Da Zhuyuan	190		Cai Zi	137	65
Hou Jiaying	**223**	**160**	Jin Zhong	74	59
Nan Ying	166		San Zhuanwan	173	60
Ma Jun	213	300	Dian Wei	147	23
Da Shao	391		**Nan Ying**	**184**	**95**
Yang Jie	205	258	Lao Ba	113	11
Shu Jia (*Sample village*)	**280**	**320**	**Mai Dichong**	**109**	**90**
Dian Tou	101	130	**Qian Suo**	**270**	**359**
Tie Chong	250	303	Bai Yi	92	215
Mu Yang	**280**	**300**	Zhou Da	168	110
A Ziying	293	282	Zhong Suo	225	112
			Su Hai		212
			Xiao Yun		101
			Lao Baizi		52
			Zhu Qingkou	219	
			Zhuan Yuan	330	
Total	**5395**		**Total**	**4888**	

A Ziying Town [information from office of A Ziying town]

A Ziying town belongs to Song Hua reservoir region and part of northwest in Song Ming County. The area of town is 242.4km^2, average temperature is 12.7℃, and the Forest coverage is 62.8%. A Ziying town has 14 village groups and 102 natural villages, and its population is 31390 in total.

Shu Jie Village Group [information from office of Shu Jie village]

It is south part of A Ziying town, governing 10 nature villages, and the population is 3434 (905 families). Total area is 10.8km^2 and the farmland area is 2.43km^2. The Shu jie river (length: 12.5km) passes through Shu Jie village group, which is a main branch of Mu Yang River.

Table 1-4. The types and area of farmland in Shu Jie Village Group

Type of Farmland	Land field	Paddy field	Land	dry land	Irrigable land
Area (km^2)	1.43	1.37	1	0.44	0.57

Table 1-5 The amount of fertilizer consumed by year in Shu Jie Village Group

Type of Fertilizer	N Fertilizer	P Fertilizer	K Fertilizer	Composite Fertilizer
Annual consumed (ton)	224500	30900	20300	73100

The information of Luo Jiaying Village, Gu Cheng Village and Long Jia Village

Table 1-6 The Data about Luo Jiaying Village, Gu Cheng Village and Long Jia Village

Data	Luo Jiaying	Gu Cheng	Long Jia
Total Families	108	129	116
Population	401	449	493
Farmland Area (km^2)	0.28	0.34	0.33
Number of using Solar Energy families	3	7	16
Number of using Bio-gas families	1	-	1
Eco-dry toilets families	102	120	10
Annual per capita income (RMB)	1500～2000	945～1500	945～1500
Crop cultivation occupy in income	Over 70%	Over 70%	Over 70%
Stockbreeding occupy in income	Under 20%	Under 20%	Under 20%

2. THE PROJECT METHODS

The method of the “promoting EDT use” project is presented in figure 2-2. The principle of the method was as follows:

Step 1: Choose the sample village for EDT repairing study.

Step 2: Choose the villagers who want to accept fixing planning with questionnaire (Appendix 4). Note the problem of EDT in details.

Step 4: Make solution plan according to problem.

Step5: Fieldwork- Fixing the EDT in village.

Step6: Feedback with questionnaire (Appendix 5) two weeks after fixing work had been finished.

2.1 The Conditions of sampling villages for Toilet Repairing

Agriculture village

The correct use of Eco-dry toilet and handling of the faeces and urine can produce fertilizer for agriculture that can increase crop yield. The villagers can easily accept this.

The mountain area

Normally the mountain villages are poorer than other places, because of remote distances and poor roads. The pathogens flourish easily in traditional toilets. The cost of health care is too much for poor villager’s family. The Eco-dry toilet can stop pathogen growth when ash is used as cover material and when the toilet is managed. For saving the cost of health, the villagers also can accept the new eco-dry toilet.

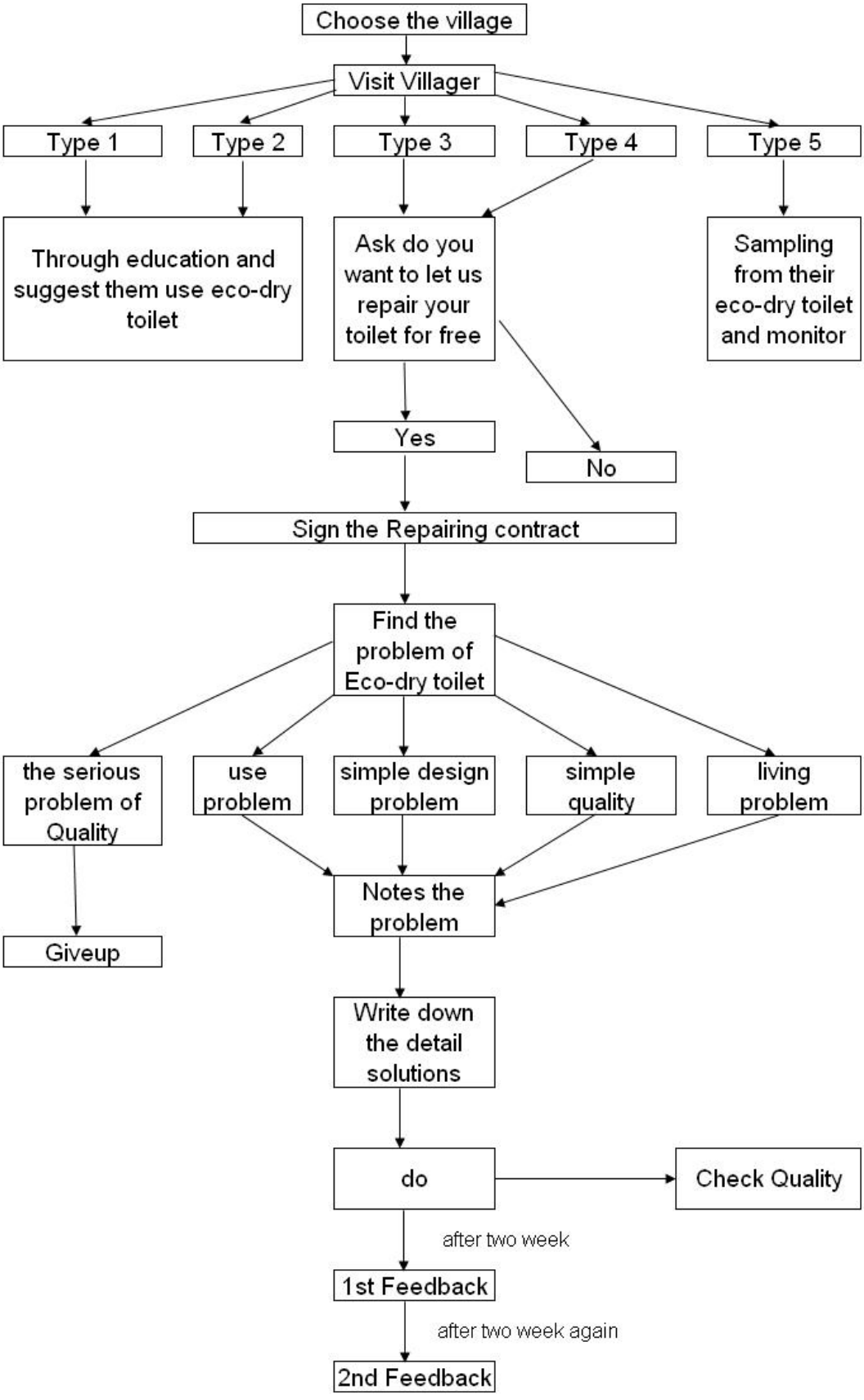


Figure 2-2 The Flow Chart of Project Method

Protection and saving water resources

The people normally use the groundwater. The traditional toilet is the most important pollution source to groundwater. The eco-dry toilet does not only protect groundwater, but can also save water. After education the people's attitude for using the eco-dry toilet will hopefully change.

Figure 2-1 The Well in the village

Cooperative village leader

Cooperation with village leader was needed, because large part of the work is communicating with villagers. Help from village management was needed in this repairing project.

Low usage percentage

The owner’s rate of private eco-dry toilet is about 60%. The user rate is only about 10%. Aim was to improve the post-project user rate to 30% ~ 50%.

According to those conditions, the Song Ming county Shu Jie village was chosen as the study area.

2.2 Project Time Schedule

The promoting EDT use project started from 17th of July to 10th of August. Time schedule is presented in table 2-1

Table 2-1 Project time schedule

Week	Mo	Tu	We	Th	Fr	Sa	Su
July	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
August	30	31	1	2	3	4	5
	6	**7**	**8**	**9**	**10**	11	12

The date of survey work is in purple, the date of meeting and statistic work is in green, the date in black is office work, the date of site-working is in blue, red date means day-off.

2.3 Survey work on study area

2.3.1 Project team organized

6 students were organized to join this project. They are second-year students from School of Environmental in Science Kunming University of Technology. They mainly conduct the survey work and report the problems of villagers.

Table 2-2 The List of Project Members

Name	Contact Phone No.	Department
Yang Chenxi	**13759133027**	KIES & TAMK
Liu Shihua	15987111393	Kunming University of Technology
Xiao Wei	15925177936	Kunming University of Technology
Yang Caijie	15925151995	Kunming University of Technology
Sun Lu	15925228637	Kunming University of Technology
Yang Zhi	15925188704	Kunming University of Technology
Sun Jing	13888208403	Kunming University of Technology

2.3.2 Survey on Study area

The survey working on-site took place on 17th, 18th, 25th and 26th of July.

On 17th and 18th of July, We visited 8 village groups with questionnaire (Appendix 4). Those were: Shu Jie Village group, Mu Yang Village group, Hou Jiaying Village group and Zhe Na Village group in A Ziying Town. Tuan Jie Village group, Nan Ying Village group, Mai Dichong Village group and Qian Suo Village group in Dian Yuan Town. (Those are marked in Appendix 2)

On 25th and 26th of July, 3 village groups were visited (5 nature villages) in A Ziying town. 3 nature villages were chosen for fixing eco-dry toilet testing place, those are Luo Jiaying Village, Long Jia Village and Gu Cheng Village and both of them are included in Shu Jie Village groups.

3. RESULTS AND SOLUTION PLAN

3.1 Survey Results

Figure 3-1 shows what problems occurred with Eco-dry toilet use. Most users think the faeces door is difficult to open and close. The old door is made of plastic, long exposure to sunlight weakens the plastic and makes it easy to break. During visits to the village the inhabitants told that there is bad smell in the new toilets, because ventilation pipes are too short.

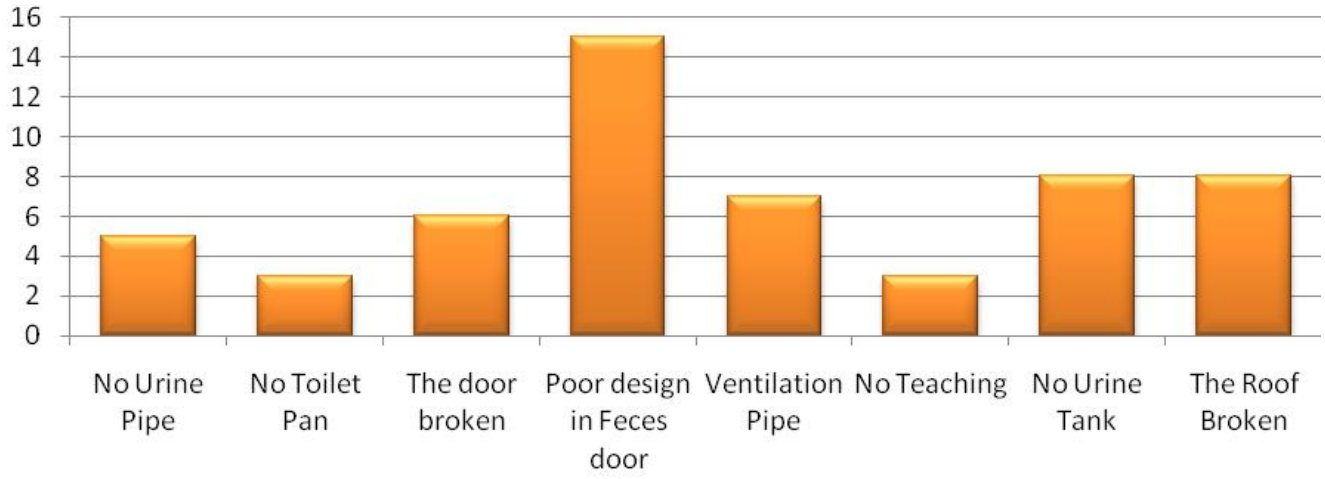


Figure 3-1 The Problems of Eco-dry Toilet in Shu Jie village group

3.2 Reasons for not using the EDT

- Bad impression

  The villager hear of other people said the eco-dry toilet is bad, so them never used it, or stopped using it.

