WATER AND SANITATION PROGRAM: **TECHNICAL PAPER**

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Economic Assessment of Sanitation Interventions in Indonesia

A six-country study conducted in Cambodia, China, Indonesia, Lao PDR, the Philippines and Vietnam under the Economics of Sanitation Initiative (ESI)

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The Water and Sanitation Program is a multi-donor partnership administered by the World Bank to support poor people in obtaining affordable, safe, and sustainable access to water and sanitation services.

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Executive Summary

A. INTRODUCTION

Statistics from the UN Joint Monitoring Programme show sanitation progress in Indonesia to be off-track – coverage has to increase by more than 13 percentage points nationally from 2008 to 2015 to meet the sanitation target of the Millennium Development Goals, which the Government of Indonesia committed to in 2002. However, after being a largely forgotten issue in the 15 years following the Asian financial crisis of 1997-98, sanitation is now receiving increasing attention from all levels of government in Indonesia. Recently the Government of Indonesia has made considerable efforts to mobilize additional resources in order to finance the country's needs for infrastructure projects. However, the annual budget allocation for sanitation remains insubstantial at 0.03% of national government spending in recent years. Since 2010, a specific budget for sanitation has existed (as opposed to being subsumed into water supply).

Since 2008, a cross-sectoral task team called the Sanitation Technical Team (*Tim Teknis Pembangunan Sanitasi* – TTPS) has promoted the development of the national sanitation sector. The Acceleration of Settlement Sanitation Development Program (*Percepatan Pembangunan Sanitasi Permukiman* – PPSP) has recently paved the way for the National Roadmap to Sanitation Development 2010-2014. For the domestic wastewater subsector, the PPSP targets 330 cities and districts, with the aim of eradicating open defecation. This will be achieved by expanding existing sewerage networks in 16 cities to serve an additional five million people, and constructing decentralized wastewater management systems (known as SANIMAS) in all PPSP target cities and districts.

Having such an ambitious sanitation development agenda, the TTPS and its partners need to cooperate with all relevant stakeholders for support, commitment and funding. They need to come up with economic arguments to justify increased spending on sanitation. Therefore, comprehensive and robust cost-benefit analyses that use reliable quantitative and qualitative techniques are needed in order to maximize the possibility of securing adequate budget allocation.

The Economics of Sanitation Initiative (ESI) Phase 2 presents a detailed cost-benefit analysis (CBA) of sanitation interventions. It provides a comprehensive analysis at household level in three cities and two rural districts in Indonesia. With its quantitative and qualitative evidence, it strengthens arguments to mainstream sanitation in the national development agenda. The study results are expected to enhance political support for sanitation development.

B. STUDY AIMS AND METHODS

The purpose of the Economics of Sanitation Initiative (ESI) is to promote evidence-based decision making using improved methodologies and data sets, thus increasing the effectiveness and sustainability of public and private sanitation spending. Better decision making techniques and economic evidence themselves are also expected to stimulate additional spending on sanitation to meet and surpass national coverage targets. The specific purpose of the ESI Phase 2 study is to generate robust evidence on the costs and benefits of sanitation improvements in different programmatic and geographic contexts in Indonesia, leading to information about which are more efficient and sustainable sanitation interventions and programs. Basic hygiene aspects are also included, insofar as they affect health outcomes.

The evidence is presented in simplified form and distilled into key recommendations to increase uptake by a range of sanitation financiers and implementers, including different levels of government and sanitation sector partners, as well as households and the private sector.

Standard outputs of CBA include benefit-cost ratios (BCR), annual internal rate of return (IRR) and payback period (PBP). Cost-effectiveness measures relevant to health impacts are also provided to give information on the costs of achieving health improvements. On the cost side, decision makers and stakeholders need to understand more about the timing and size of costs (e.g. investment, operation, maintenance), as well as financial versus non-financial costs, in order to make the appropriate investment decision that increases intervention effectiveness and sustainability. For data analysis and interpretation, financial costs were distinguished from non-financial costs, and costs were broken down by financier. In addition, intangible aspects of sanitation not quantified in monetary units are highlighted as being crucial to the optimal choice of sanitation interventions.

C. DATA SOURCES AND STUDY SITES

A range of surveys and data sources were used in five selected field sites – see Table A – covering three urban and two rural sites:

1. Household questionnaires were used in a total of 1500 households over the five sites (300 per site) divided between households with improved and unimproved sanitation (Table A).
2. Focus group discussions were conducted to elicit behavior and preferences in relation to water, sanitation and hygiene from different population groups, with main distinctions by sanitation coverage (with versus without) and gender.
3. Physical location surveys were carried out to identify important variables in relation to water, sanitation and hygiene in the general environment, land use, water sources and environmental quality.
4. Water quality measurement surveys were undertaken to identify the relationship between the type and coverage of toilets in the selected field sites, and the quality of local water bodies. The study enabled assessment of the impact of specific local sanitation features on water quality.
5. Market surveys were carried out in each field site. For economic evaluation, local prices are required to value the impacts of improved sanitation and hygiene. Selected resource prices were recorded to reflect local values.
6. Health facility surveys were conducted in 2-3 health facilities serving each field site, covering at least one community health center (PUSKESMAS) and one local public hospital. Variables collected include numbers of patients with different types of sanitation-related diseases, and the types and cost of treatment provided by the facilities.

D. MAIN ECONOMIC ANALYSIS RESULTS

Economic analysis combines evidence on the cost and benefits of sanitation improvements at household level. The benefit values come from the following components:

- Improved health and thus avoiding costs due to sickness (disease treatment, transportation for having treatment, productive time loss, and premature mortality).
- Time benefits from having a private toilet (less travel and no queuing time).
- Reduced water treatment and water access costs due to being able to use nearer water sources as they are no longer polluted due to poor sanitation.

Benefit-cost figures vary depending on whether a system is operating at its 'optimal' or 'actual' capacity. The optimal cost/benefit of a system is the average cost/benefit per household when it operates at its designed capacity and is fully utilized by the household members, while the actual

TABLE A: LIST OF SUB-DISTRICTS AND VILLAGES FOR ESI II SURVEY AREAS IN FIVE CITIES/DISTRICTS IN INDONESIA

No	City/District	Sub-districts	Villages
1	Banjarmasin City	Central Banjarmasin	Pekapuran Laut, Kelayan Luar
2	Malang City	- Kedung Kandang - Lowokwaru	- Mergosono, Tlogomas, Arjowinangun - Dinoyo
3	Payakumbuh	North Payakumbuh	Talawi, Kotopanjang, Payolinyam and Kubu Gadang villages
4	Lamongan District	Turi	Geger, Keben, Badurame, Turi
5	Tangerang District	- Sepatan - Rajeg	- Sarakan, Kayu Agung - Sukasari, Tanjakan

cost/benefit reflects the similar costs at its observed rate of capacity utilization. The BCR is the main measurement of efficiency reported in this study: an efficient sanitation investment is defined as one that has a BCR value greater than 1. Figure A and Figure B show that the BCR values for almost all sanitation options at all study sites were greater than 1. The two exceptions are in the urban site of Banjarmasin where the BCR of the SANIMAS (*Sanitasi Berbasis Masyarakat*/Community-Based Sanitation) and the sewerage systems at their actual capacities are less than 1, due largely to operating at 70% and 14% of their potential capacity, respectively.

These results above reflect open defecation as a starting point. However, some populations already have access to some form of sanitation facility, and hence it is relevant to

FIGURE A: BENEFIT-COST RATIOS OF DIFFERENT SANITATION OPTIONS IN THE TWO RURAL SITES

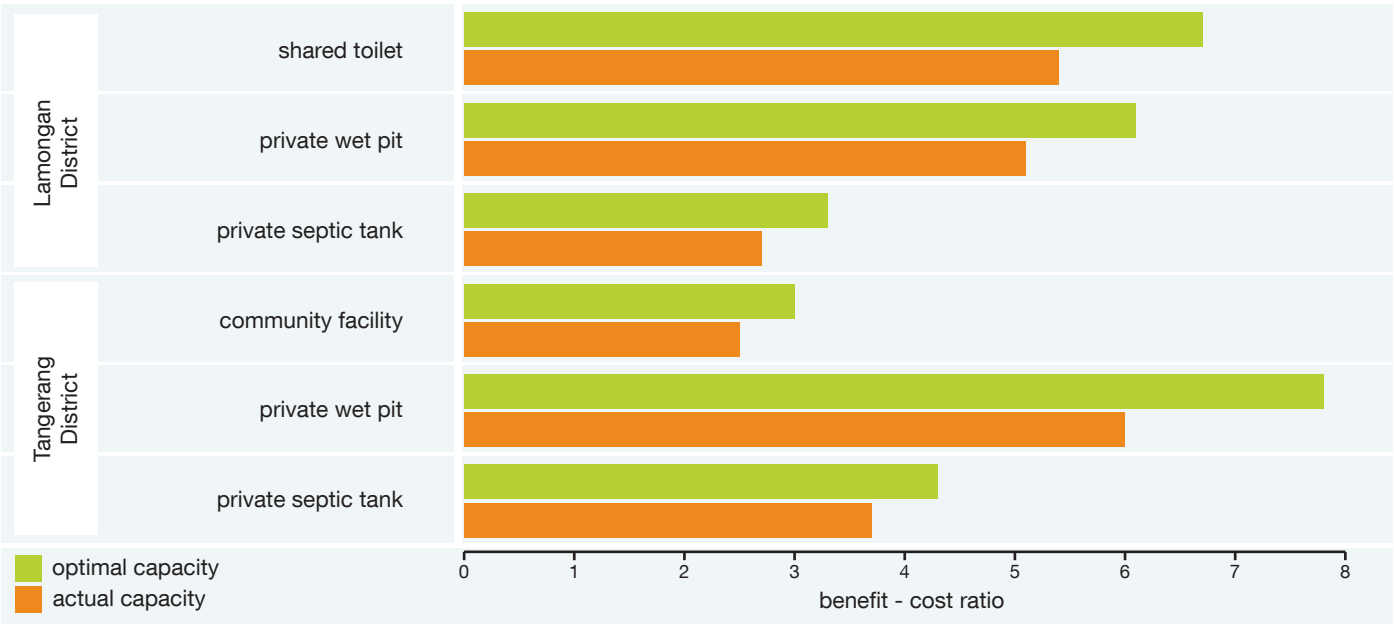
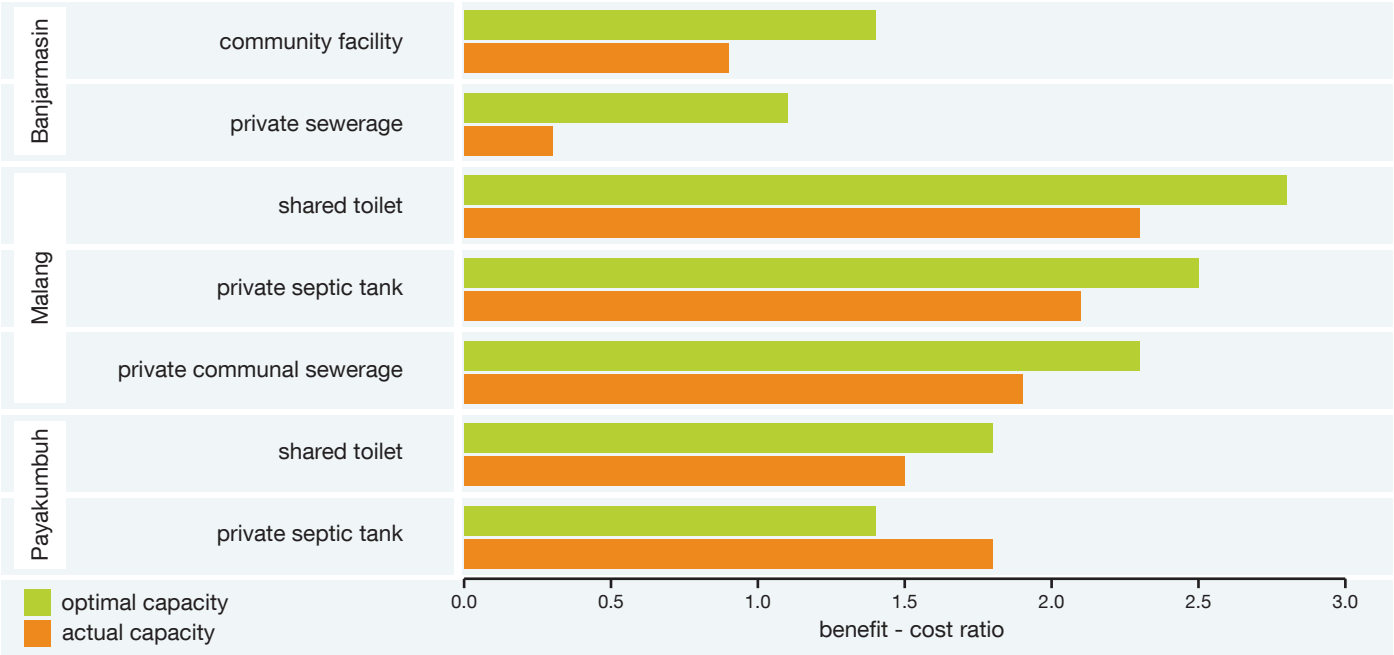


FIGURE B: BENEFIT-COST RATIOS OF DIFFERENT SANITATION OPTIONS IN THE THREE URBAN SITES



assess the 'incremental' economic performances of moving up the sanitation ladder. Such an analysis is applicable for households that may consider upgrading their existing sanitation option to a better one. For example, households still using shared toilets or community toilets may wish to move up to private septic tank or private sewerage. Table B and Table C show the economic performance of moving up some sanitation ladders in the rural study areas (Lamongan and Tangerang) and urban areas (Banjarmasin and Malang), respectively. Most steps up the ladder lead to a BCR of greater than 1 due to the incremental benefits outweighing the incremental costs. However, in some cases in urban areas when moving to sewerage options, the costs outweigh the benefits, and hence the BCR falls below 1.