- Simultaneous use of traditional toilet

  Some villager's families both have traditional toilet and eco-dry toilet. According to Chinese traditional custom, people don't want to use new one, if old one is

present. Also if people don't like the new toilet, they will still use old one. So, the traditional toilet existence has very tremendous impact on the usage of eco-toilet.

Figure 3-2 Old and New Toilet

- Poor quality of the toilet construction

  The problem is from construction quality and inner quality problems that can affect usage or can be so serious that they prohibit it the usage of the toilet

Figure 3-3 Bad Construction Quality

- Use is against living customs

  Some people do not like toilet inside the home and beside kitchen or living room. Also has some reasons about Chinese fengshui.

Define these living customs (fengshui etc.)

- Wrong location

  The construction team didn't communicate with inhabitants before building eco-toilet. They build it on the roof, the user found it difficult to use and difficult to empty and hard to clean. (Figure 3-4)

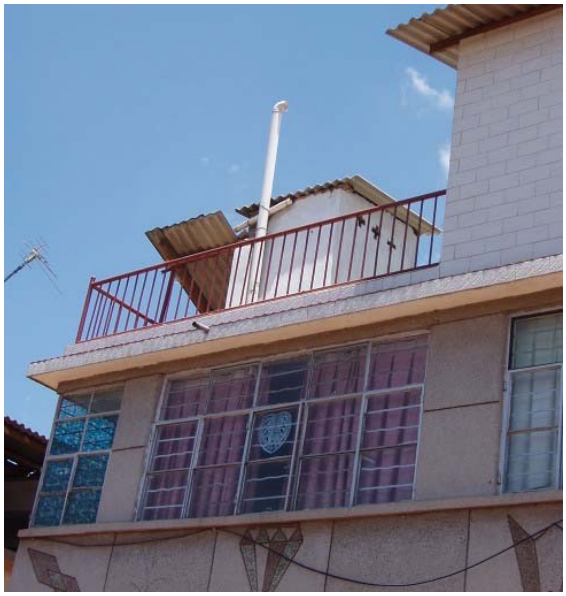


Figure 3-4 EDT was built on the roof

- Inconvenient to use

  Define situations where the toilet could be inconvenient: old people, toilet is too high, or handicapped can't access it easily, rain can make ground wet in front of it and so on (toilet is too far also)

- Bad smell

  The bad smell from toilet for three reasons:

  - Wrong usage, the excreta and urine become mixed; water enters the excreta when cleaning.
  - Poor workmanship, the ventilation pipe is not high enough, cannot take away the bad smell from the faeces room; or ventilation pipe is not straight.

Figure 3-5 Short Ventilation pipe

Figure 3-6 Ventilation pipe turning

- Poor construction quality and technology

  Urine pipe is of poor quality, shorter than standard, door opens the wrong way, ventilation pipe is shorter than standard, there is no fly screen, no light in side and construction team is not skilled in construction et cetera.

Figure 3-7 Poor construction quality or unprofessional construction (Photo by Ma Wenting)

- Difficult to clean

  The faeces emptying hole is too small or the distance is too short between emptying holes and opposite wall.

After statistic work we selected 13 users for testing of fixing eco-dry toilets in Shu Jie Village group. The list of 13 users is in Appendix.3

3.3 Solutions

- Removing traditional toilet

  One month after repairing eco-toilet and after education and negotiation and villager's family using the toilet very well, we helped to remove traditional toilet.

- Inspect toilet for possible simple repairs depending on the situation

  Those quality problems that could be fixed easily were examined. For example, the door opening in the wrong way, the ventilation pipe being too low and so on. But in cases of wrong location or more serious problems of masonry that were too big problems to repair the toilets were left out of the study.

The table 3-1 is presented solutions for fixing EDT

Table 3-1 The problems and solutions of private eco-dry toilet.

Problems	Solution
Never tried because of bad impression	Education
Also has traditional toilet	After education and negotiation, help to removing old one
Can’t use because of quality	Inspect toilet for possible easy repairs
Against living customs	Education
Wrong location, can't use	Cannot change anything
Inconvenience	Education
Bad smell	Searching reason and improve (Add ventilation pipe higher)
Wrong way to clean	Teach the right way to clean
Difficult to clean feces room	Remake feces door, Teach the way to clean

4. FIXED TOILETS AND INNOVATION

4.1 Fixed EDT on-site

On 7th, 8th, 9th and 10th of August we were in Shu jie village group and started fixing the toilets. At first, I sent two people to transport the materials for each user (Appendix 2). The others visited village leader, and found two workmen fixing the toilet. I divided them into two groups, 3 persons each group. Two groups could change to be supervisor in morning and afternoon.

4.2 Fixed EDT Before and After

Ventilation pipe

Ventilation pipe was extended to ease up the smelling problem. The figure 4-1 was taken in *Yang Jiashou' home*.

Figure 4-1 Ventilation Pipe Before and After Fixing

In this case, the ventilation pipe was blocked by roof eave a little bit. If construction team have considered the eave and changed the location of ventilation pipe, it would be better now.

Change of a plastic door to an iron door

The iron door of toilet was used in 2005, but in 2006 the construction project changed to plastic door, because of budget savings. The plastic was weak after a long time in sunlight. We found out that a lot of plastic doors were broken when we were in the village. After we heard complaints from village people about failure to use the dry toilet because of no door, we decided to fix it. The figure 4- was taken in *Yang De's home*.

Figure 4-2 Change of the Door From Plastic To Iron

Feces door redesign

As I wrote before poor design is the problem in faeces door. In this fixing project, we tried to remake the new faeces door for all of them. Figure 4-3, which was taken in *Du Yongen's home*, shows the new doors.

Figure 4-3 New Design of the Feces Door

Add fly net to the ventilation pipe

The fly net is a key part in the ventilation system of dry toilet. Unfortunately, construction team missed the part in all dry toilets. In figure 4-4 the worker is adding fly net to ventilation system. (in Zou Xian's home)

Figure 4-4 Adding Fly Net Between Ventilation Pipe And Ventilation Head

Fly net can keep flies or other bug from entering the toilet through the ventilation pipe. It's necessary to add the net at the end of the ventilation pipe.

4.3 Innovation in Feces door

In this repair project I got lots of help, so I got some new ideas for toilet design and aim to make it more optimized and more humane. I hope that more users can accept this new toilet.

There are two types of feces door in Dry toilet, one is iron door (Fig 4-5) and another is porcelain door (Fig 4-6). The advantages of iron feces door is easy installation, easy to open, and clean. But iron is also easy to become rusty and weak after long time exposure outdoors. The porcelain will not become weak but be easy to break and more difficult to open and close.

Figure 4-5 Old Feces Door (Iron)

Figure 4-6 Old Feces Door (Porcelain)

The New Design is using the porcelain plate (30×30cm) and stainless steel channel. As Figure 4-7 and Figure 4-8 show. If user should empty feces room, they would put the porcelain sheet up. It's not only easy to open without breaking porcelain plate, but also last longer and do not break easily.

Figure 4-7 New Design Feces Door

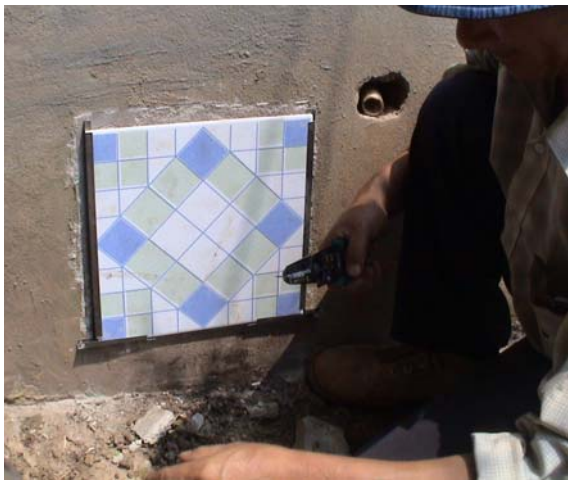


Figure 4-8 Remake New Feces Door

5. FEEDBACK AND BUDGET

5.1 Fixed EDT Feedback

After four weeks of fixing toilet project, we came back to Shu jie village for feedback surveying. 7 users started to use fixed dry toilet and gave positive comments about the eco-dry toilet. 4 users didn't use the fixed toilet yet. They have same reason: they used dry toilet for storing room before fixing, but didn't empty and clean the dry toilet after fixed, because of being busy in farming. But they promised to use dry toilet after cultivation time. July and August are farming season.

Table 5-1 Result of feedback in fixed toilets

	Name	Address	Comments
Start to use	Jiang Qinying	Luo Jiaying Village	Good, would like to use
	Zou Xian	Luo Jiaying Village	Good, would like to use
	Zou Jiande	Luo Jiaying Village	Good, would like to use
	Du Yongen	Luo Jiaying Village	Good, would like to use
	Yang Jiashou	Luo Jiaying Village	Good, would like to use
	Wang Jiaxue	Luo Jiaying Village	Good, would like to use
	Sun Baojian	Long Gong Village	Good, would like to use
Not yet	Li Jiankun	Gu Cheng Village	No time to clean toilet, because of farming work
	Li Yanwei	Gu Cheng Village	
	Li Wenyun	Gu Cheng Village	
	Yang De	Luo Jiaying Village	
N/G	Li Wenzhong	Gu Cheng Village	Not at home
	Du Tao	Luo Jiaying Village	Not at home

According to table 5-1, the reuse percentage is 53.8%, the nonuse percentage is 30.8%. Two users were not at home, so we could not ask about the use of toilet.

5.2 Project Budget

Total of 7 people worked in this fixing toilet project for about one month. **5000RMB** was spent totally. About 2000RMB was spent in transportation, about 2000 spent for living cost in village and 1000RMB for material cost.

Table 5-2 The price list of material

Material	Amount	Price (RMB)	Total (RMB)
clip of urine pipe	5	1	5
urine pipe	5	4	20
toilet pan	7	-	-
iron door	4	90	360
porcelain plate	25	1.5	37
ventilation pipe	4	20	80
aluminous channel	1	10	10
nail	1	8	8
fine iron net	1	5	5
glue water	2	3	6
urine tank	8	6	48
pipe connection	6	3	18
T type of head of pipe	5	5	25
concrete	1	12	12
labor	3	100	300
asbestic tile	5	10	50
SUM (RMB)	**984**		

6. DISCUSSION

6.1 General

In 2005 and 2006, the Kunming municipality government operated for building Eco-dry toilets in rural area, aiming to improve living quality of rural inhabitants and the Dian Lake protection. It has constructed about 60000 private eco-dry toilets, however this project was failed because of only less than 10% of people used the new toilet.

Although this project popularization failed, it still very influential in Kunming municipality. The rural areas villagers start to know and accept new technology, start to seek advanced technology and start to improve living quality. And also government begins to develop eco-industry in rural area.

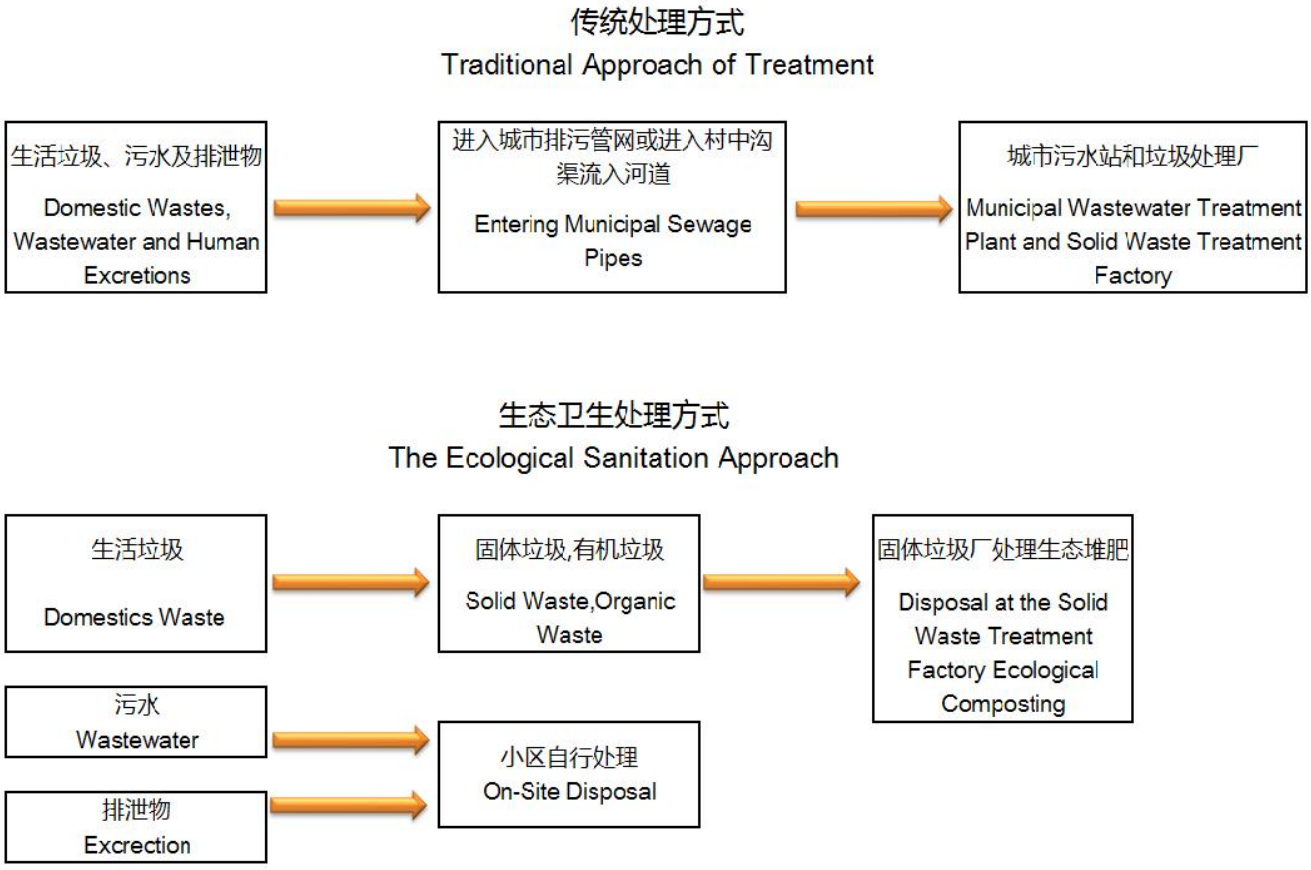


Figure 6-1 Two kinds of treatment approaches in sanitation (Yang Chenxi made)

Nowadays, the traditional approach of excreta treatment is still dominant in Chinese rural area. And recently Chinese government has taken some new concept of treatment for villages from other developed countries. At present traditional approach of excreta treatment is still used in rural areas and also in the suburbs of cities. According to the flow chart, we can see the treatment is too simplified. With development of urban and rural areas, more and more waste is produced, the traditional approach has been unable to treat huge amount of waste that is from urban and rural areas. That is why Chinese government starts to use the ecological sanitation approach in both urban and rural areas for excreta treatment.

6.2 Eco-Sanitation System in Rural Area

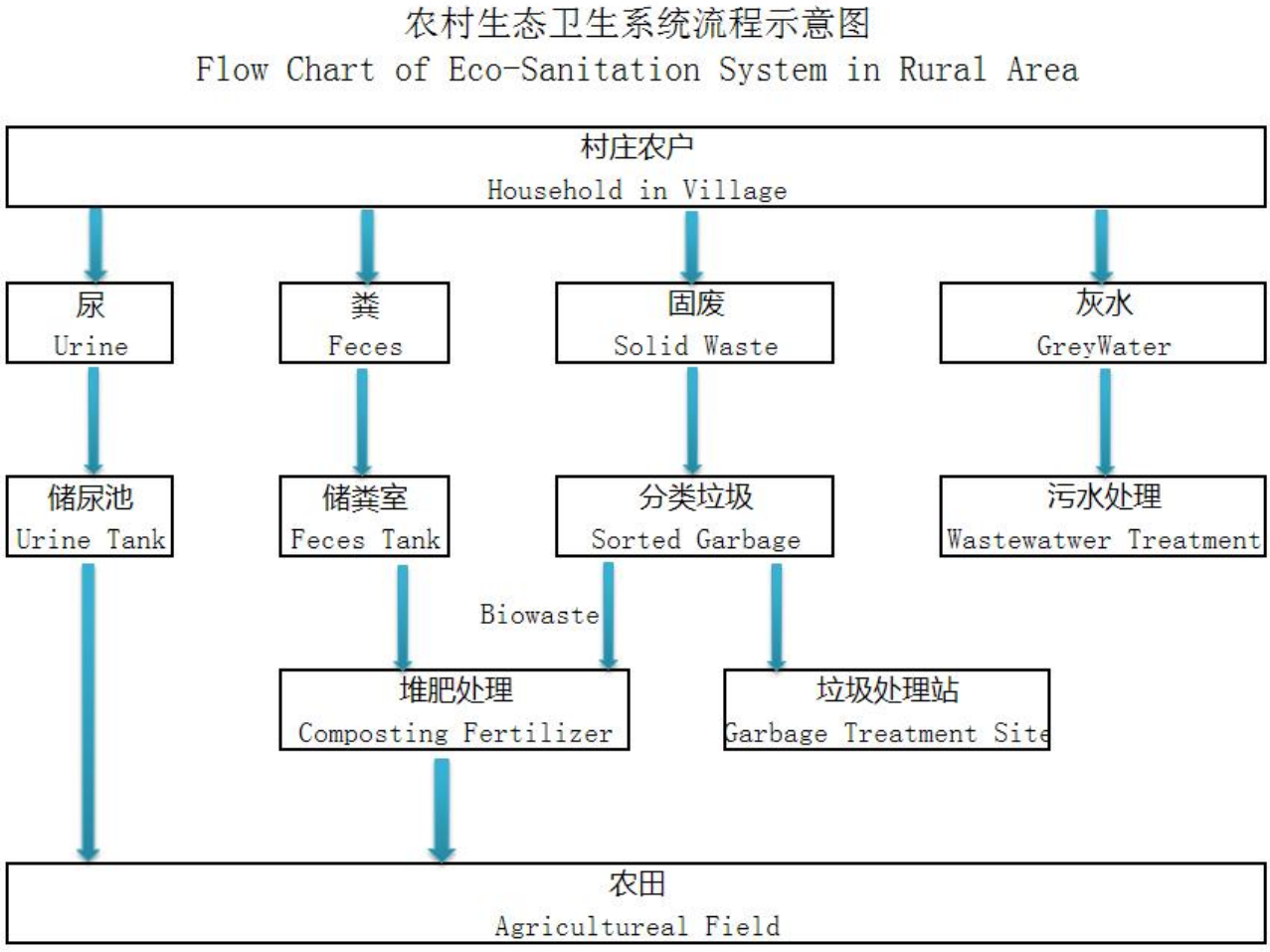


Figure 6-2 The flow chart of Eco-Sanitation System in rural area (Yang Chenxi made)

Development of the rural economy is one of the national policies in China. Kunming municipality at each level have focused on this rural reform, however, in the first popularization project, it made inevitable mistakes.

The eco-sanitation system is a system, which contains a lot of things, not only one eco-dry toilet. The figure 6-8 shows the whole system, the toilet is only one part of this eco-sanitation system. It should be integrated with waste, wastewater and farmland management.

Wastewater reform:

Most of the villages use tap water, but there is no good sewage network underground in village. And no drainage system exists. The wastewater and greywater are led in open drains into the channels and to the river.

The wastewater should be treated by ecological approach, like building a mini-filtration setting system in home, or making a simple filter by sand. The basic principle is simple treatment before drainage.

Figure 6-3 The Channel In Village

Energy reform:

The clean energy and bio-energy should be used in household. At present some villages still use burning wood or coal for energy supply. We advocate using solar energy, biogas energy to replace old energy forms. Building a biogas toilet or biogas tank in home is recommended when possible, it's not used only to dispose the waste but also can solve the energy problem.

Figure 6- 4 The Solar Heating System

Waste reform:

When we were in village and found there is not any place for disposal of waste, and it's a general problem in Chinese villages. We can see the waste everywhere but few place for waste disposal. The bio-waste and the farming-waste are mixed together. And the waste treatment approach is also simple, only burning and landfilling.

Figure 6-5 Burning Waste

The waste reform should start as soon as possible in rural village. With living quality improvement in rural area, the amount of living waste is also increasing rapidly. The village government should set a place for waste. A waste station of which function is to simply sort garbage by separating the living waste from the bio-waste and the agricultural waste. Bio-waste and farming-waste can be used in composting fertilizer.

Stockyard reform:

The stockyard lies at home while people live with livestock. It imperils the human health easily. Concentrated livestock breeding is a good approach, but it requires villagers to accept this new concept.

Figure 6-6 The Henhouse Beside Kitchen

Farmland reform:

Agriculture is the most important industry in a country, since 1980s Chinese farmers began to use the all kinds of chemical fertilizer for improve yield of crop. After 30 years, water and soil eutrophication becomes a big environmental problem, due too chemical fertilizer used on the farmland.

Figure 6-7 The Double Chamber Composting System

In order to adjust soil fertility, protect groundwater and prevent non-point source pollution, the farmland should be developed. The eco-farmland project contains two basic principles, one is soil, and other is farming waste. Some villagers used double chamber composting system for farming waste treatment. The double chamber composting system is shown in the figure 6-7. Farming-waste is added, included with faeces and golden enzymes (a biocatalyst for speeding rot) in one chamber. Another chamber is for collection of waste leachate. Organic bio-fertilizer can be produced after 6-8 weeks. The leachate can also be used in the farmland. This setting can dispose of the farming waste on-site and the product can be used to adjust soil fertility.

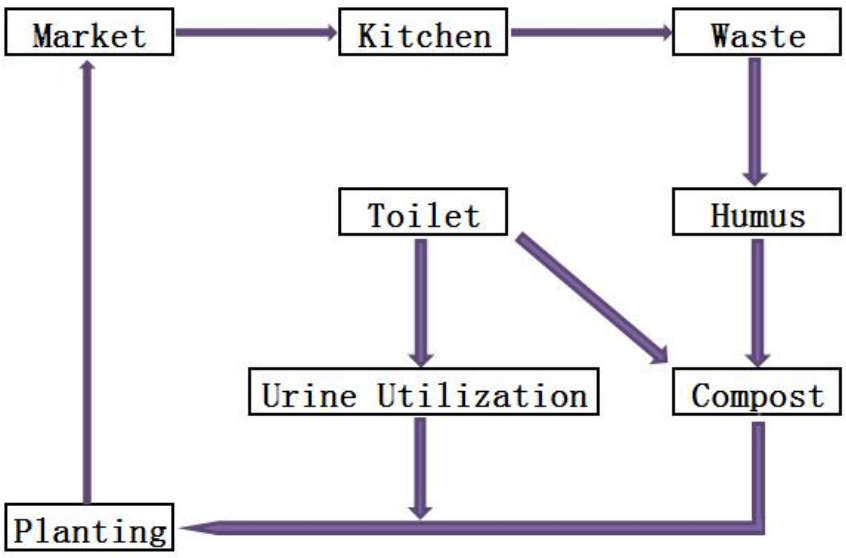


Figure 6-8 Cycle of Eco-Sanitation System

In the agricultural system, the eco-dry toilet is only one part. But in Kunming case, government constructed only dry toilets. It did not take into account the whole system and the usage percentage was thus low. As the figure 6-8 shows, building a real eco-sanitation system in village, constructing the mini private wastewater treatment system, setting waste station and building a composting system, then adding the dry toilet, a cyclic system can be formed. After people live in that new system, they will accept dry toilet naturally.

6.3 The Approach of Popularization In Rural Area

The main reason for the failure was weak education and participation of the villagers. The original plan of popularization was to build 100000 private eco-dry toilets in 3 or 4 years. In fact almost 40000 private toilets were built in one year. The pace of public awareness and education cannot follow that of the construction. The educational level is low in rural area in general. The public awareness and education is important before introduction of a new technology in rural area.