E. DISAGGREGATED RESULTS

E1. COSTS

Figure C and Figure D illustrate the main contributors of economic cost in rural and urban areas, respectively. Within the total economic costs, both in rural and urban areas, the capital costs are the main contributors and in some cases there were almost no dedicated program costs. However, in cases such as SANIMAS development in Tangerang district and other sanitation options applied in Payakumbuh (using the Community-Led Total Sanitation (CLTS) approach) there were significant program costs. The program costs are any incurred costs for raising awareness and capacity among targeted beneficiaries prior to the facility construction, as well as program management. For instance, Tangerang SANIMAS (a community-based sanitation system/CBS), was provided under an initiative of the central government, WSP and NGOs. The NGOs (BORDA and its local NGO partner, BEST) performed the awareness and capacity building of the communities.

Figure D shows the urban sites. The community sanitation option (SANIMAS) and the sewerage with treatment option are both from the site of Banjarmasin. In 2009, the SANIMAS systems were utilized by 70% of the intended beneficiaries, and the sewerage system was operating at 14% of its capacity, thus the actual average cost per household for both sanitation options was much higher than the optimal cost.

E2. HEALTH BENEFITS

Health care is the main contributor to costs averted in the move from open defecation to improved sanitation, representing between 60% and 70% of total health costs in both rural and urban sites (Figure E). The savings per household are higher in rural areas due to higher baselines of disease, and savings decline significantly with subsequent moves up the sanitation ladder.

TABLE B: RURAL AREA EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARING DIFFERENT POINTS ON THE SANITATION LADDER

Efficiency measure	Scenario	Lamongan: Moving from shared latrine to private septic tank	Lamongan: Moving from private wet latrine to private septic tank	Tangerang: Moving from community latrine to private septic tank
Benefits per US$ input	Optimal	2.9	1.9	3.5
	Actual	2.4	1.6	2.7
Internal rate of return (%)	Optimal	92%	36%	86%
	Actual	62%	21%	58%

TABLE C: URBAN AREA EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARING DIFFERENT POINTS ON THE SANITATION LADDER

Efficiency measure	Scenario	Banjarmasin: Moving from shared/community latrine to		Malang: Moving from private wet latrine to communal sewerage
		Private septic tank	Private toilet with sewerage	
Benefits per US$ input	Optimal	1.9	0.3	0.7
	Actual	1.2	0.2	0.6
Internal rate of return (%)	Optimal	48%	-7%	0%
	Actual	17%	-8%	-2%

FIGURE C: BREAKDOWN OF ANNUAL ECONOMIC COSTS PER RURAL HOUSEHOLD (US$)

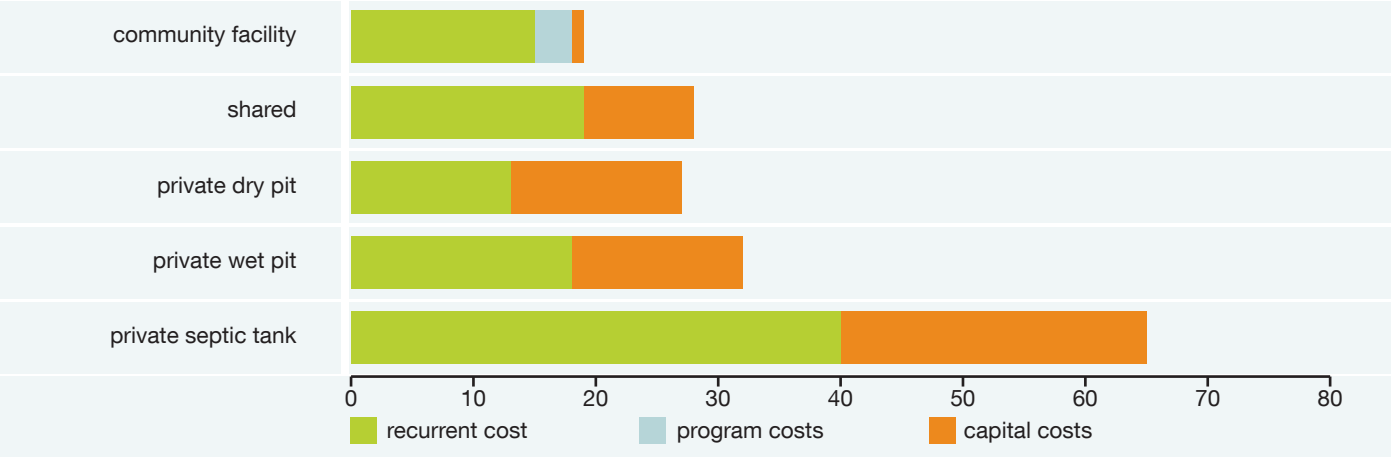


FIGURE D: BREAKDOWN OF ANNUAL ECONOMIC COSTS PER URBAN HOUSEHOLD (US$)

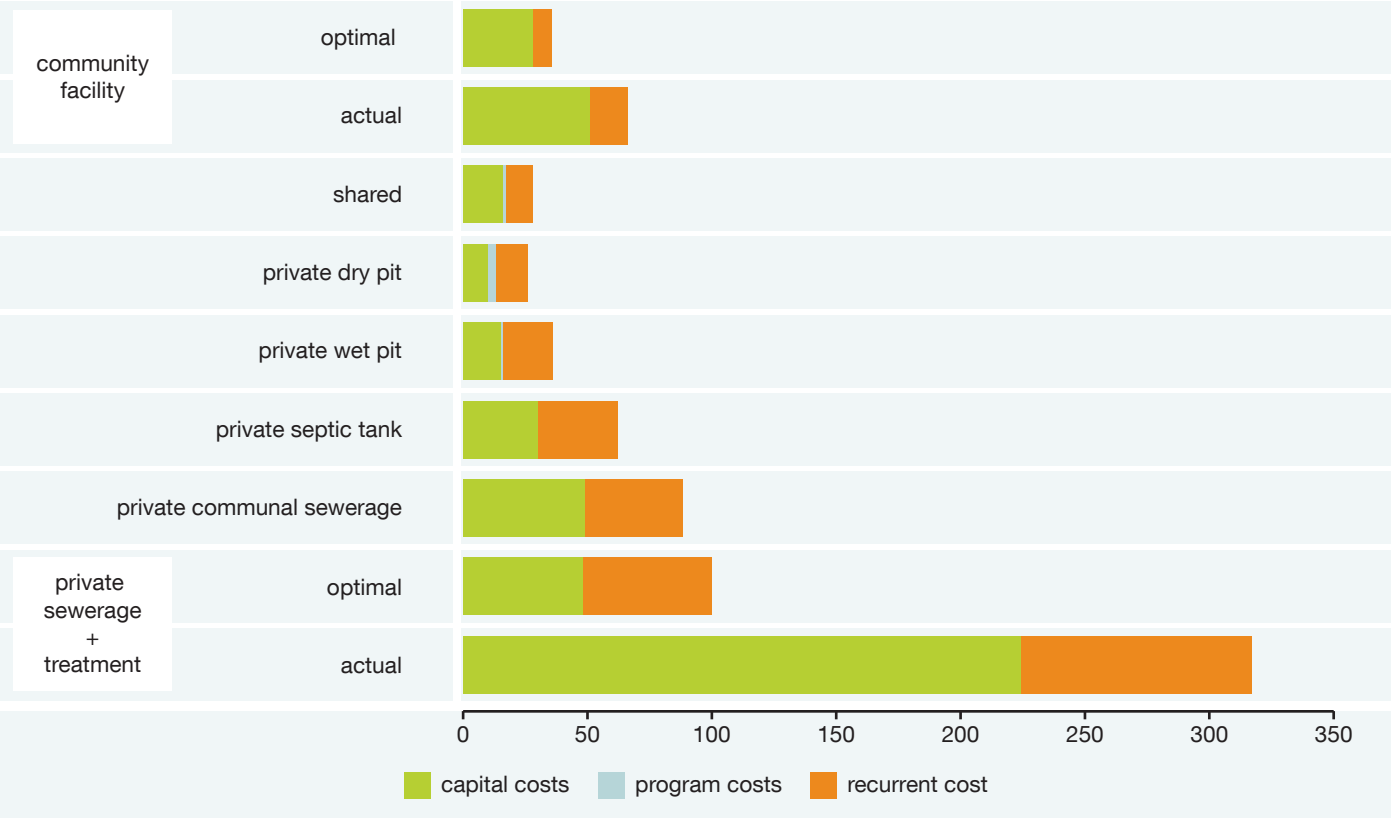
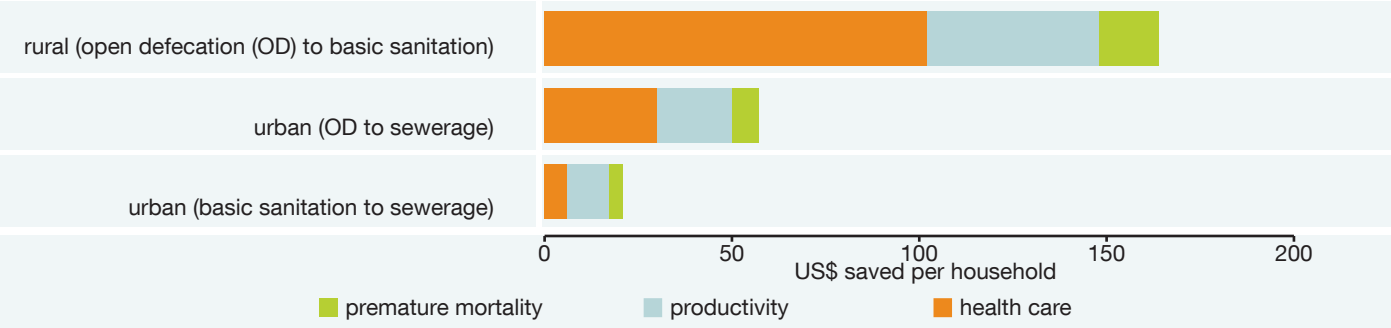


FIGURE E: HEALTH COSTS AVERTED OF IMPROVED SANITATION OPTIONS



E3. WATER BENEFITS

Drinking water treatment costs are higher than the costs of obtaining the water in all study sites. In Banjarmasin, a city with many rivers, households spend much more on water treatment and for water access compared with the other study sites. The economic cost of treating drinking water is greater than the cost incurred in accessing water.

Annual average costs saved per household are calculated based on the assumption that after 100% improved sanitation is achieved, a cheaper treatment method can be chosen. Table D depicts annual incurred costs of water treatment and annual average saved costs per household following 100% sanitation improvement. The cost savings are lower than the total costs incurred because it is assumed that the majority of households do not change their behavior due to force of habit.

E4. ACCESS TIME SAVINGS

Time saving is one of the major benefit value drivers in the CBA calculation. The average annual value of potential time saved per household is shown in the Figure F. The time benefit values are calculated under the following assumptions:

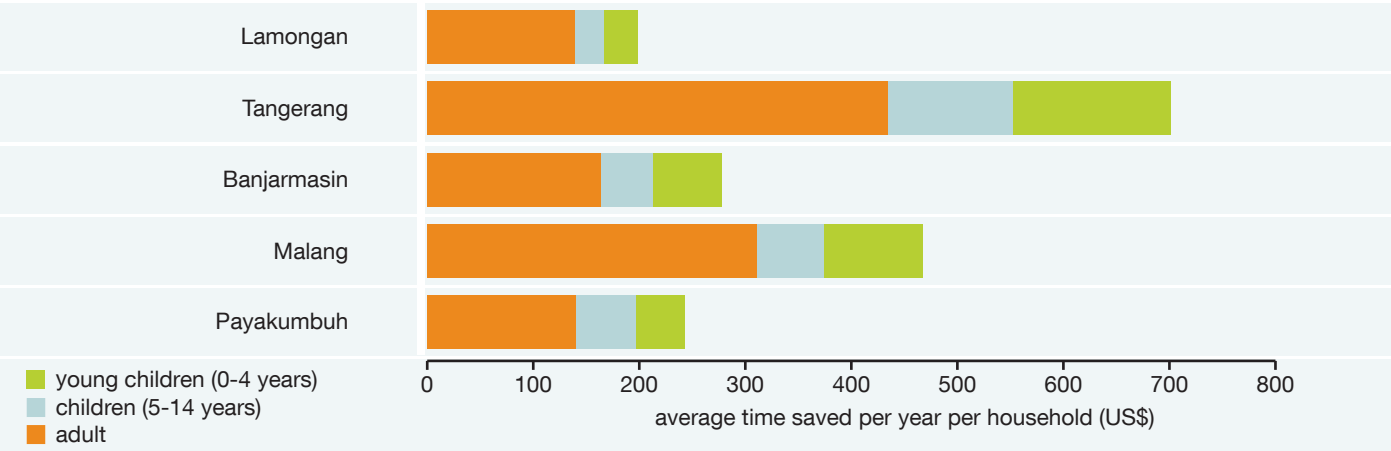
- Access time savings are obtained when a household has private access to an improved toilet at their home.
- The value of time saved per year is equivalent to 30% of the average annual income for adults. For children, half of the value of adults is used, recognizing that the OD practices of children affect the time use of adults.
- The household income is based on the national average wage.