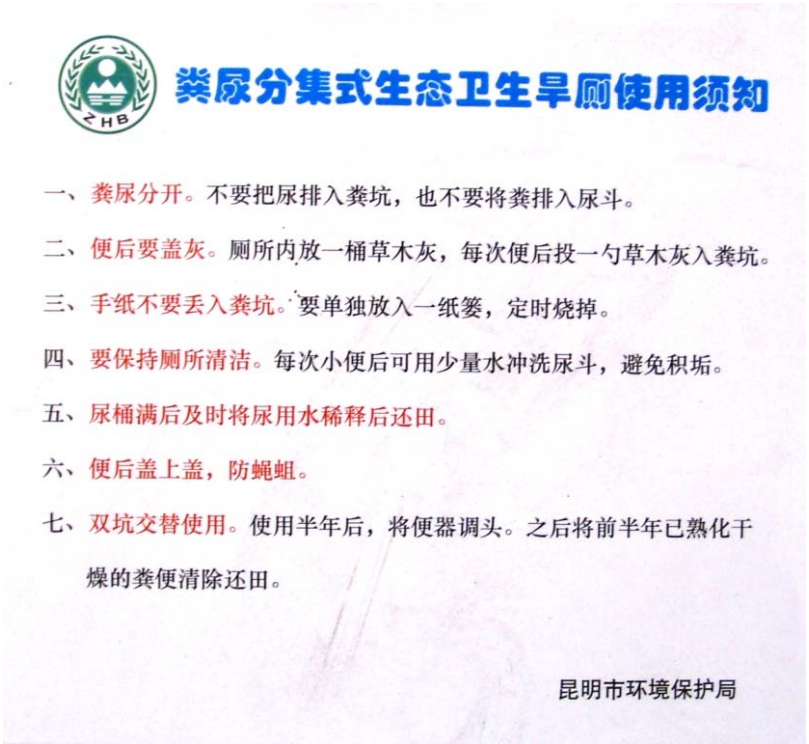


Figure 6-9 Toilet user instructions (Photo by Miikka Ristkari)

When we visited villages, most people said that nobody taught them how to use the new toilet. Somebody used it in old way, urine and faeces mixing together; somebody remade it to a traditional toilet; somebody used it as a storage. Also we found that village people did not have any material about dry-toilet usage. They did not know why the urine and faeces should be separated, they did not know how to use the urine in the right way. They were confused, but nobody answered their questions. This is why EDTs were not used in villages. We got toilet use instructions in a public dry toilet (figure 6-9). However the pictures showing how to use it would have been better than article description in rural areas because many people are illiterate.

The better method of teaching village people would have been face to face.

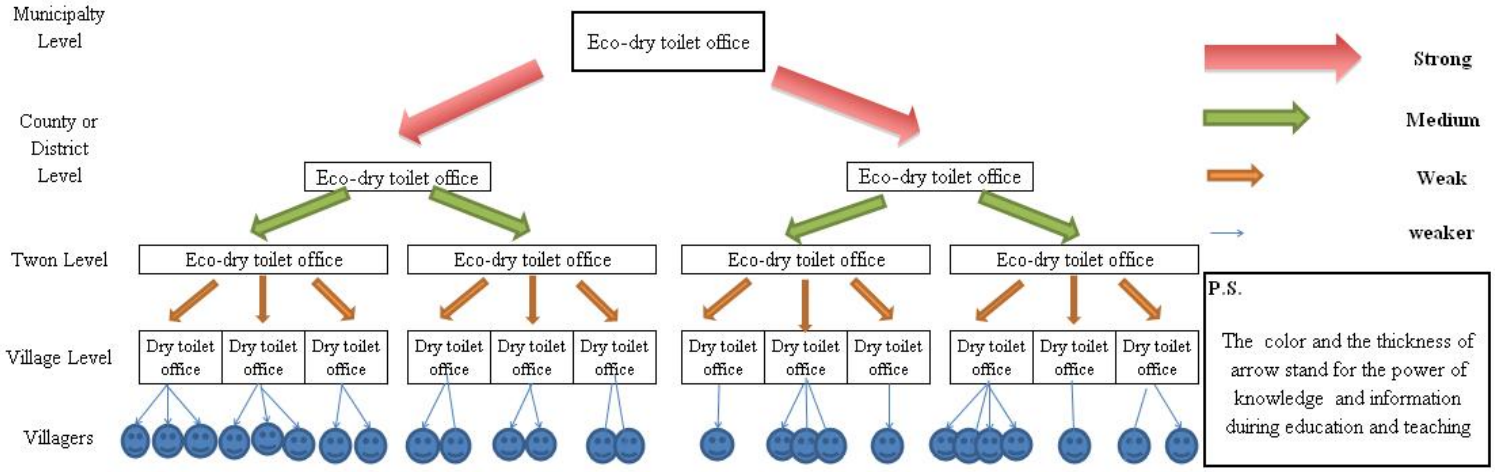


Figure 6-10 The Chain of Knowledge in Popularization (Yang Chenxi)

Figure 6-10 shows the process of education public awareness in this project. Huge amount of dry toilets has been built. The people from county toilet office were organized and trained by municipality toilet office. After training, they taught the people from town toilet office. In this way, educational information communicated level by level down to the villager level. However after several levels, the power of knowledge will be weak. It's like the nutrition cycle in the food chain.

At first, amount of toilet construction should be controlled. Then technicians should be sent to the village, teach and introduce the technology to village people or village office people face to face. The chain of knowledge communication should be short. After training it would be better to leave the article or picture materials, even video or audio information for village office.

6.4 Environmental Technology in Rural Area

China is a developing country in the world, especially in its rural areas. The basic problem is low income for households in rural area. Village people just care what benefits them immediately. This popularization project is good, but it is operated at a wrong time. The goal of Kunming municipality government is also right, but wrong in methods.

Eight villagers took an additional survey, when we did feedback questionnaire (Appendix 5). The topic was “Which environmental project are you interested in?”

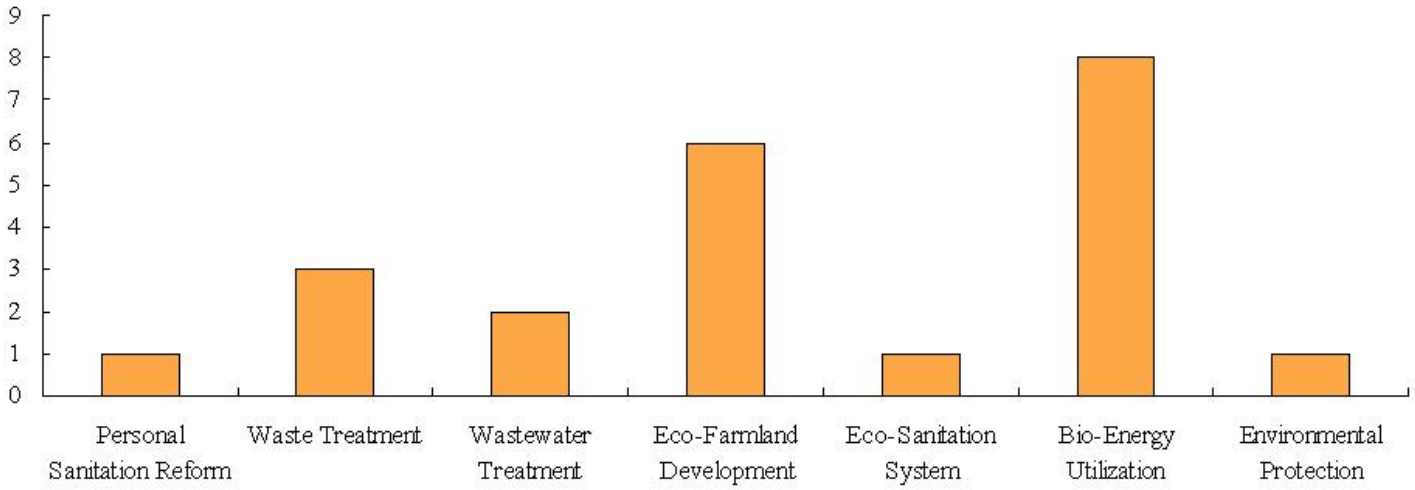


Figure 6-11 Environmental Projects Which Are Villagers Interested in

Figure 6-11 shows to us, village people prefer to accept bio-energy utilization and Eco-farmland development. They think those two fields can give immediate

benefit to them. They don’t care about environmental protection or eco-sanitation system, because the environment and the sanitation cannot increase income directly. There is a vicious circle, low education leads to less advanced technology, less advanced technology can result in poor living and the education will be influenced by poor living. Developing education is the first step of breaking vicious circle in rural areas. That is why I said, a good project chose wrong objective in wrong time.

As a conclusion of this project the villagers started to utilize the toilets more and become slightly more interested in environmental projects in general. This project cannot be used as direct remediation for the mistakes that have happened in the EDT construction project, but it shows some of the ways that can be used to correct the situation.

7. **SELF-EVALUATION**

In general, my project of promoting Eco- dry toilet use was successful. I have leant a lot from this project and also the engineers working in KIES.

This is my first time to operate a project: lack of experience, some mistakes in project planning and ineffective project scheduling led to extra time spent in preliminary work. The same happened to questionnaire designing, information was found missing for the analysis of survey result.

This practice has enriched my experience to operate projects and survey skills, and more importantly it shows the ecological development merits more attention from China.

8. REFERENCES

Electronic

1. Development of Chinese community. *The state department*. 1995[cited 14.11.2007]. Available from World Wide Web: http://www.cdd.org.cn/list_detail.asp?IT_Code=JYJL&IT_ID=DTID070302164132318492%20%20%20%20%20%20%20%20%20%20&ID_ID=IDID070518130645703854

2. Kunming Municipality Environmental Protection Bureau. *Information center of KEPB*. 1995-2008[cited 14.11.2007]. Available from World Wide Web: http://www.kmepb.gov.cn/kmhbj/77691491618652160/20060420/1462.html

3. Fu Yang city. *Fu Yang online*. 1998-2005[cited 22.12.2007]. Available from World Wide Web: http://www.agws.fy.gov.cn/04(bf)/web/gsgc.htm

4. Yi Long Net. *eLong,Inc*. 1999-2008. [cited 22.12.2007]. Available from World Wide Web: http://zhinan.elong.com/guide/100000010479

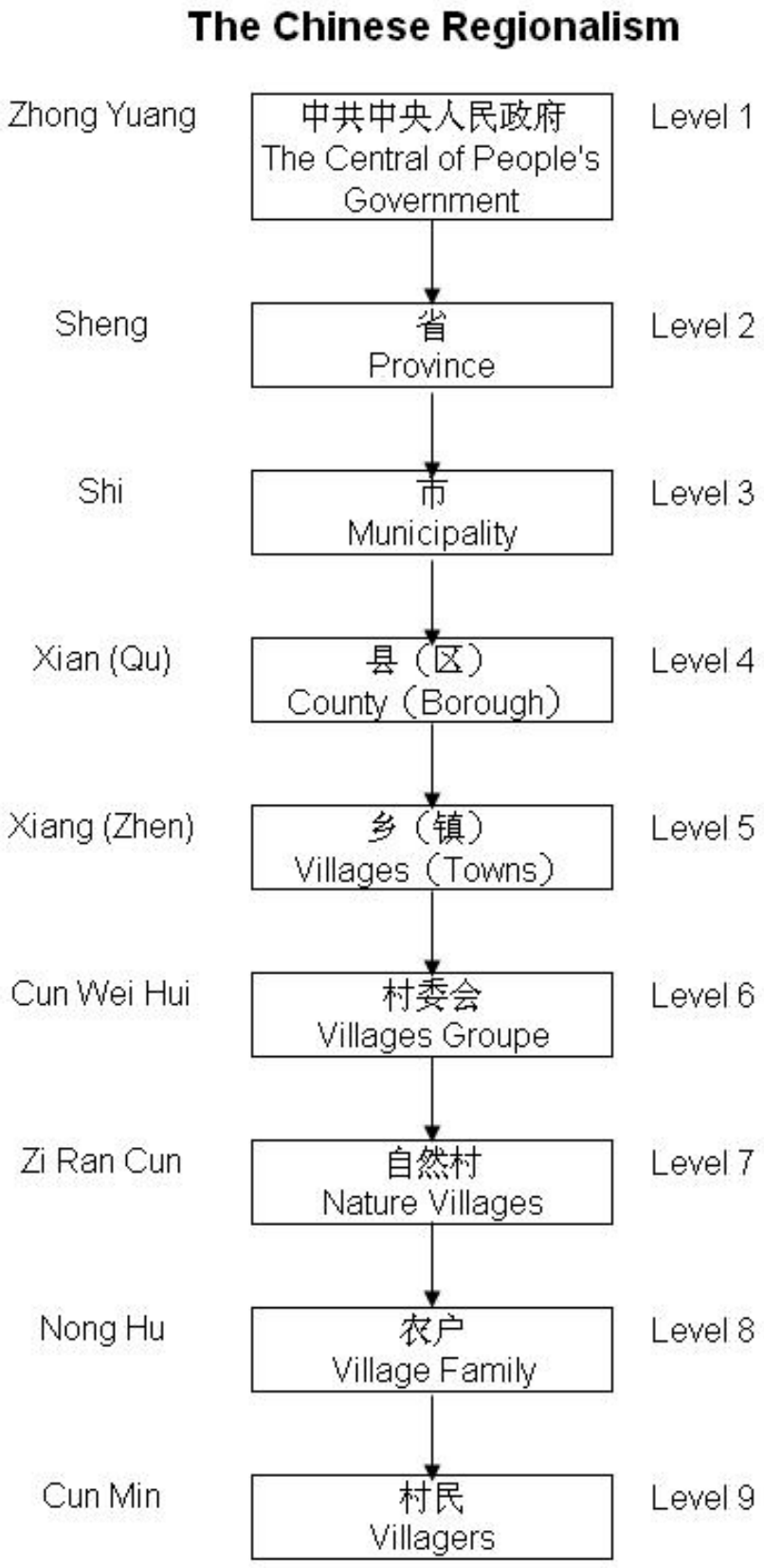
5. District planning. *Lan Weixing*. 2000 [cited 22.12.2007]. Available from World Wide Web: http://www.xzqh.org/QUHUA/53yn/0127sm.htm

Printed

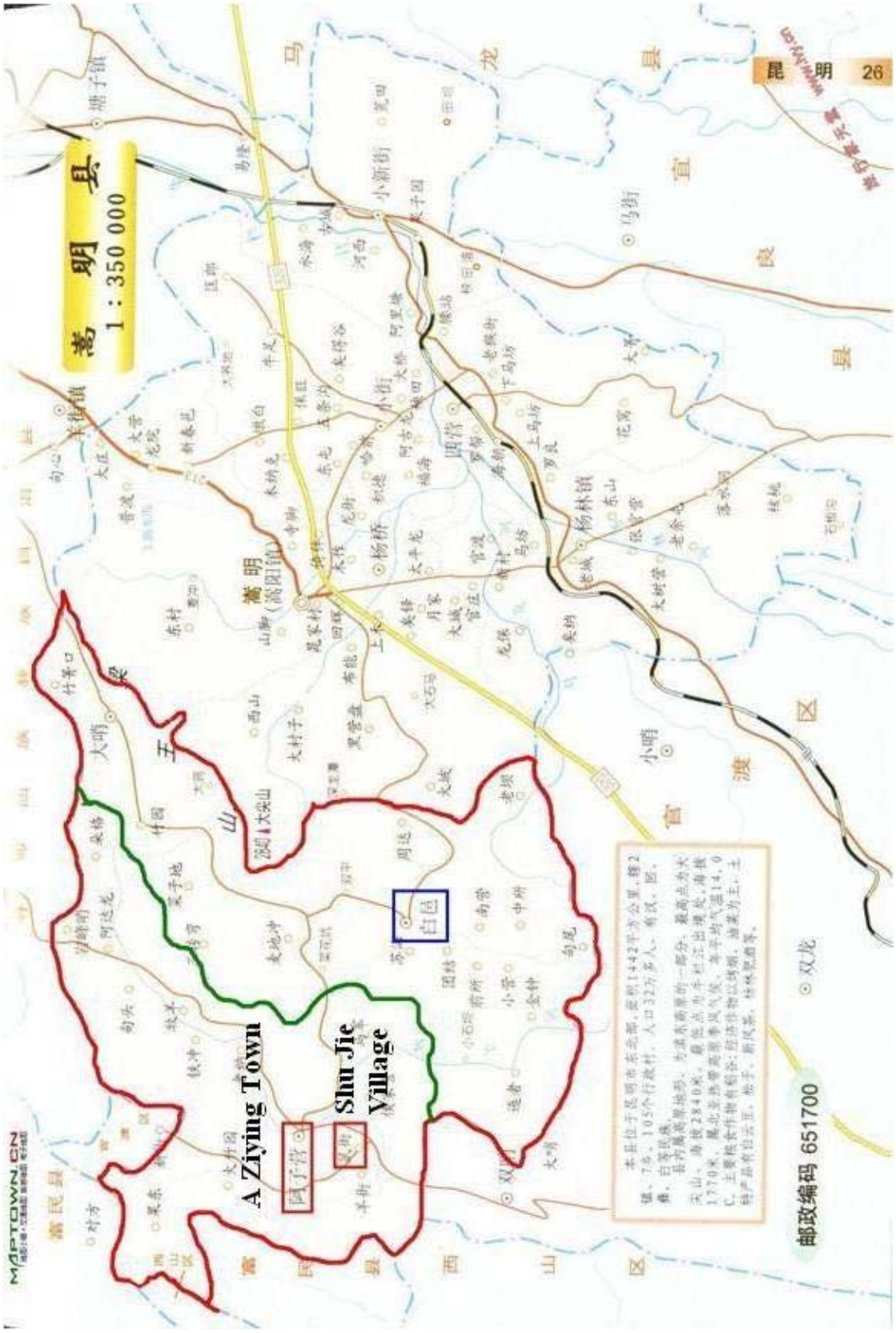
6. Kunming Municipality Government. *The Yearbook of Kunming Municipality in 2006.*

7. ZHI GUOQIANG (KIES). *Report of Eco-Dry Toilet experimentation in Kunming Municipality*. 2005

Appendix 1. The Chinese Regionalism



Appendix 2. Map of Song Ming County [4]



Appendix 3 The list of user who has accept toilet fixing

User Name	Address	Solution	Contact
Sun Baojian	Long Jia Village	Change to iron door	0871-7952772
Li Jiankun	Gu Cheng Village	Iron door, Fix roof, Urine pipe, Ventilation pipe	13888725187
Li Yanwei	Gu Cheng Village	Fix roof	13648710282
Li Wenzhong	Gu Cheng Village	Fix Roof, Urine tank	15812087747
Li Wenyun	Gu Cheng Village	Urine pipe, Ventilation pipe	15911620160
Jiang Qinying	Luo Jiaying Village	Iron door, Urine tank, toilet pan, Urine pipe, Teaching	0871-7970529
Zou Jiande	Luo Jiaying Village	T Ventilation pipe head, Toilet pan, Teaching	0871-7970529
Du Yongen	Luo Jiaying Village	Feces door, Fix roof	0871-7952597
Yang Jiashou	Luo Jiaying Village	Urine tank, Ventilation pipe, Fix roof	15812087699
Du Tao	Luo Jiaying Village	Feces door, Ventilation pipe, Teaching	13577157328
Zou Xian	Luo Jiaying Village	Urine pipe, Urine tank, Ventilation pipe, Teaching	13668719175
Yang De	Luo Jiaying Village	Iron door, Fix roof	13669754417
Wang Jiaxue	Luo Jiaying Village	Urine pipe	

Appendix 4. Questionnaire of user selection for fixing dry toilet

Questionnaire of user selection

No. _____

Name		Sex	M F	Age		nation		Family size	
Address	County		Town		Village group		Village		
Do you have private dry toilet		Y N	Do you Like it		Y N _____				
Reason (if choose No):									
Using of dry toilet	Using (how long) _____ Used（How long）_____ Never use_____								
Location of dry toilet:		Do you want to accept fix dry toilet in free		Y N					
Do you know, how to use dry-toilet?									
How do you use urine:		How do you use feces:							
Types of household:		Types of crop in your farmland:							
Comments:									

Date of Eco-dry Toilet（only for accept fixing user）					
High of Vent-pipe	cm	Direction of doors open	In Out	Toilet pan	
Inner size of toilet	L_____ cm × W_____ cm × H_____ cm				
High of feces room: _____cm		Urine pipe:		Urine Tank:	
Quality Problem:					
Design Problem:					
Comments:					
Surveyor Signature: _____			Date: _____		

Appendix 5. Feedback Questionnaire of after fixing dry toilet

Feedback Questionnaire

Name		Address	A Ziying Town Shujie Village grope_____Village		No.
Do you begin to use dry toilet			Yes	No，because_____	
Suggestion after fixing toilet：					
Your favorite toilet	Eco-dry toilet	Biogas toilet	Water flow toilet	other_____	
What kinds of toilet suit for your home?					
Do you use this toilet continue?			Would you like to suggest your friend to use?		
Which environmental project are you interesting? (can choose 3 options) A. Personal sanitation reform B. Waste Treatment C. Wastewater Treatment D. Eco-farmland development E. Eco-Sanitation system development F. Bio-energy utilization G. Environmental Protection					
Comments：					
Please Signature, if you approve of this fixing toilet（or fingerprint）:					
Surveyor signature:			Date:		

昆明市环境科学研究院(KIES) 生态研究中心
TAMK University of Applied Science

Appendix 6 Report on Survey to Zhong He and Tai Shi Villages

Document responsible organization:

Kunming Institute of Environmental Science
Tampere Polytechnic University of Applied Sciences

Date started: 2007-05-08
Date last modified: 2007-05-14

Draft started by Yang Chenxi
Final by Miikka Ristkari

Brief:

This document is a report on our open questionnaire survey to Zhong He and Tai Shi villages. The surveys were conducted on 19th and 20th of April. We found out that the main reasons for abandoning or rejecting the urine-diverting dry toilets are bad quality and faulty design, as well as difficulty in use. However, the survey only covered 21 households.

Relevant documentation:

Survey Statistic_update.xls
Social_acceptance_of_dry_toilets_in_zhonghe_village_PAMS SEA-3 YASS FR.pdf

Table of Contents

1. Background

After reading the “Social acceptance of dry toilets in Zhong He village” by Liang Chuan et al., it was decided we decided to conduct a small survey to Zhong He and some other village. This other village came out to be Tai Shi, as these villages represent the two ends of village life and living conditions, mainly rich and poor villages. The purpose of the survey would be to introduce the village life to us, as well as to give us firsthand information on the situation with the dry toilets.

Tai Shi village had a failed dry toilet introduction project in 2002-2003.
Zhong He village had a partially successful dry toilet project in 2003-2005.

2. Forming the questionnaire

The questionnaire was formed by making a draft after examining a few sample surveys. After the draft we held discussion and analyzed the questions, and through discussion an open questionnaire paper was made. The survey paper involves general questions of family, sanitation and the household economy. The questions were chosen to be quite broad to get different kinds of opinions from the respondents.

3. Survey location and selection method

We chose two villages, Zhong He village and Tai Shi Village. Zhong He was chosen first and we finally chose Tai Shi because it was the first village to receive ecological dry toilets. Before constructing ecological dry toilets in Zhong He, the Kunming Institute of Environmental Science had done groundwork and educational campaings with the villagers. We want to see how is going on after 2 years.

Zhong He and Tai Shi are both located by the Dian Lake. Zhong He village

belongs to Da Yu Township and Cheng Gong County and has a population of around 400. The Tai Shi village belongs to Gu Cheng Township and Jin Ning County and has a population of around 370

4. Conducting the survey

Before going on with the survey, we decided on the methods on how to conduct the survey. The surveys would be open and the surveyors would avoid leading the respondents into answers, but rather we wanted the respondents to discuss the problems in their own initiative. We would ask the questions from the questionnaire and write down the answers, while sometimes giving comments and probing further into the issues.

4.1 Zhong He village

On 19th of April we went to Zhonghe village. When we arrived to Zhonghe village we separated into two groups of 2 and 3 persons. This was to get a more coverage during the short time we had in the village. After about 4 hours we got 17 questionnaires back totally. Yang Chenxi was the surveyor in 2 person group and Ma Wenting in 3 person group. Other people present were Miikka Ristkari, Pu Limin and Yang Hongfu.

4.2 Tai Shi Village

On 20th of April we visited Tai Shi village. We spent there about 2 hours, during which we walked around the village and spoke with the residents. In Tai Shi we surveyed only three households with the questionnaire, as the visit was more like an inspection and familiarization visit for us. We were three persons, Miikka Ristkari, Yang Chenxi and Pu Limin.