If a household has previously practiced open defecation and then changes to using a private toilet, they have the highest potential saved time. Households in Tangerang and Malang have the highest potential time saved compared with the other study sites. According to the Household Survey, the average travel/waiting time for people in Tangerang and Malang to reach and access defecation places (open land/waterway, shared latrine and community latrine) are the highest i.e. longer than 8 minutes per round trip. Meanwhile, similar access time in the other sites is below 6 minutes per round trip. Therefore, people in Tangerang and Malang have the highest potential saved time if they all have a private toilet (Figure F).

TABLE D: WATER ACCESS AND HOUSEHOLD TREATMENT COSTS INCURRED AND AVERTED (US$)

Variable	Annual average costs per household		Annual average costs saved per household following 100% sanitation coverage	
	Water source access	Water treatment	Water source access	Water treatment
Lamongan	6	14	1	1
Tangerang	8	15	1	1
Banjarmasin	12	34	2	11
Malang	8	21	1	3
Payakumbuh	10	23	1	2

FIGURE F: AVERAGE POTENTIAL TIME SAVED PER YEAR PER HOUSEHOLD



E5. INTANGIBLE BENEFITS OF SANITATION OPTIONS

For households who currently have no toilet, they perceive that "proximity" and "cleanliness" are the most important factors for getting a toilet, followed by "not having to share", "privacy", "non-pollution" and "comfort" (see Figure G). Due to technical challenges in converting these intangible benefits into economic values, as well as distinguishing the value of each one separately (such as from a willingness-to-pay survey), these impacts were not monetized.

E6. TOURISM BENEFITS

Tourism is an important economic activity in Indonesia. In 2008, it provided US$7.4 billion of revenue, the third highest contributor of foreign exchange revenues, after oil and gas and palm oil. It also provides an important source of local government tax income, as well as jobs for 6.7 million Indonesians.

This study attempted to explore the impacts of general sanitary conditions on tourists' preferences to visit Indonesia and recommend Indonesia to their family and friends as a desirable holiday destination. Beside tourists on holiday, business visitors were also included in the survey. Figure H shows respondents' perceptions of general sanitary conditions of public places in cities, which generally are poorer than in private places, such as hotels, swimming pools, and restaurants. This shows that they perceived a considerable gap in sanitary conditions between different places in Indonesia.

Tourists and business visitors gave their opinions on what aspects of sanitation concerned them the most when visiting Indonesia. Each respondent could choose a maximum of three factors. Figure I shows that food was the highest ranked factor, followed closely by drinking water (including bottled water) and unsanitary toilets. The availability of public toilets was also a concern ranked by 10% of visitors. Also of concern to business visitors especially was the handling of currency notes.

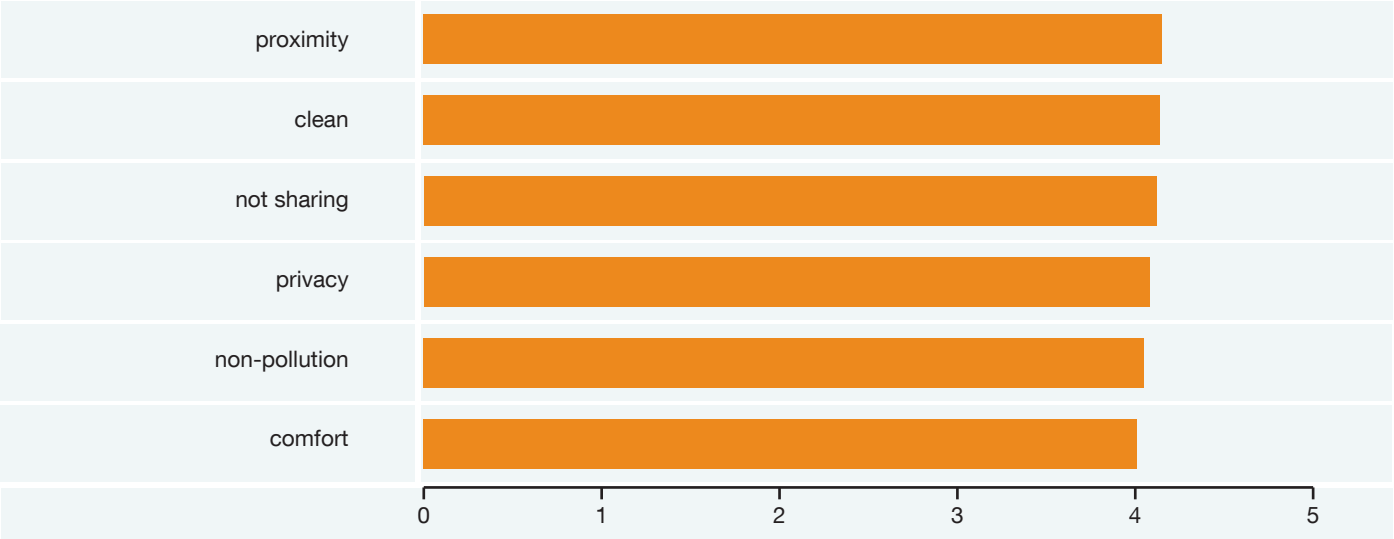
E7. BUSINESS BENEFITS

The business survey was conducted in Jakarta and Bandung and covered restaurants, hotels, a garment factory and food processing industries. Most companies stated that among other factors as indicated in Figure J, pleasant environment for staff (which is represented by cleanliness, good air quality and good sanitation) is the most important factor to consider in locating their business. Workers' health and availability of good quality water are other sanitation-related factors stated as being important by the interviewed businesses.

E8. PROGRAM PERFORMANCE

The Program Approach Analysis (PAA) contrasts and compares the key indicators of impact for assessment of program effectiveness in relation to different impacts of improved sanitation. Table E shows selected indicators of financing and program performance. The key indicator "% household members using their improved toilet regularly", which was used to calculate health and access time

FIGURE G: THE IMPORTANT FACTORS OF HAVING A TOILET (AVERAGE SCORE OF RESPONDENTS, RANKED FROM NOT IMPORTANT = 1 TO VERY IMPORTANT = 5)



benefits under actual program conditions (for use in the cost-benefit analysis), varied from 70% in Banjarmasin to 84% in both Payakumbuh and Malang. However, as shown in the lower part of Table E, other indicators of sanitation practices show quite significant non-use of sanitation facilities by children. Rates of handwashing at critical times are below 50% in Tangerang, Banjarmasin and Malang. For the majority of sanitation options and sites, financing was provided by the household. Community toilets were largely funded from non-household sources in Tangerang and Banjarmasin; while sewerage solutions were also largely funded from non-household sources in Malang and Banjarmasin.

FIGURE H: GENERAL SANITARY EXPERIENCE (SCORE: 5 = VERY GOOD, 1 = VERY POOR)

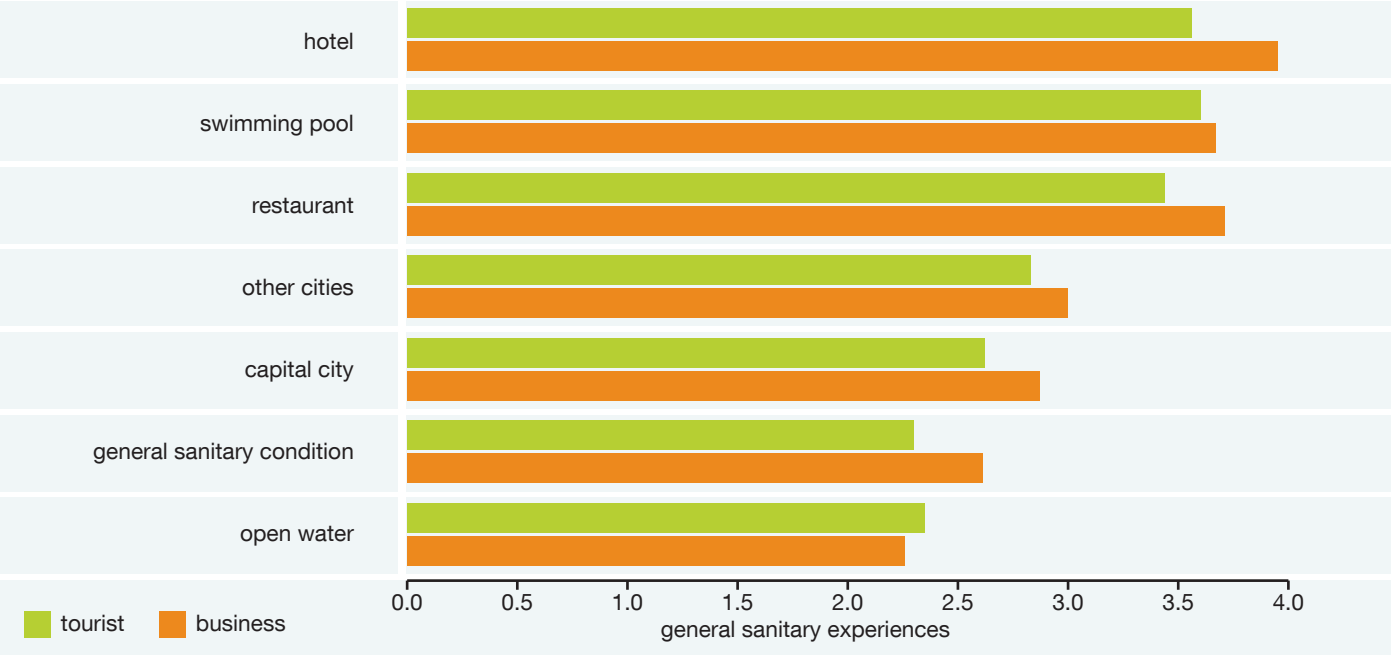


FIGURE I: SANITATION FACTORS CONCERNING VISITORS WHEN VISITING INDONESIA (UP TO 3 RESPONSES POSSIBLE PER RESPONDENT)

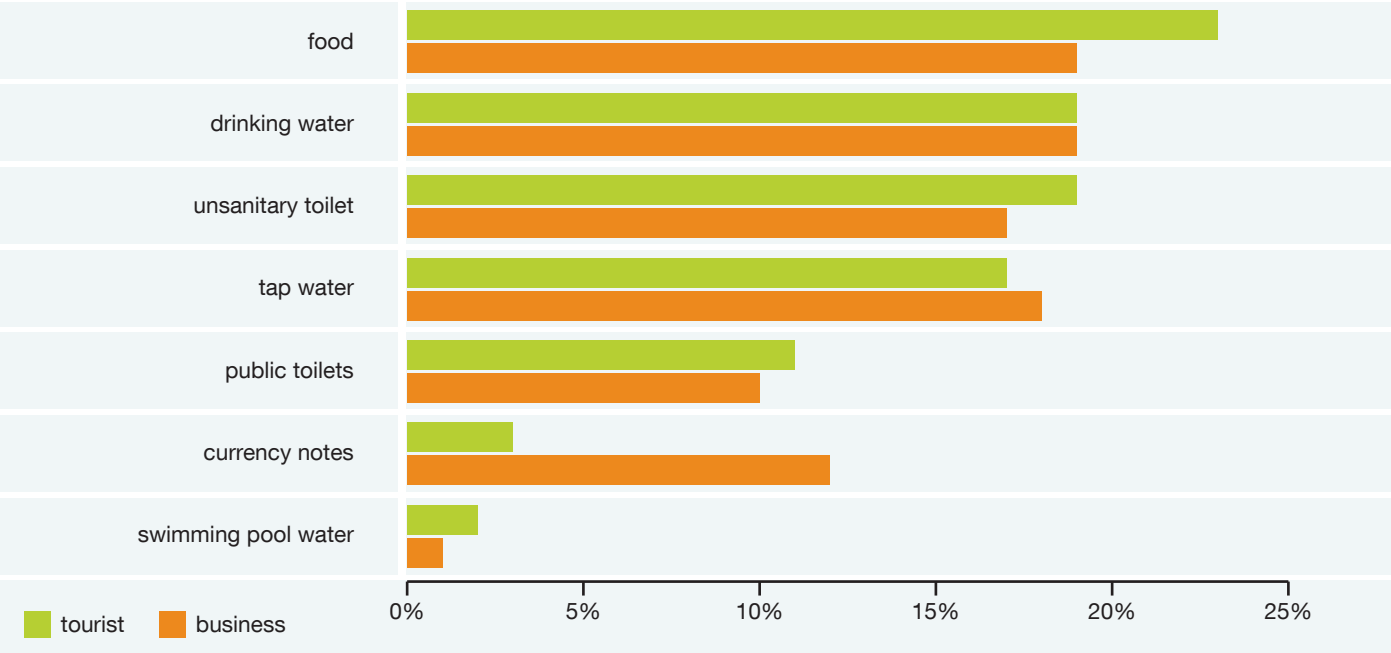


FIGURE J: IMPORTANCE OF ENVIRONMENTAL SANITATION CONDITIONS FOR LOCATING THE COMPANY (1 = UNIMPORTANT; 5 = IMPORTANT)

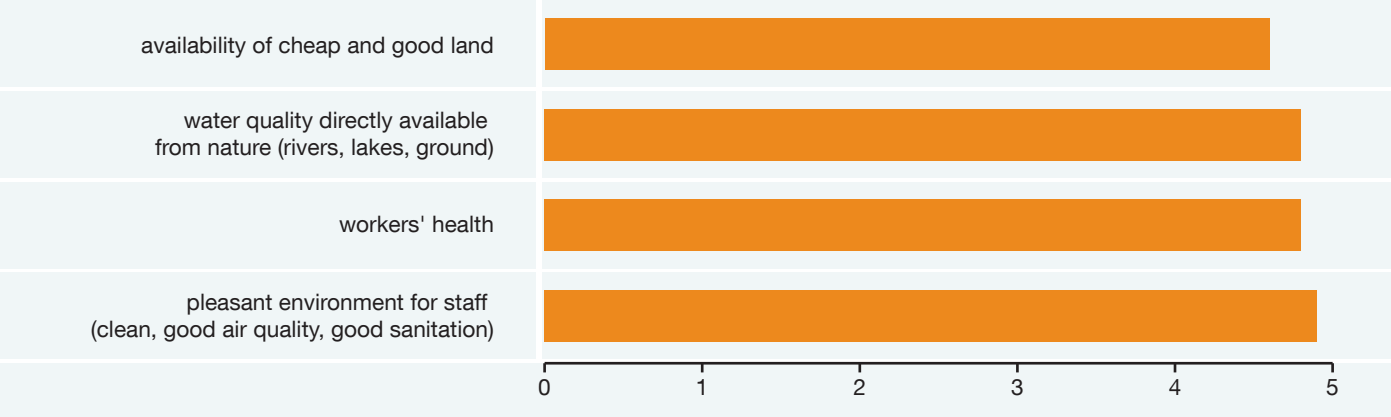


TABLE E: SELECTED INDICATORS OF FINANCING AND PROGRAM EFFECTIVENESS

Variable	Rural sites		Urban sites		
	Lamongan	Tangerang	Banjarmasin	Malang	Payakumbuh
Years of program	7	1	Still ongoing	13	Still ongoing
% household members using their improved toilet regularly	81%	82%	70%	84%	84%
HOUSEHOLD CONTRIBUTION TO COST (FINANCIAL & NON-FINANCIAL)					
Community	100%	30%	11%	na	na
Shared	100%	100%	100%	100%	82%
Private dry pit	100%	100%	100%	100%	0%
Private wet pit	100%	100%	100%	100%	71%
Private septic tank	100%	100%	100%	100%	100%
Private sewerage	na	na	9%	na	na
Community sewerage	na	na	na	37%	na
SANITATION PRACTICES AMONG HOUSEHOLDS:					
Using bush for defecation (sometimes or often)	16%	20%	2%	1%	17%
Using bush for urination (sometimes or often)	23%	29%	2%	4%	26%
Children using latrine	12%	13%	12%	57%	5%
Children defecating in yard	39%	55%	29%	31%	36%
Washed hands with soap yesterday	96%	21%	12%	50%	94%
Washing hands after defecation (sometimes or often)	87%	4%	7%	32%	84%

F. CONCLUSIONS

The study results reveal that all sanitation interventions are economically feasible at rural sites. The actual benefit-cost ratio or BCR values range from 2 (private septic tank in Lamongan district) to 6 (community and private pour-flush toilets in Tangerang district). As payback periods are short, the internal rates of return are very high, exceeding 100% in many cases. At urban sites, all sanitation ladder options are economically feasible at their optimal utilization, with BCR values ranging from 1.1 for private toilet connected to the sewerage system in Banjarmasin to 4 for private wet pit in Malang city. In practice, below optimal capacity utilization at project sites leads to reductions in some BCR values to below 1.

The benefit value drivers in the quantitative analysis includes the costs related to sickness, such as physician's fee, medicines and transport to health facilities, as well as saving time from not traveling to a site of open defecation or queuing at public toilets. Marginal benefits have been valued related to averted pollution of local water sources and reduced travel or treatment costs; however, the actual economic benefits are likely to be significantly greater than those valued in this study. Among the valued benefits, the health benefits will most likely lead to financial savings for households as well as health care providers. Therefore, decreased risks to health as a consequence of having better sanitation would lead to reduced household spending for health-seeking efforts, thus safeguarding cash resources for other uses.

As well as the above quantitative BCR results, there are also non-monetized benefits that should be considered to justify any sanitation investment. People may consider paying a higher price to acquire intangible benefits such as comfort, privacy, cleanliness and environmental improvements. Women and the elderly are particularly likely to enjoy these benefits. As well as individual and community-scale benefits, an improved environment can also have positive knock-on effects on tourism and business, as well as generating employment and value through a thriving sanitation supply market.

The results point to the finding that, in order to have efficient and economically feasible sanitation interventions – particularly for a sewerage system and a community toilet (SANIMAS) – the most important conditions are to increase the utilization of the facilities towards the optimal level (100%) and to increase the capacity utilization of the treatment facility. The results of sensitivity analysis also point to the uncertainty surrounding the benefits obtainable from improved sanitation, and hence their economic feasibility. The choice of conservative input values in the baseline assessment and the omission of several benefits from the quantitative analysis, suggest that the benefit-cost ratios will be higher – possibly significantly higher – than those reported in the baseline assessment.

G. RECOMMENDATIONS

The development of sanitation in Indonesia has become a national issue. The Government of Indonesia has placed the sanitation developments among the national priorities, declared in the 2nd National Sanitation Conference, December 2009. The Sanitation Technical Team has initiated a national "giant step" of sanitation development by means of organizing the Acceleration of Settlement Sanitation Development Program (PPSP) 2010-2014. One of the targets is for Indonesia to be free of open defecation by the end of 2014, or earlier.

The ESI cost-benefit results can contribute to several of the six PPSP stages, which are (1) advocacy, (2) institutional preparation, (3) City Sanitation Strategy, (4) detailed technical proposals, (5) implementation, and (6) monitoring and evaluation.

Advocacy requires robust and convincing data and information to present the importance of sanitation improvement at household, community and national level. Decision makers at central, provincial and local levels can each utilize the study results as evidence of the economic importance of sanitation, thus leading to demand creation for sanitation.

The City Sanitation Strategy can use the CBA model to enrich its Environmental Health Risks Assessment (EHRA) study. The outcomes of such a study demonstrate not only indicative health risks of particular areas, but also potential quantitative benefits that might be acquired should the sanitation condition in the areas be improved.

The detailed technical proposals – whose aim is to obtain commitments of contribution from stakeholders – can gain from field evidence on the costs and potential cost-benefits of improved sanitation and hygiene programs, as well as information on the actual performance of different programs.

Monitoring and evaluation can learn from the frameworks used in this study, such as the CBA and PAA models, which are tools to periodically measure performance of sanitation

programs during and after implementation. Sanitation financiers and implementers will be able to assess to what extent the implemented sanitation programs have achieved their goals and targets, and the division of the total benefits amongst the different beneficiaries and stakeholders. In the long run such assessments are expected to increase program sustainability.

Three further overarching recommendations for decision makers are proposed:

1. **Intensify efforts to improve access for the entire Indonesian population to improved basic sanitation.** Indonesia approved a sound community-based sanitation strategy in 2008 that needs to be implemented, and enough evidence is available to show that establishing a viable sanitation market – where demand by all income levels meets affordable and good quality supply – is feasible. For policy makers and local governments, this requires special attention to ensure demand is triggered, health benefits are captured, and coverage is sustained (i.e., avoiding returning to open defecation). Sanitation providers, from wholesalers to community-based masons, need to improve on affordable, upgradable latrine structures and design to ensure widespread uptake. Information on sanitation options and models for households everywhere in Indonesia is another key element for rapidly accelerating and sustaining coverage.

2. **Go beyond basic sanitation provision, where the population demands it and the funding is available.** In densely populated urban areas, only basic sanitation provision is no longer feasible due to the higher expectations of populations, space constraints and risks of groundwater pollution. Decision makers should therefore be aware of the full range of conveyance and treatment options, and their related costs and benefits, in order to avoid investing in expensive technologies that are difficult and costly to sustain. In municipalities where funding is sufficient to permit more sustained and quality services, these will better capture the full environmental and health benefits and respond to the population's wish for a clean, liveable environment.

3. **Promote evidence-based sanitation decision-making.** Variation in economic performance of sanitation options suggests that careful consideration of site conditions and local demand and preferences is needed to select the most appropriate sanitation option and delivery approach. Decisions should take into account not only the measurable economic costs and benefits, but also other key factors for a decision, including intangible impacts and socio-cultural issues that influence demand and behavior change, availability of suppliers and private financing, and actual household willingness and ability to pay for services.

Foreword

The Economics of Sanitation Initiative (ESI) was first launched in 2007 as a response by the Water and Sanitation Program (www.wsp.org) to major gaps in evidence among Southeast Asian countries on the economic aspects of sanitation. The initiative provides evidence that supports sanitation advocacy, elevates the profile of sanitation, and acts as an effective tool to convince governments to take action. The ESI Phase 1 found that the economic costs of poor sanitation and hygiene amounted to over US$9.2 billion a year (2005 prices) in Cambodia, Indonesia, Lao PDR, the Philippines, and Vietnam. The ESI Phase 2 analyzes the costs and benefits of alternative sanitation interventions and will enable stakeholders to make decisions on how to spend funds allocated to sanitation more efficiently. Due to the successful traction the study has gained in the East Asia and Pacific region, ESI has extended to Africa, South Asia and Latin America and the Caribbean.

In recognition of sanitation as a key aspect of human development, target 10 of the Millennium Development Goals includes access to safe sanitation: "to reduce by half between 1990 and 2015 the proportion of people without access to improved sanitation". This reflects the fact that access to improved sanitation is a basic need: at home as well as when at the workplace or school, people appreciate and value a clean, safe, private and convenient place to urinate and defecate. Good sanitation also contributes importantly to achieving other development goals such as child mortality reduction, school enrolment, nutritional status, gender equality, clean drinking water, environmental sustainability and improved quality of life of slum dwellers.

Despite its recognized importance, sanitation continues to lose ground to other development targets when it comes to priority setting by governments, households, private sector and donors. This fact is hardly surprising given that sanitation remains a largely taboo subject in society, neither is it an 'attractive' subject for media to promote as a worthy cause or politicians to stake their career on. Furthermore, limited data exist on the tangible development benefits of sanitation for decision makers to justify making it a priority in government or private spending plans.

Based on this premise, the World Bank's Water and Sanitation Program (WSP) is leading the Economics of Sanitation Initiative to compile existing evidence and to generate new evidence on socio-economic aspects of sanitation. The aim of ESI is to assist decision-makers at different levels to make informed choices on sanitation policies and resource allocations.

In Indonesia, Phase 1 was completed in 2008, which estimated the economic and social impacts of unimproved sanitation on the population and economy of Indonesia, among other countries of Southeast Asia. The study showed that the economic impacts of poor sanitation are US$6.3 billion per year for Indonesia, or US$28.6 per capita. This is equivalent to 2.3% of annual GDP. These and other results were disseminated widely to national policy makers, sector partners, and decentralized government levels of Indonesia.

The current volume reports ESI Phase 2, which examines in greater depth the costs and benefits of specific sanitation interventions in a range of field settings in Indonesia. The purpose is to provide information to decision makers on the impact of their decisions relating to sanitation – to understand the costs and benefits of improved sanitation in selected rural and urban locations, as well as to enable a better understanding of the overall national level impacts of improving sanitation coverage in Indonesia, such as on tourism and businesses. On the cost side, decision makers and stakeholders need to understand more about the timing and size of costs (e.g. investment, operation, maintenance), as well as financial versus non-financial costs, in order to

make the appropriate investment decision that increases intervention effectiveness and sustainability. On the benefit side, the monetary as well as non-monetary impacts need to be more fully understood in advocating for improved sanitation as well as making the optimal sanitation choice. For cost-benefit estimations, a sample of sites representing different contexts of Indonesia was selected to illustrate the range and sizes of sanitation cost and benefits and to assess efficiency of sanitation interventions.

The research under this program is being conducted in four other countries: Cambodia, Lao PDR, Philippines and Vietnam, as well as covering Yunnan Province in the People's Republic of China. While WSP has supported the development of this study, it is an 'initiative' in the broadest sense, which includes the active contribution of many people and institutions (see Acknowledgment).