5. Results and Discussion

After this open interview - survey, we found that only few families still use private ecological dry toilet. Mostly families would like to use public ecological dry toilet

and also some families are still using old traditional toilet. In some occasions the households said they used ecological dry toilet, but the toilets were clearly not used. Also at least one household responded that they use the private ecological dry toilet during winter, as there is less smell then.

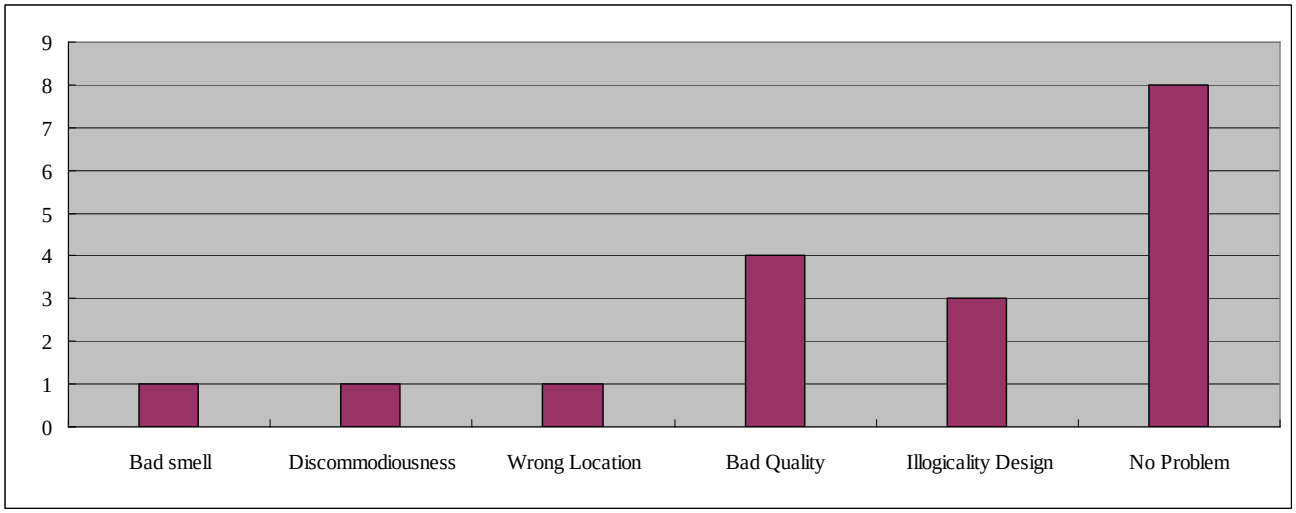


Figure 1. The Problems of Eco-Dry Toilets

There are many reasons to cause the people to be unable or unwilling to use private ecological dry toilet. Technical reasons are wrong toilet location, bad toilet quality, difficulty to empty and difficulty to use. Social and habitual reasons are against living customs, against habits, against culture (as in Han-zu feng shui). Practical reasons are wrong location and ease of use of the traditional toilets, as well as fear of bad smell.

It is not wise to make any conclusions based on such a small survey population, but it seems that the public ecological dry toilets are quite well received. (This also based on field visits to several public ecological dry toilets elsewhere than these two villages.) With maintenance and cleaning infrastructure and a bit improved design, they might provide a good way to access large population in the countryside.

This survey will help us in forming a bigger survey, which will hold educational (or, as a better word, informational) campaign elements aimed at gathering diverse opinions in Kunming municipality.

6. Appendix:

6.1. Questionnaire used in Zhong He and Tai Shi Viilage

Kunming Municipality UD dry toilet survey

KIES TAMK

Surveyer:	

Date:	

ID:

County	
Township	
Village	

Respondent family name:						
Respondent gender:		Female	Male			
Respondent age:	5-10	11-20	21-30	31-40	41-60	61-90
Respondents household size:		1	2	3	4	5-

Sanitation

Types of toilets household members use while in home	
what kinds of toilet did you used most often	
Types of toilets household members use while in work	
What is the toilet preference, i.e. what kind of toilet is most liked?	
Why is this kind of toilet(s) liked the best?	
Problems and advantages of the toilets in use?	
How could the toilets be made better?	
What is a comfortable place for a toilet?	
Public or private toilet is better?	
Why is public or private toilet better?	

Kunming Municipality UD dry toilet survey

KIES TAMK

Surveyer:		Date:	

ID:

County	
Township	
Village	

Respondent family name:						
Respondent gender:		Female	Male			
Respondent age:	5-10	11-20	21-30	31-40	41-60	61-90
Respondents household size:		1	2	3	4	5-

Sanitation

Types of toilets household members use while in home	
what kinds of toilet did you used most often	
Types of toilets household members use while in work	
What is the toilet preference, i.e. what kind of toilet is most liked?	
Why is this kind of toilet(s) liked the best?	
Problems and advantages of the toilets in use?	
How could the toilets be made better?	
What is a comfortable place for a toilet?	
Public or private toilet is better?	
Why is public or private toilet better?	

6.2. Detailed Survey Data

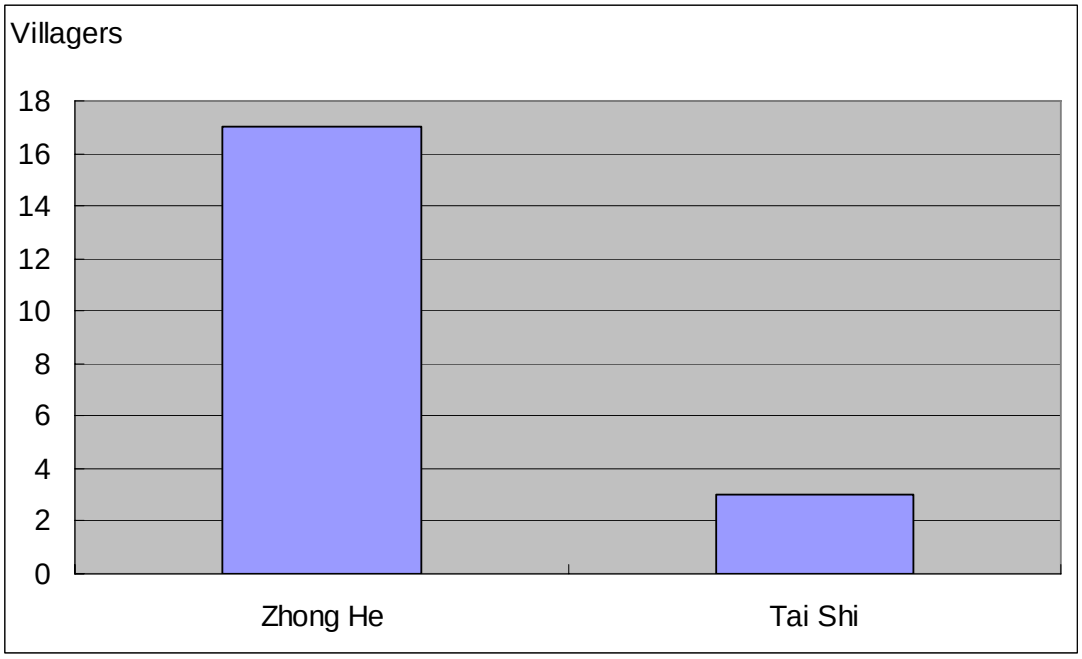


Figure 2 Respondents in respective villages

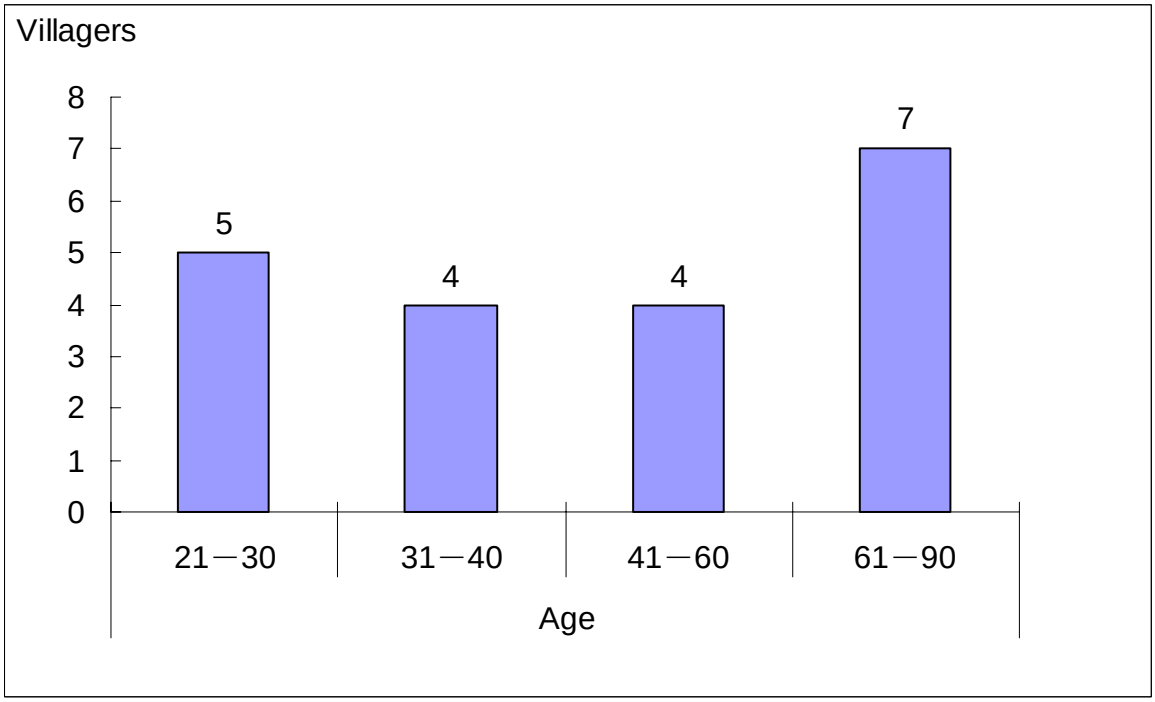


Figure 3 Age of respondents

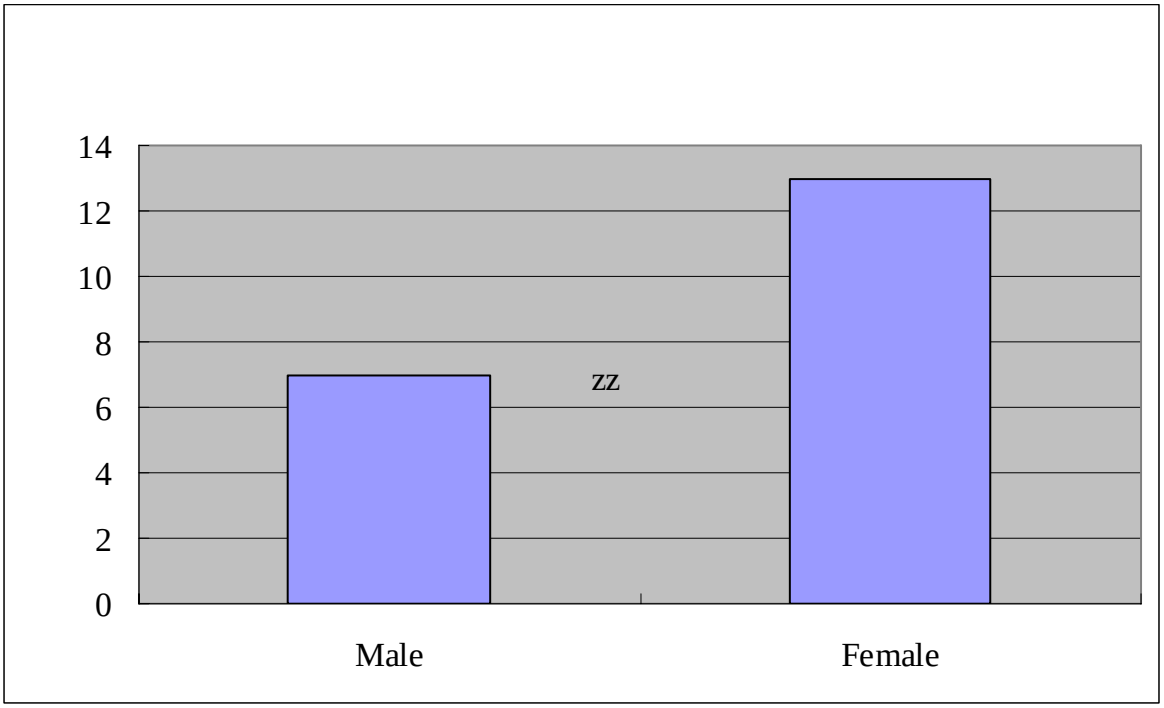


Figure 4 Gender of respondents

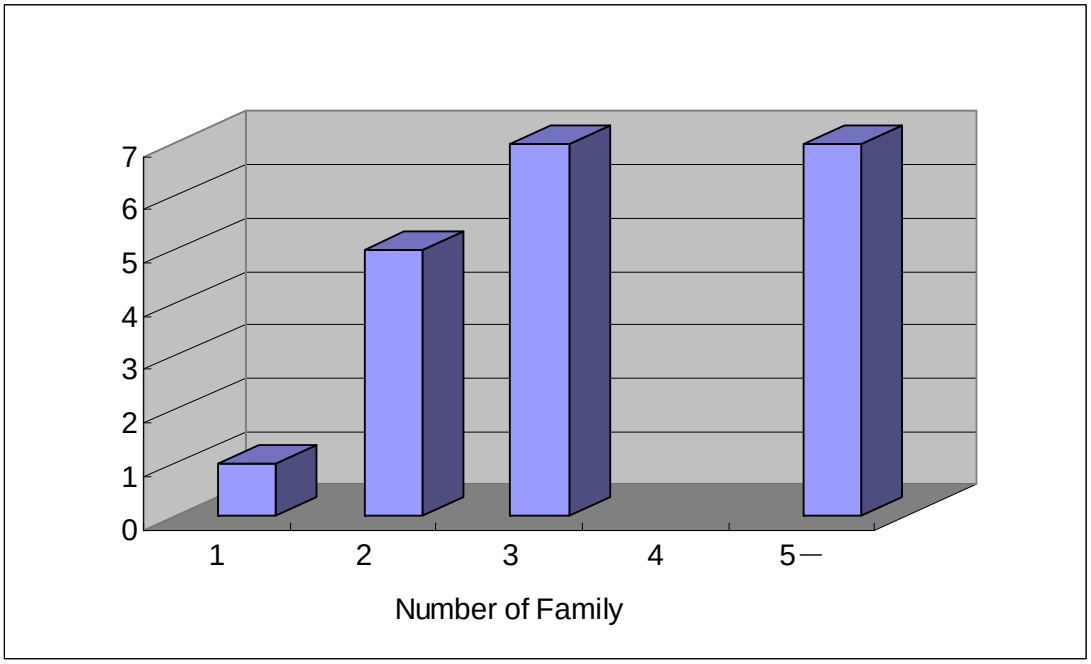


Figure 5 Household size

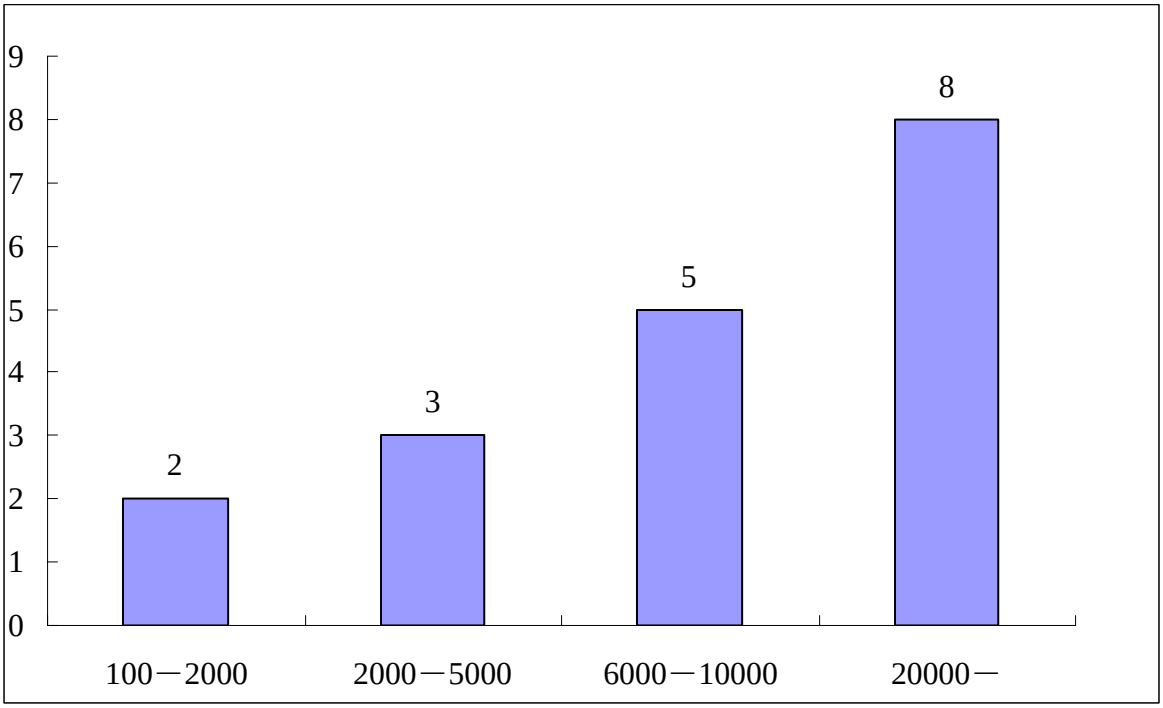


Figure 6 Household income (Annual, RMB)

Zhong He is very wealthy village due to horticulture, this explains high incomes.