Abbreviations and Acronyms

ADB	Asian Development Bank
ALOS	Average Length of Stay (in hospital)
ALRI	Acute Lower Respiratory Infection
AMPL	*Air Minum dan Penyehatan Lingkungan* (Drinking Water and Environment Restoration)
APBD	*Anggaran Pendapatan dan Belanja Daerah* (Local budget)
APBN	*Anggaran Pendapatan dan Belanja Negara* (National budget)
ASSDP/PPSP	The Acceleration of Settlement Sanitation Development Program/ *Percepatan Pembangunan Sanitasi Permukiman*
AusAID	Australian Agency for International Development
BAPPENAS	The Indonesian National Development Planning Agency
BCR	Benefit-Cost Ratio
BEST	*Bina Ekonomi Sosial Terpadu* (Integrated Social Economy Development)
BOD	Biochemical Oxygen Demand
BORDA	Bremen Overseas Research and Development
BPLHD	Local Environmental Management Agency
CBA	Cost-Benefit Analysis
CBS	Community-Based Sanitation
CBSS	Community-Based Sewer System
CER	Cost-Effectiveness Ratio
CLTS	Community-Led Total Sanitation
COD	Chemical Oxygen Demand

CSS	City Sanitation Strategy
CWSHP	Community Water, Sanitation and Health Project
DALY	Disability-Adjusted Life-Year
DEP	Detailed Engineering Program
DEWATS	Decentralized Wastewater Treatment System
DHS	Demographic and Health Survey
DO	Dissolved Oxygen
EAP	East Asia and the Pacific region
E. coli	Escherichia coli
ESA	External Support Agency
ESI	Economics of Sanitation Initiative
FGD	Focus Group Discussion
FY	Financial Year
GDP	Gross Domestic Product
GNP	Gross National Product
GRP	Gross Regional Product
HCA	Human Capital Approach
HH	Household
HWWS	HandWashing With Soap
IBRD	International Bank for Reconstruction and Development
IDS	Institute of Development Studies, University of Sussex, UK

IEC	Information, Education, and Communication
IRR	Internal Rate of Return
ISSDP	Indonesia Sanitation Sector Development Program
JAMKESKO	*Jaminan Kesehatan Kota* (Urban Health Insurance)
JMP	Joint Monitoring Programme, of WHO and UNICEF
kg	Kilograms
KLH	*Kementerian Lingkungan Hidup* (Ministry of Environment)
KUDP	Kalimantan Urban Development Project
LIPI	*Lembaga Ilmu Pengetahuan Indonesia* (The Indonesian Institute of Science)
LP3ES	*Lembaga Penelitian, Pendidikan dan Penerangan Ekonomi* (Institute for Social and Economic Research, Education, and Information)
MCK	*Mandi Cuci Kakus* (public toilet)
MCK ++	MCK that is also designed to produce biogas
MDG	Millennium Development Goal
mg/l	Milligrams per liter
MoH	Ministry of Health
MPW	Ministry of Public Works
NGO	Non-Governmental Organization
NPV	Net Present Value
NTB	Nusa Tenggara Barat/West Nusa Tenggara (Province)
NTT	Nusa Tenggara Timur/East Nusa Tenggara (Province)
OD	Open Defecation

ODF	Open Defecation Free
O&M	Operations and Maintenance
P2KP	*Program Pengentasan Kemiskinan di Perkotaan* (Urban Poverty Alleviation Program)
PAA	Program Approach Analysis
Pamsimas	*Penyediaan Air Minum dan Sanitasi Berbasis Masyarakat* (Community-based water supply and sanitation)
PBP	Payback Period
PD PAL	*Perusahaan Daerah Pengelolaan Air Limbah* (local wastewater management company)
PDAM	*Perusahaan Daerah Air Minum* (local government-owned drinking water enterprise)
PHBS	*Perilaku Hidup Bersih Sehat* (Health and Hygiene Behavior)
PPLP	*Pengendalian Penyakit dan Penyehatan Lingkungan* (Disease Control and Environmental Health)
Puskesmas	*Pusat Kesehatan Masyarakat* (Community Health Center)
Puslitbang SDA/ PusAir	*Pusat Penelitian dan Pengembangan Sumber Daya Air* (Center of Research and Development on Water Resources)
RBC	Rotating Biological Contactor
SANIMAS	*Sanitasi Berbasis Masyarakat* (Community-Based Sanitation)
SANTT/TTPS	Sanitation Technical Team/ *Tim Teknis Pembangunan Sanitasi*
SDG	Sanitation Donor Group
SPAL	*Sistem Penyaluran Air Limbah* (collection network/sewerage system)
STBM	*Sanitasi Total Berbasis Masyarakat* (Community-Based Total Sanitation)

STP	Sewage Treatment Plant
SUSENAS	*Survei Sosial Ekonomi Nasional* (national socio-economic survey)
TSSM/SToPs	Total Sanitation and Sanitation Marketing/*Sanitasi Total dan Pemasaran Sanitasi*
UKS	*Unit Kesehatan Sekolah* (School Health Unit)
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USDP	Urban Sanitation Development Program
VOSL	Value of Statistical Life
WASPOLA	Water and Sanitation Policy Formulation and Action Planning
WB	World Bank
WC	Water Closet
WHO	World Health Organization
WSLIC	Water and Sanitation for Low Income Communities
WSP	Water and Sanitation Program
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

Glossary of Terms

Benefit-cost ratio (BCR): The amount by which an intervention's benefits exceed the same intervention's costs. Technically: the ratio of the present value of the stream of benefits to the present value of the stream of costs. The higher the ratio, the more efficient the intervention.

Cost per case averted: The discounted value of the costs for each case of a disease that is avoided resulting from an intervention.

Cost per DALY averted: The discounted value of the costs for each DALY that is avoided resulting from an intervention.

Cost per death averted: The discounted value of the costs for each death that is avoided resulting from an intervention.

Cost-effectiveness ratio (CER): The ratio of the present value of the future costs to the present value of the future health benefits in non-monetary units (cases, deaths, disability-adjusted life-years). The lower the CER the more efficient the intervention.

Diarrhea: The passage of three or more loose or liquid stools per day, or more frequently than is normal for the individual. It is usually a symptom of gastrointestinal infection, which can be caused by a variety of bacterial, viral and parasitic organisms. Infection is spread through contaminated food or drinking-water, or from person to person as a result of poor hygiene.

Disability-Adjusted Life-Year (DALY): a measurement of the gap between current health status and an ideal health situation where the entire population lives to an advanced age, free of disease and disability. One DALY can be thought of as one lost year of "healthy" life (WHO 2010).

Ecological sanitation (EcoSan)[1]: a new paradigm in sanitation that recognizes human excreta and water from households not as waste but as resources that can be recovered, treated where necessary and safely used again. It is based on the systematic implementation of reuse and recycling of nutrients and water as a hygienically safe, closed-loop and holistic alternative to conventional sanitation solutions (GTZ, 2009). The objectives are to offer economically and ecologically sustainable systems that aim to close the natural nutrient and water cycle. The approach is based on the systematic implementation of reuse and recycling of nutrients and water as a hygienically safe, closed-loop and holistic alternative that seeks to protect public health, prevent pollution and at the same time return valuable nutrients and humus to the soil.

Externality: an externality is a consequence of an activity that is experienced by unrelated third parties. An externality can be either positive or negative. In the case of a sanitation intervention in a community practicing open defecation, a positive externality can result, whereby benefits extend beyond the households practicing improved sanitation, such as preventing surface and ground water pollution, reducing bad odors and improving outward (visual) appearances. An important positive externality in the case of sanitation is the reduced levels of disease, thus impacting labor force productivity.

[1] http://www.ecosan.nl

Helminthes: Parasitic worms that live and feed off living hosts, receiving nourishment and protection while disrupting their hosts' nutrient absorption, causing weakness and disease.

Hepatitis A: Acute infectious disease of the liver caused by the hepatitis A virus, which is commonly transmitted by the fecal-oral route via contaminated food or drinking water.

Hepatitis E: A viral hepatitis (liver inflammation) caused by infection with a virus called hepatitis E virus (HEV). HEV is transmitted via the fecal-oral route.

Improved sanitation: The use of the following facilities in the home compound: flush/pour-flush to piped sewer system/septic tank/pit latrine, ventilated improved pit (VIP) latrine, pit latrine with slab, or composting toilet (JMP, 2008).

Income elasticity of demand: Measures the responsiveness of the demand for a good to a change in the income of the people demanding the good. It is calculated as the ratio of the percentage change in demand to the percentage change in income. For example, if, in response to a 10% increase in income, the demand for a good increased by 20%, the income elasticity of demand would be 20%/10% = 2.

Intangible impact: An identifiable non-monetary consequence of an intervention that cannot be easily seen, touched or physically measured. It is a gain or loss that cannot be sufficiently quantified for purposes of accounting or financial reporting, but that contributes to changes in quality of life and project performance such as employee morale, work or life satisfaction, or quality of environment. Intangible benefits of improved sanitation include, for example, quality of life, comfort, security, dignity, personal and cultural preferences, among others.

Internal rate of return: A measure used to compare the profitability of alternative uses of investment funds (or 'projects'). It is the interest (or 'discount') rate at which the net present value (NPV) of costs (negative cash flows) of the investment equals the net present value of the benefits (positive cash flows) of the investment. In other words, the interest rate for which the BCR equals unity (1).

Lifecycle costs: A costing analysis that takes into account not only the investment costs, but also operations and maintenance – hence giving a fuller picture of the commitment in future expenditures needed to keep a sanitation system running over its expected lifespan.

Malaria: A mosquito-borne infectious disease caused by a eukaryotic protest of the genus Plasmodium.

Malnutrition: The insufficient, excessive or imbalance of nutrient consumption.

Net benefit: The monetary difference between present value of the future stream of benefits to the present value of the future stream of costs.

Net present value (NPV): The discounted value of the current and future stream of net benefits from a project. The NPV, a time series of cash flows, both incoming and outgoing, is the sum of the present values of the individual cash flows. In the case when all future cash flows are incoming (such as coupons and principal of a bond) and the only outflow of cash is the purchase price, the NPV is simply the present value of future cash flows minus the purchase price.

Open defecation: The practice of disposing human feces in fields, forests, bushes, open bodies of water, beaches or other open spaces or disposed of with solid waste (JMP, 2008).

Payback period (PBP): Represents the number of periods (e.g. years) that are necessary to recover the costs incurred until that time point (i.e. investment plus recurrent costs). For example, a $1000 investment which returned $500 per year would have a two-year payback period. Payback period intuitively measures how long something takes to "pay for itself."

Septic tank: Rectangular chamber, usually sited just below ground level, that receives and partially treats brown water from flush toilets, and can include other household wastewater.

Unimproved sanitation: The use of the following facilities: flush/pour flush without isolation or treatment, pit latrine without slab/open pit, bucket, hanging toilet/hanging latrine, use of a public facility or sharing any improved facility, no facilities, bush or field (open defecation) (JMP, 2008).

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Other country reports:

Economic assessment of sanitation interventions in Cambodia. Sam Sok Heng, Guy Hutton, Poch Kongchheng, Kov Phyrum. Water and Sanitation Program. World Bank. 2011.

Economic assessment of sanitation interventions in Lao People's Democratic Republic. U-Primo Rodriguez, Guy Hutton, Alan Boatman. World Bank, Water and Sanitation Program. 2012.

Economic assessment of sanitation interventions in the Philippines. U-Primo Rodriguez, Guy Hutton, Nelissa Jamora, Dieldre Harder, Jeremy Ockelford and Edkarl Galing. World Bank, Water and Sanitation Program. 2011.

Economic assessment of sanitation interventions in Vietnam. Nguyen Viet Anh, Guy Hutton, Hoang Thuy Lan, Phan Huyen Dan, Le Thu Hoa, Bui Thi Nhung. World Bank, Water and Sanitation Program. 2012.

Economic assessment of sanitation interventions in Yunnan Province, People's Republic of China. Liang Chuan, Guy Hutton, Yang Liqiong, Fang Jinming, Zhang Tiwei, Dong Lin, Zhang Pu, Luo Ronghuai. World Bank, Water and Sanitation Program. 2011.

Regional synthesis report:

Economic assessment of sanitation interventions in Southeast Asia. Guy Hutton, U-Primo Rodriguez, Asep Winara, Nguyen Viet Anh, Sam Sok Heng, Kov Phyrum, Liang Chuan, Isabel Blackett, Almud Weitz. World Bank, Water and Sanitation Program. 2012.

Summary reports are available for each country, in both English and in the local languages. All country reports are accessible from http://www.wsp.org/pubs/index.asp

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Selected Development Indicators

Variables	Indonesia
Population	
Total population (millions, 2008)	227.78 million
Rural population (%)	51.7 %
Urban population (%)	48.3 %
Annual population growth (%) (2005-2010)	1.27 %
Under 5 population (% of total) (2007)	10.8 %
Under 5 mortality rate (deaths per 1,000) (2003-2007), IDHS	44.0
Female population (% of total) (2005)	49.7 %
Population below poverty line (%) (2006)	17.75 %
Economic	
Currency name	Indonesian Rupiah (IDR)
Year of cost data presented	2009
Currency exchange with US$ (2009 average)	10,387
GDP per capita (US$) (2009)	US$ 2,349
GDP per capita in International $, adjusted for purchasing power	I$ 4,205
Sanitation	
Improved total (%) (2008)	52 %
Improved rural (%) (2008)	36 %
Improved urban (%) (2008)	67 %
Sewerage connection (national, 2008) (%)	2 %
Open defecation (%) (2008)	26%

Sources: http://www.datastatistik-indonesia.com and World Bank Development Data

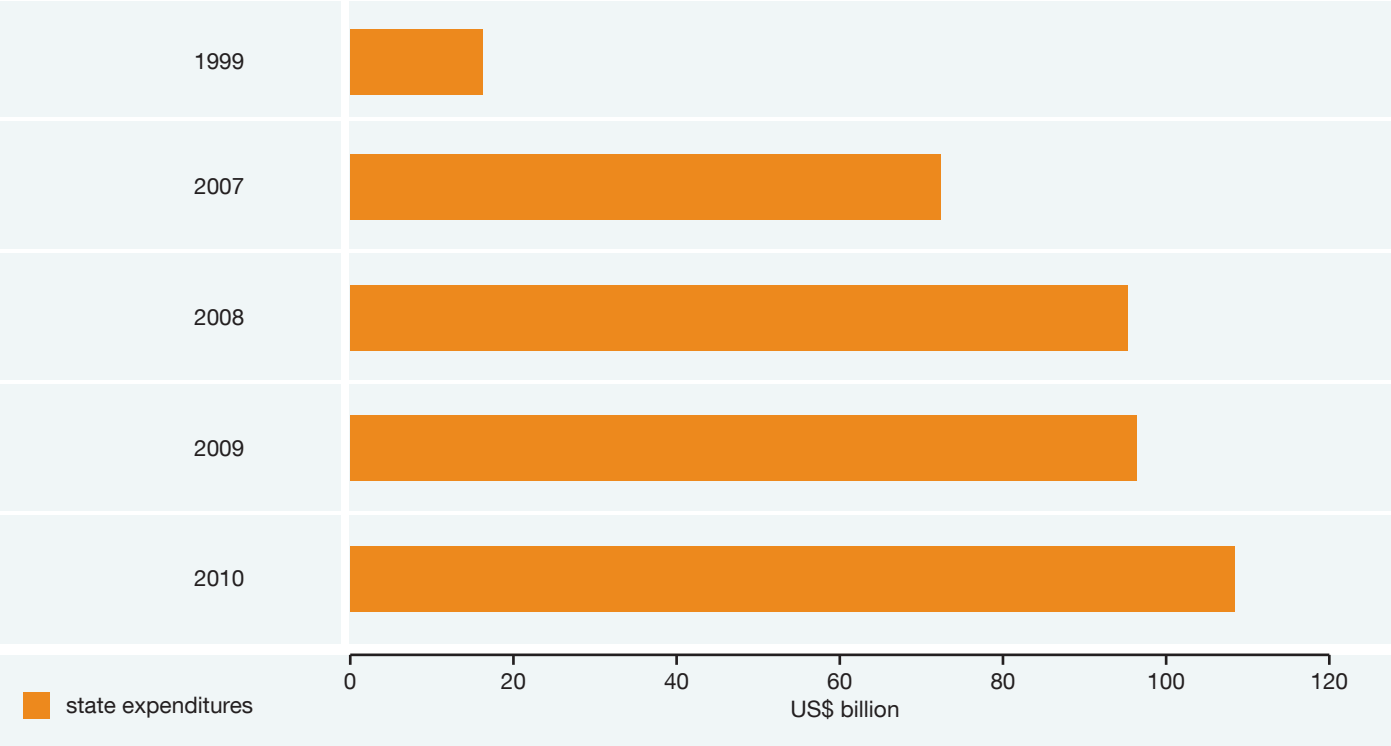
I. Introduction

1.1 BACKGROUND

Sanitation is receiving increasing attention from all levels of government in Indonesia, after being a largely forgotten issue in the past 15 years following Asian financial crisis of 1997-98 with its serious deleterious effect on the State budget. Recently the Government of Indonesia has made considerable efforts to mobilize additional resources in order to finance the country's needs for infrastructure projects. However, investment in sanitation remains less politically and financially attractive than sectors such as energy and transport, due to the tight monetary policy of the Government and the substantial State budget deficits. The annual budget allocations for sanitation remains insubstantial at 0.03% of national government spending in recent years[2]. Since 2010, a specific budget for sanitation exists (as opposed to be subsumed into water supply). Figure 1 shows the increasing State budget.

At the national level, there exists a cross-sectoral task team called Sanitation Technical Team (SanTT/TTPS), which was established in 2008 to promote the development of the

FIGURE 1: THE STATE BUDGET (APBN) DEVELOPMENT IN 1999 VERSUS THE LAST 4 YEARS[3]



[2] Financial Working Note, Urban Sanitation Development Program (USDP), 2009 and 2010.
[3] Ministry of Finance, Fiscal Policy Agency (*Badan Kebijakan Fiskal*), http://www.fiskal.depkeu.go.id

national sanitation sector. The TTPS consists of all government ministries involved in water and sanitation: National Development Planning Agency (BAPPENAS), Ministry of Public Works (MPW), Ministry of Health (MoH), Ministry of Home Affairs (MoHA), Ministry of Finance (MoF), Ministry of Environmental Affairs (MEA) and the Ministry of Industry (MoI). The team and its stakeholders, which includes the Sanitation Donor Group (SDG), have already delivered many sanitation-related initiatives both at national as well as local levels. This is part of the government's efforts to increase the access of improved sanitation facilities according to the Millennium Development Goal (MDG) target for water supply and sanitation.

According to the MDG declaration, Indonesia has committed to achieve 65.5% coverage of access to improved sanitation by the year 2015. The WHO/UNICEF Joint Monitoring Programme (JMP), which is responsible for monitoring the water and sanitation target, defines improved sanitation as access to own private toilet facility with excreta isolated with water seal or slab. In the report 'Results of National Basic Health Research' (RISKESDA), the National Socio-Economic Survey (SUSENAS) revealed in 2007 that 58.9% households have their own toilets (73.2% in urban areas and 49.9% in rural areas) and 12.1% of households use shared toilets (14.3% of urban areas and 10.7% in rural areas). Therefore, from the SUSENAS survey, sanitation access needs to increase by more than 7 percentage points nationally to achieve the MDG target. Using the JMP analyses of 2010, which apply different criteria for what is an improved latrine, access to improved sanitation stands at 52% in 2008 (67% in urban areas and 36% in rural areas), which is below the SUSENAS results, and more than 13% from the target.

The Indonesian Demographic and Health Survey (DHS) which was also utilized by the JMP to generate national coverage figures, has also presented different coverage figures. The survey, conducted in 2007, reported that 57% of all households have a private toilet, 10% of the households use shared facilities, and the remaining 33% do not have a toilet. Hence, this amounts to a proportion of persons with access to basic of sanitation — in this case private and shared toilets — to 67%, which is only a relatively small difference from SUSENAS result. According to DHS, the urban-rural differences of having a private toilet are quite significant: 75% of urban households compared to only 43% in rural areas enjoy the privilege of a private latrine. The JMP coverage figures of national sanitation coverage for 1990 and 2008 are depicted in the Table 1.

In line with cultural and economic diversity throughout the country, the sanitation coverage varied considerably between the 33 provinces that make up Indonesia. Figure 2 shows sanitation coverage by province according to SUSENAS 2007. Household ownership of an improved latrine varies from 25% to 80%, while in several provinces rates of open defecation remain above 40%.

However, there has not been any clear indicator with regards to the reason behind variations among provinces. For instance, the numbers and percentage of poor people in urban area by province does not give any positive correlations with the coverage of "Private Toilet" and "No Toilet." However, Nusa Tenggara Barat Province with the highest percentage of poor people in the urban area (28.84%) has the highest "No Toilet" and the second lowest "Private Toilet" coverage. Figure 3 shows the variation of toilet ownership by households in urban and rural areas.

TABLE 1: SANITATION COVERAGE IN INDONESIA – 1990 VERSUS LATEST YEAR (2008)

Coverage type	Rural (%)		Urban (%)		Total (%)	
	1990	2008	1990	2008	1990	2008
Improved	**22**	**36**	**58**	**67**	**33**	**52**
Unimproved	**78**	**64**	**42**	**33**	**67**	**48**
Shared	7	11	8	9	7	10
Unimproved facility	23	17	16	8	21	12
Open defecation	48	36	18	16	39	26

Source: WHO/UNICEF Joint Monitoring Programme for Water Supply & Sanitation, March 2010

FIGURE 2: SUB-NATIONAL SANITATION COVERAGE (SUSENAS 2007)

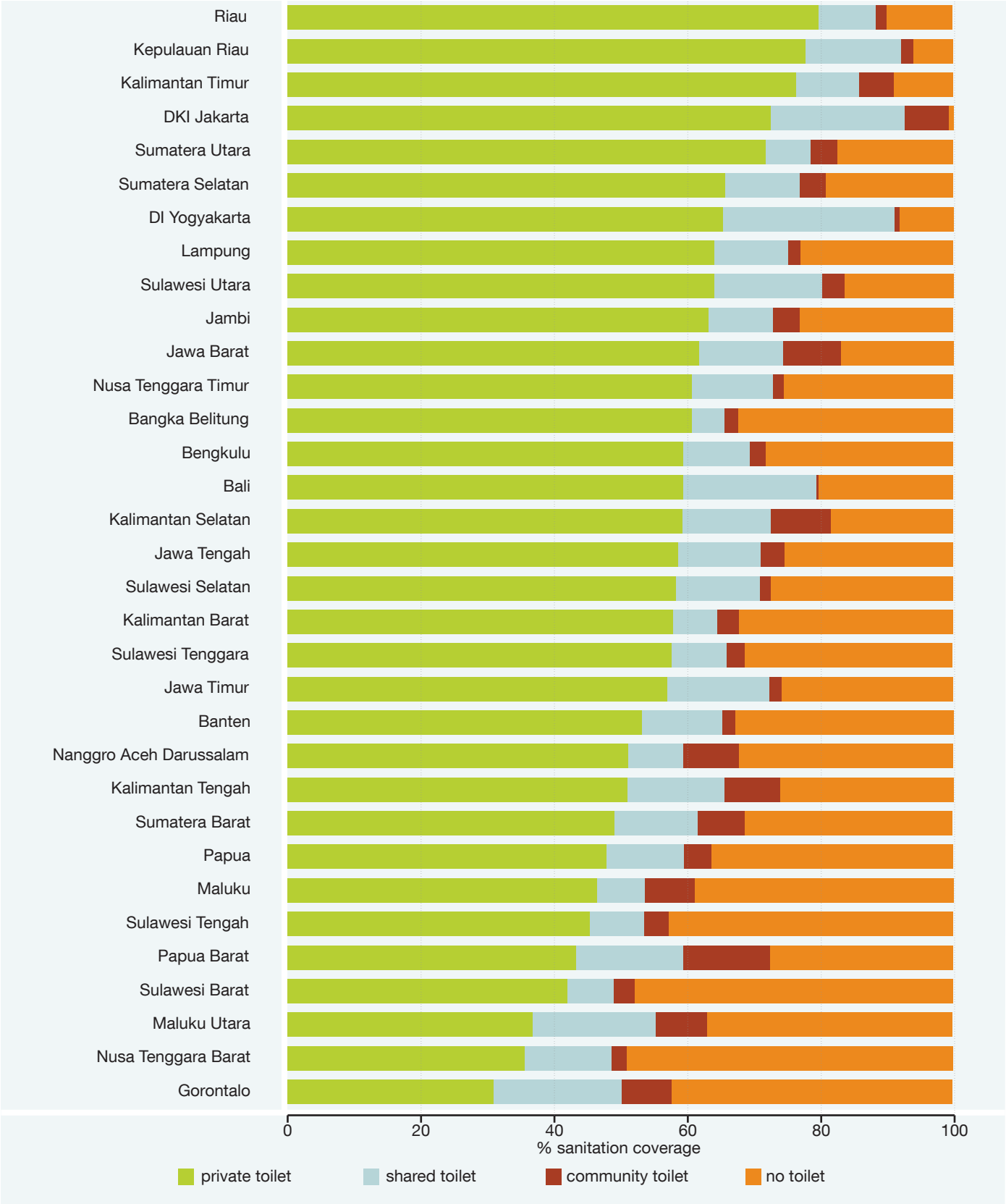
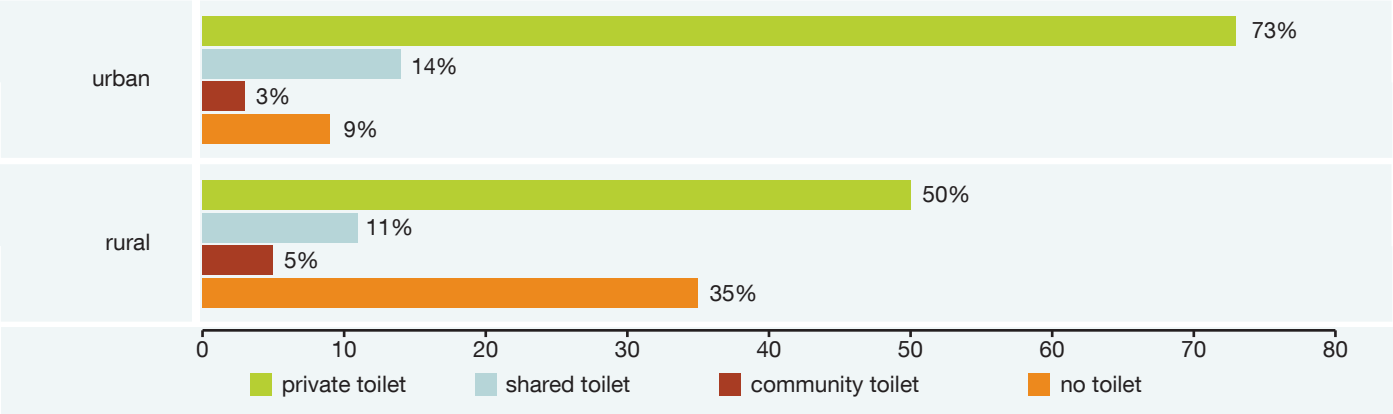


FIGURE 3: VARIATIONS IN SANITATION COVERAGE BY RURAL/URBAN (SUSENAS 2007)



1.2 ONGOING SANITATION PROGRAMS

In order to increase sanitation coverage and to improve equity in its distribution, the SanTT/TTPS encourages sanitation development in urban and rural areas to become a national development priority. In line with this, an initiative 'Acceleration of Settlement Sanitation Development Program,' also known as program Percepatan Pembangunan Sanitasi Permukiman (ASSDP/PPSP), paved the way for the National Roadmap to Sanitation Development 2010-2014 and set the sanitation development targets within the following period[4]:

- 'Freedom from open and careless defecation' in urban and rural areas in accordance with the Sanitation Strategic Plans of each related department/agency at national level.
- At-source reduction of waste generation and more environmentally-friendly waste management by applying sanitary landfill or controlled landfill systems at the final disposal site[5], and using safer technology.
- Reduction of flooding in a number of cities/urban areas.