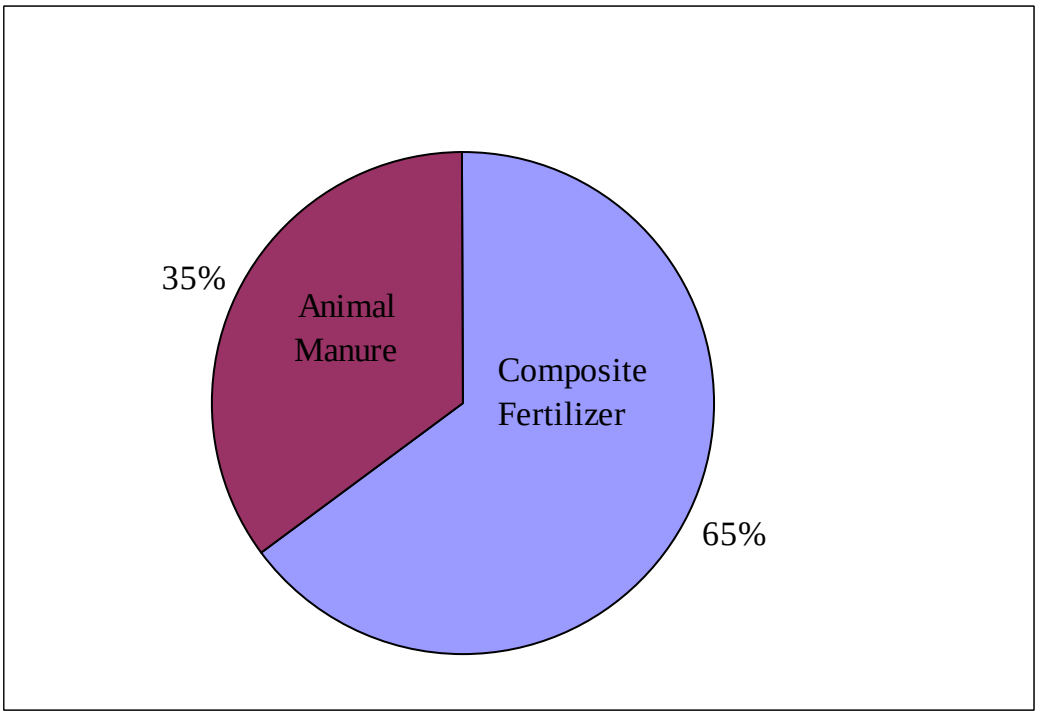


Figure 7 Fertilizers used by households

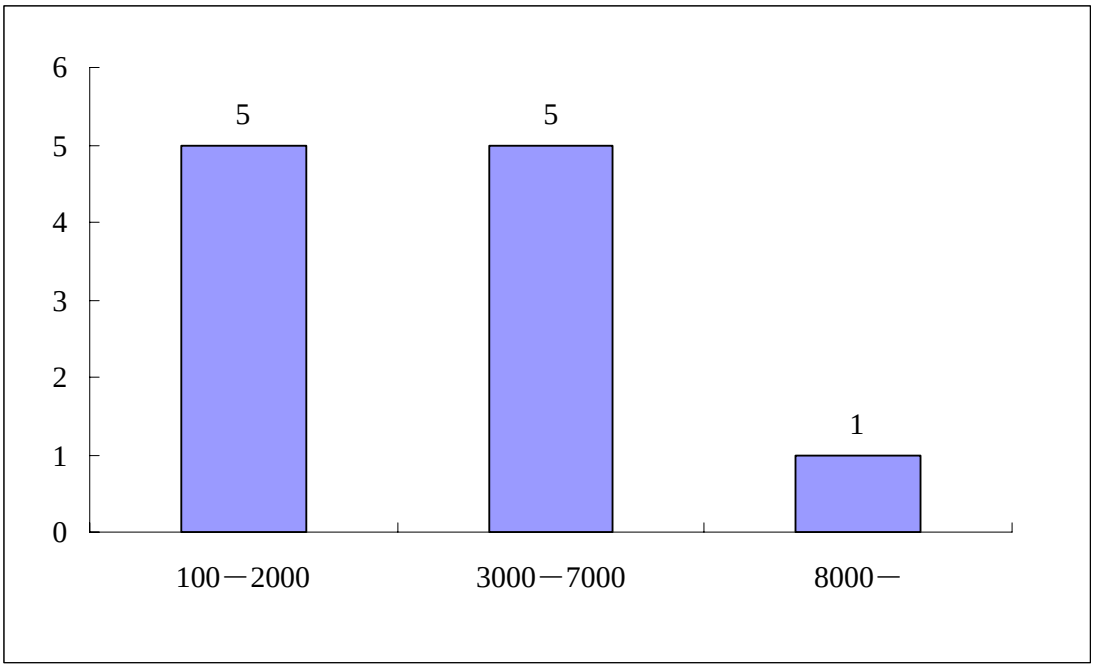


Figure 8 Money spent on health per household annually

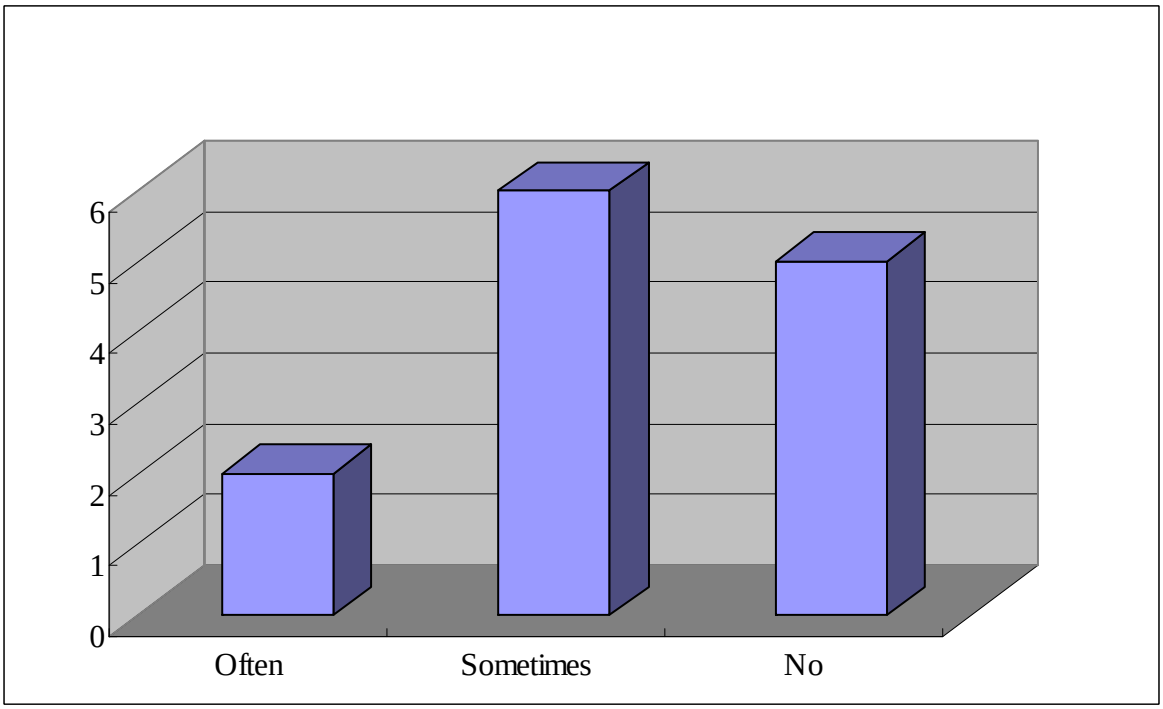


Figure 9 Stomach sickness, diarrhea incidence

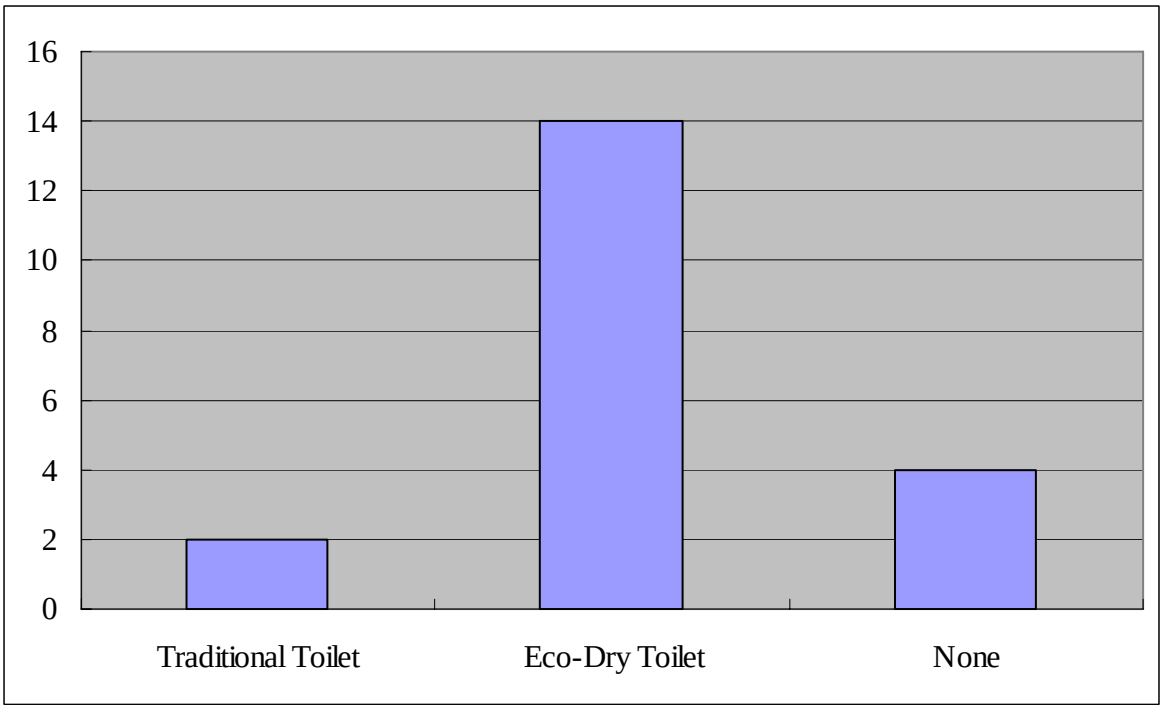


Figure 10 Toilet in household

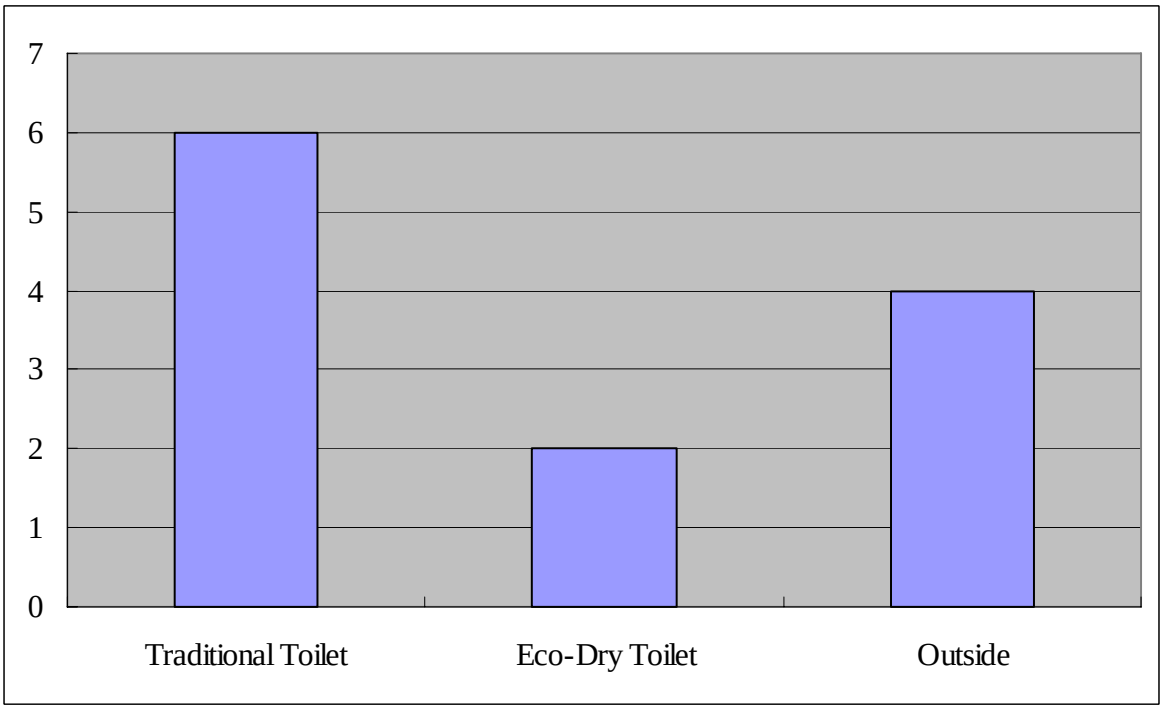


Figure 11 Toilet used during working time

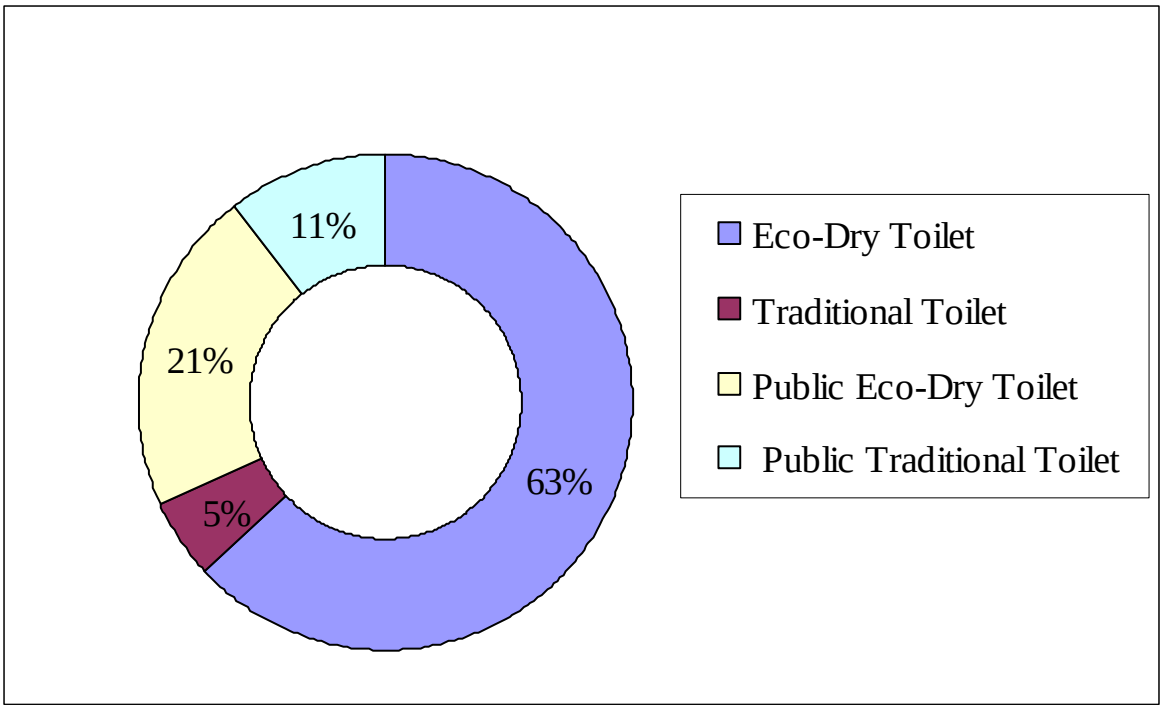


Figure 12 Respondent's favorite toilet (does not reflect household view)

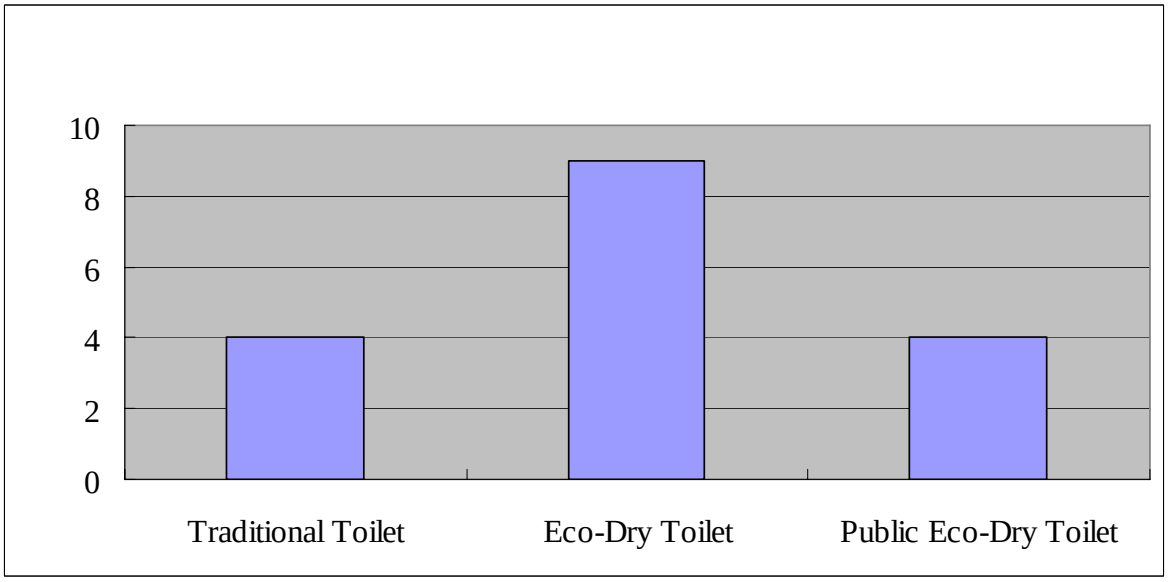


Figure 13 Most often used toilet

6.3. Numerical data of some answers of the survey

Village	Zhong He				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**18**
	Tai Shi	1	1	1																			**3**
Annual Household Income (RMB)	100-2000	1																				1	**2**
	2000-5000			1							1										1		**3**
	6000-10000				1	1				1					1				1				**5**
	20000-						1	1	1			1	1	1		1		1		1			**9**
Annual Household Health Spent(RMB)	100-2000				1		1		1		1											1	**5**
	3000-7000	1				1		1				1							1		1		**6**
	8000-																	1					**1**
Types of Fertilizer	Composite	1			1	1		1	1	1		1						1	1	1	1		**11**
	Animal Manure					1	1	1				1									1	1	**6**
Toilet Used Most Often	ODT				1	1			1		1												**4**
	EDT		1	1			1	1		1				1	1		1				1		**9**
	PEDT	1										1				1		1				1	**5**
Toilet Used In Work	ODT				1	1	1	1	1				1										**6**
	PEDT											1							1		1		**3**
	Outside	1	1	1						1													**4**

ODT=Old Dry Toilet EDT=Eco-Dry Toilet PEDT= Public Eco-Dry Toilet