The roadmap reflects the Government's commitment to seriously put sanitation within the mainstream of national development priorities. Currently, preparations are underway for a Presidential Instruction (Inpres) that legally binds local governments to achieve targets.

These targets shall be achieved by means of:

- Increased service of off-site sewerage networks by 5% of total urban population, or 5 million people in 16 cities, and constructing SANIMAS (Community Based Sanitation) facilities in each city. The priority is given to 330 selected cities/districts.
- Implementing 3R (Reduce, Reuse and Recycle) practices to reduce waste by 20% and improving waste management service in 240 priority cities.

The prioritized locations of the ASSDP/PPSP Program are as follows:

- Megapolitan, metropolitan, big and medium cities
- Provincial capitals
- Cities of autonomous status
- Towns in the territories of districts/cities with vulnerable sanitation conditions

Having such an ambitious sanitation development agenda, the SanTT/TTPS and its partners need to cooperate with all relevant stakeholders such as government bodies, the national and local parliaments, NGOs, and the private sector for joint support and commitment. They need to be able to obtain and utilize robust data and information on the benefits of sanitation improvement for the public. By competing for budget allocations for operational spending and infrastructure investment; the sanitation sector needs to come up with economic arguments to justify increased spending. Therefore, more comprehensive and robust cost-benefit analyses are needed, using reliable quantitative and qualitative techniques, in order to enhance the possibilities of securing adequate budget allocation.

[4] Roadmap to Sanitation Development 2010-2014, ISSDP Phase 2, 2009
[5] Final disposal site or *Tempat Pembuangan Akhir* (TPA) has been changed to Final Processing Site according to Government Law on Solid Waste No. 18/2008.

Results from ESI Phase 1, which described the economic losses that result from poor sanitation, have become an important reference for sanitation stakeholders including all levels of government in Indonesia. Extensively reported by the media, the estimated economic losses of inadequate sanitation and hygiene – and the implied benefits of improving sanitation and hygiene – have successfully raised the profile of sanitation in government affairs.

The Phase 2 of ESI presents the results of a detailed cost-benefit analysis (CBA) of sanitation interventions. It provides a more comprehensive analysis at household level than has ever been attempted in Indonesia, and with its large amount of quantitative and qualitative evidence, it strengthens arguments to prioritize sanitation in the national development agenda. As mentioned above, sanitation development in Indonesia falls mainly under local governments' responsibility. The sanitation situation in many cities and districts, particularly the domestic wastewater sub-sector, are still below minimum service level standards – especially in slums and densely populated areas. Nonetheless, there has not been any adequate attempt to position sanitation as one of the development program mainstreams of local stakeholders. In fact, sanitation is being neglected due to the perception that it lacks political leverage. Although the study results do not represent the country-wide sanitation situation, they give indicative values on the benefits of sanitation improvement as a whole. The study is expected to enhance political support for sanitation development, particularly for the PPSP Program in Indonesia.

1.3 REPORT OUTLINE

The report is structured as follows:

Chapter 2 describes the study aims that cover the following issues:

- The overall study purpose: the expected contribution of the study from a broader point of view such as promoting evidence-based decision making using improved methodologies and data sets, and the debate on approaches to sanitation financing and ways of scaling up sanitation improvements to meet national targets.
- The specific study use: the expected contribution of the study to various specific issues such as providing advocacy material, comparing efficiency of sanitation options to support optimal selection of sanitation options, and proposing measures to maximize the benefits of sanitation programs.

Chapter 3 presents the study methods that describe the whole flow of data collected (inputs) and eventual cost-benefit assessments (outputs). It also covers the methodologies of technical sanitation interventions evaluation, costs and benefits evaluation, field studies, program approach analysis, and national studies. The chapter describes field sites and how they were selected, the cost estimation methodology, benefit estimation methodology, data sources and data analysis. The national studies consist of tourist and business surveys.

Chapter 4 describes benefits of improved sanitation and hygiene at local level. Three main benefit value drivers at household level are analyzed i.e. health aspects, water aspects (sources and access) and access time to sanitation facilities. In addition, there are also analysis of intangible sanitation preferences and external environment issues.

Chapter 5 describes the national benefits of improved sanitation and hygiene. It covers the effects of improved sanitation and hygiene to tourism visits, business and foreign investment, sanitation markets, health indicators and water quality.

Chapter 6 presents the costs of improved sanitation and hygiene. It describes the cost summaries of specific sanitation options at each study site, financing sanitation and hygiene, sanitation option by wealth quintile and costs of moving up the ladder.

Chapter 7 analyzes the performance of different sanitation programs. It covers more specific issues on the program design – i.e. how the sanitation technologies are actually delivered. It selects and compares different key indicators of program performance.

Chapter 8 presents the cost-benefit analysis of sanitation improvement and hygiene practices, covering both quantitative and qualitative impacts of improved sanitation.

Chapter 9 discusses the study results and the main interpretations and messages.

Chapter 10 presents recommendations to decision makers based on the study findings in Indonesia. Sanitation development has been moving up the agenda in Indonesia and in this regard the ESI Phase 2 results are expected to deliver valuable support for decision makers to allocate additional resources for the sanitation sector and help them select more efficient and sustainable sanitation services.

II. Study Aims

As mentioned in the previous chapter, sanitation has been attracting considerable attention from governments in Indonesia. The TTPS has secured a position for sanitation in the mainstream national development priorities, through the PPSP. However, despite being a key development priority, the sanitation agenda has yet to win support from all its stakeholders.

The Economics of Sanitation Initiative (ESI) Phase 2 study seizes on this momentum and has been designed to meet the TTPS requirements for robust evidence on the benefits of sanitation improvement. Thus, it will help the sanitation development team to design matching interventions that are economically viable.

2.1 OVERALL PURPOSE

The purpose of the Economics of Sanitation Initiative (ESI) is to promote evidence-based decision-making using improved methodologies and data sets, thus increasing the effectiveness and sustainability of public and private sanitation spending.

Better decision-making techniques and economic evidence themselves are also expected to stimulate additional spending on sanitation to meet and surpass national coverage targets.

2.2 STUDY AIMS

The aim of this current study is to generate robust evidence on the costs and benefits of sanitation improvements in different programmatic and geographic contexts in Indonesia, leading to selection of the most efficient and sustainable sanitation interventions and programs. Basic hygiene aspects are also included, insofar as they affect health outcomes.

The evidence is presented in simplified form and distilled into key recommendations to increase uptake by a range of sanitation financiers and implementers, including various levels of government and sanitation sector partners, as well as households and the private sector.

Standard outputs of cost-benefit analysis include benefit-cost ratios, internal rate of return, payback period, and net benefits (see Glossary). Cost-effectiveness measures relevant to health impacts will provide information on the costs of achieving health improvements. In addition, intangible aspects of sanitation not quantified in monetary units are highlighted as being crucial to the optimal choice of sanitation interventions.

This study also contributes to the debate on approaches to sanitation financing and ways of scaling up sanitation improvements to meet national targets.

2.3 SPECIFIC STUDY USES

By providing hard evidence on the costs and benefits of improved sanitation, the study:

- Provides advocacy material for increased spending on sanitation and generates the attention of sector stakeholders to efficient implementation and scaling up of improved sanitation.
- Enables the inclusion of efficiency criteria in the selection of sanitation options in government and donor strategic planning documents, and in specific sanitation projects and programs.
- Brings greater focus on appropriate technology through increased understanding of the marginal costs and benefits of moving up the 'sanitation ladder' in different contexts.
- Provides the empirical basis for improved estimates of the total costs and benefits of meeting sanitation

targets (e.g. MDG targets), and contributes to national strategic plans for meeting and surpassing the MDG targets.

- Contributes to the design of feasible financing options through identification of the beneficiaries as well as cost incidence of sanitation programs.

2.4 RESEARCH QUESTIONS

In order to fulfill the overall purpose of the study, research questions were defined that have direct bearing on sanitation policies and decisions. Separate questions were defined for overall efficiency (i.e. costs versus benefits), and for costs and benefits[6].

The major concern in economic evaluation is to understand economic and/or financial efficiency, in terms of return on investment and recurrent expenditure. Hence the focus of economic evaluation is on what it costs to deliver an intervention and what the returns are. Several different efficiency measures allow examination of the question from different angles, such as number of times by which benefits exceed costs, the annual equivalent returns, and the time to repay costs and start generating net benefits (see box). Also, as sanitation and hygiene improvement also falls within the health domain, economic arguments can be made for investment in sanitation and hygiene interventions with the health budget, if the health return per unit cost invested is competitive compared with other uses of the same health budget.

As well as overall efficiency questions, it is useful from decision-making, planning and advocacy perspectives to better understand the nature and timing of costs and benefits, as well as how non-economic aspects affect the implementation of sanitation interventions, hence affecting their eventual efficiency (see boxes below). Furthermore, given that

BOX 1. RESEARCH QUESTIONS ON SANITATION EFFICIENCY

i. Are the benefits greater than the costs of sanitation interventions? By what proportion do benefits exceed costs (benefit-cost ratio – BCR)?

ii. What is the annual internal rate of return (IRR)? How does the IRR compare to national or international standards for investments of public and private funds? How does the IRR compare to other non-sanitation development interventions?

iii. How long does it take for a household to recover its initial investment costs, at different levels of cost sharing (payback period – PBP)?

iv. What is the net gain of each sanitation intervention (net present value – NPV)? What is the potential interest in sanitation as a business opportunity?

v. What is the cost of achieving standard health gains such as averted death, cases and disability-adjusted life-year (DALY)?

vi. How does economic performance vary across sanitation options, program approaches, locations, and countries? What factors explain performance?

BOX 2. RESEARCH QUESTIONS ON SANITATION COSTS

i. What is the range of costs for each technology option in different field settings? What factors determine cost levels (e.g. quality, duration of hardware and software services)?

ii. What proportion of costs are capital, program and recurrent costs, for different interventions? What are necessary maintenance and repair interventions, and costs, to extend the life of hardware and increase sustainability?

iii. What proportion of total (economic) cost is financial in nature? How are financial and economic costs financed in each field location?

iv. What are the incremental costs of moving from one sanitation improvement to another - i.e. up the sanitation ladder – for specified populations to meet sanitation targets?

[6] 'Costs' and 'benefits' refer simultaneously to financial and economic costs, unless otherwise specified.

several impacts of improved sanitation cannot easily be quantified in monetary terms, this study attempts to give greater emphasis to these impacts in the overall cost-benefit assessment. The following boxes list a range of research questions considered by this study – note, however, that not all questions could be addressed, or fully addressed in this study (e.g. in the 'Benefits' box, questions iv through to viii are largely unanswered by this study).

In addition, other research questions are crucial to appropriate interpretation and use of information on sanitation costs and benefits. Most importantly, the full benefits of a sanitation intervention may not be received due to factors in the field that affect uptake of and compliance with the intervention. These factors need to be better understood to advise future program design. Also, the ESI study touches on many financing issues, related to who is paying for the interventions and who is benefiting from the interventions (and thus who may be willing to pay). Given that scale-up cannot be achieved with full subsidization of sanitation interventions by government or other sector partners, it will be key to better understand how public money and subsidies can be used to leverage further investments from the private sector and from households themselves.

BOX 3. RESEARCH QUESTIONS ON SANITATION BENEFITS

i. What local evidence exists for the links between sanitation and the following impacts: health impact, water quality and water users, land use, time use, welfare, tourism, and the business environment (including foreign direct investment)?

ii. What is the extent of the financial and economic benefits related to health expenditure, health-related productivity and premature mortality; household water uses; time savings; property value; and other welfare impacts?

iii. What proportion of the benefits are pecuniary benefits (financial gains) and what proportion are non-pecuniary benefits?

iv. What proportion of each benefit accrues to households that invest in sanitation and what proportion is external to the investor?

v. What is the actual or likely willingness to pay of households and other agencies for improved sanitation? What is up-front versus annual recurrent willingness to pay?

vi. How do benefits accrue or vary over time?

vii. How is improved sanitation – and the related costs and benefits – tangibly linked with poverty reduction? What is the potential impact on national income and economic growth?

viii. What is the overall household and community demand (expressed and latent demand) for improved sanitation?

BOX 4. OTHER RESEARCH QUESTIONS

i. How do program design and program implementation affect costs and benefits? In practice, (how) can sanitation programs be delivered more efficiently – i.e. reducing costs without reducing benefits?

ii. How to leverage grants to incentivize investments in sanitation?

iii. What factors determine program performance? What are the key factors of success and constraint, including contextual, institutional, financial, social and technical?

iv. Which program approaches are best suited to which technical options?

v. What is the acceptability of different sanitation options and program approaches?

vi. What other issues determine intervention choice and program design in relation to local constraints: energy use, water use, polluting substance discharge, and option robustness/durability/maintenance requirements?

vii. Based on research findings, what other key issues enter into sanitation option decisions?

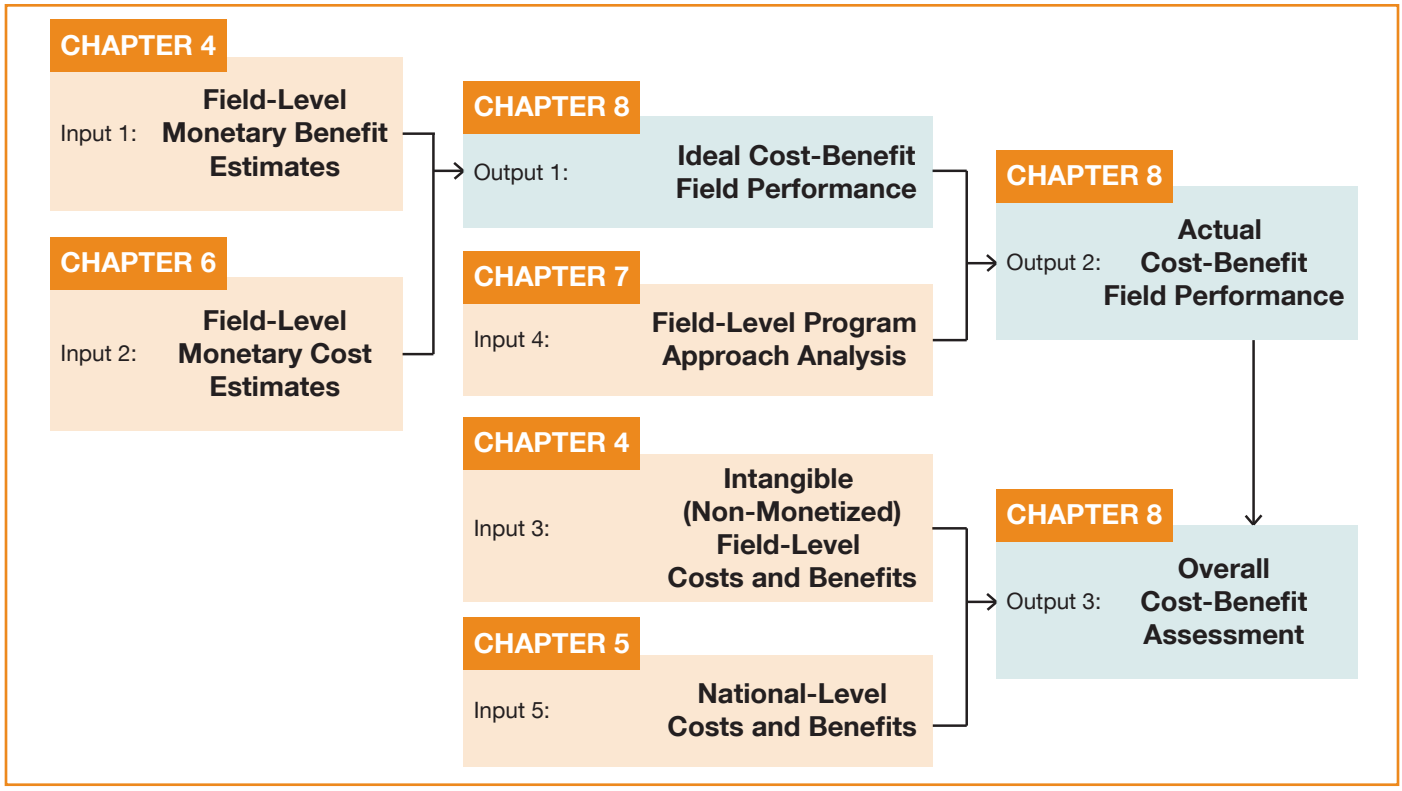
III. Methods

The study methodology in Indonesia follows a standard methodology developed at regional level reflecting established cost-benefit techniques, which has been adapted to sanitation interventions and the Indonesia field study based on specific research needs and opportunities. As shown in Figure 4 the study consists of a field component that leads to quantitative cost-benefit estimates as well as in-depth study of qualitative aspects of sanitation. Two types of field-level cost-benefit performance are presented: Output 1 reflects ideal performance assuming the intervention is delivered, maintained and used appropriately, and Output 2 reflects actual performance based on observed levels of intervention effectiveness in the field sites. However, both these analyses are partial, given that intangible benefits of sanitation improvements as well as other benefits that may accrue outside the sanitation improvement site are excluded. Hence Output 3, overall cost-benefit assessment, takes these into account.

3.1 TECHNICAL SANITATION INTERVENTIONS EVALUATED

The type of sanitation evaluated in this study is household human excreta management. Interventions to improve household human excreta management focus on both on-site and off-site sanitation options. Indeed one of the key aims of this study, where possible, is to compare the relative efficiency of different sanitation technologies. Basic hygiene aspects of sanitation are also included, insofar as they affect health outcomes and intangible aspects.

FIGURE 4: FLOW OF DATA COLLECTED (INPUTS) AND EVENTUAL COST-BENEFIT ASSESSMENTS (OUTPUTS)



As well as human excreta management, interventions that jointly address human waste and domestic wastewater management (especially in urban areas) are considered.

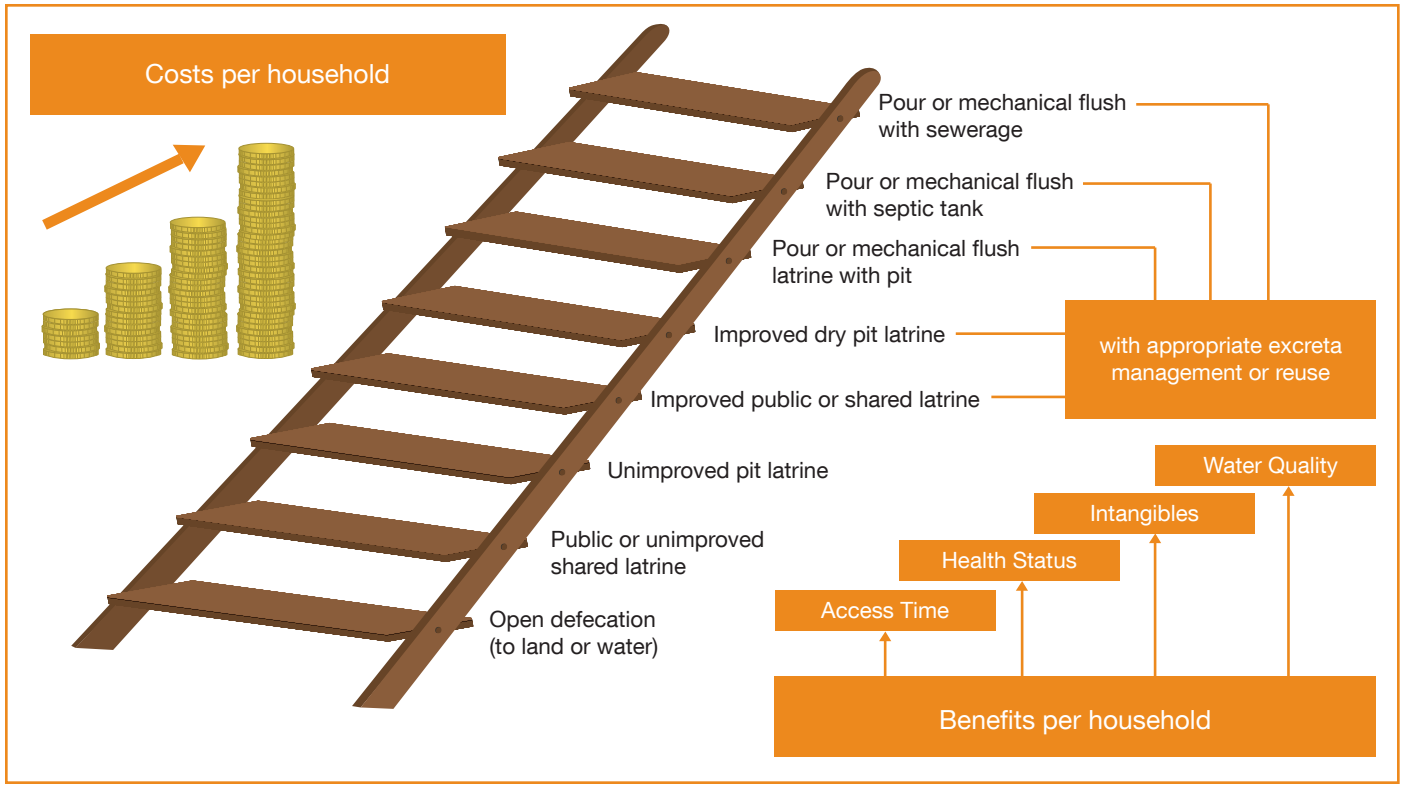
To qualify as an economic evaluation study, cost-benefit analysis compares at least two intervention options. It usually includes comparison with the baseline of 'do nothing'. However, comparing two sanitation options will rarely be enough: ideally the analysis should compare all sanitation options that are feasible for each setting – in terms of affordability, technical feasibility, and cultural acceptability – so that a clear policy recommendation can be made based on efficiency of a range of sanitation options, among other factors.

Technical sanitation options include all those interventions that move households up the sanitation ladder and thus bring benefits. Figure 5 presents a generalized sanitation ladder. The upward slope of the ladder reflects the assumption of greater benefits as you climb the ladder, but (generally) with higher costs. The progression shown in Figure 5 is not necessarily true in all settings and hence needs to be adjusted to setting-specific features (e.g. rural or urban, physical/climatic environments such as soil type or water scarcity).

While the study proposes conducting analyses of the costs and benefits of achieving the MDG targets and beyond, sanitation options are not be restricted by 'unimproved' and 'improved' sanitation as defined by the WHO/UNICEF Joint Monitoring Programme (JMP). For example, some households will be interested in upgrading from one type of improved sanitation to another type, such as from VIP to septic tank, or from septic tank to sewerage. Other households are faced with a decision whether to replace a facility that has reached the end of its useful life. And under some program approaches (e.g. Community-Led Total Sanitation or CLTS), households are encouraged to move up the ladder, even if it does not imply a full move to JMP-defined 'improved' sanitation, such as to the use of shared or unimproved private latrines.

Using the ladder as a starting point, Table 2 shows different types of intervention (sub-categories) within the more broadly defined sanitation options. This classification provides an overview to allow a framework for interpretation of

FIGURE 5: REPRESENTATION OF THE SANITATION TECHNOLOGY "LADDER"



the specific options evaluated in the field settings (shown in 3.2.2), given that option sub-categories may have different associated costs and benefits.

The field studies revealed that the sanitation ladders typically found in the study sites can be described by a simpler set of options:

1) Open defecation
2) Shared/community/public latrine
3) Community toilet with decentralized wastewater treatment
4) Private dry pit latrine
5) Private wet pit latrine
6) Private toilet with septic tank
7) Private toilet with sewerage and off-site treatment

Open defecation is the lowest point on the sanitation ladder, against which the relative benefits of the other sanitation options are measured.

3.2 COSTS AND BENEFITS EVALUATED

Sanitation costs are the denominator in the calculations to estimate the cost-benefit and cost-effectiveness ratios, and thus crucial to the evaluation of sanitation option efficiency. Summary cost measures include the total annual and life-cycle costs (see Glossary), cost per household and cost per capita. For financing and planning purposes, this study disaggregates costs for each sanitation option by capital, program and recurrent costs; by financial and economic costs; by financier; and by wealth quintile. The incremental costs of moving up the sanitation ladder are assessed.

To maximize the usefulness of economic analysis for diverse audiences, benefits of improved sanitation and hygiene are divided into three categories.

1. Household direct benefits: these are incurred by the households that are making the sanitation improvement. These actual or perceived benefits will drive the decision by the household to invest in sanitation,

TABLE 2: CLASSIFICATION OF SANITATION OPTIONS IN INDONESIA

Categories		Sub categories	
0	Open defecation	0.1	In house - wrap and throw
		0.2	On plot
		0.3	On land outside plot
		0.4	In house-excreta disposed to fish pond
		0.5	In house-excreta disposed to canals/water body
1	Shared community/public latrine unimproved	1.1.	No slabs
		1.2	No superstructures
		1.3	Inadequate sub structures
		1.4	More than one of above
2	Private latrine, unimproved	2.1	No slabs
		2.2	No superstructures
		2.3	Inadequate sub structures
		2.4	More than one of above
3	Community/public toilet, improved	3.1	Any of the technology option 5 - 6
4	Shared toilet, improved	4.1	Any of the technology option 5 - 6
5	Private dry latrine, improved	5.1	Simple dry pit latrine
		5.2	Ventilated Improved Pit latrine
6	Private wet latrine, improved	6.1	Pour flush toilet - non water tight pit
		6.2	Pour flush toilet - septic tank
		6.3	Pour flush toilet - communal sewerage[1]
		6.4	Pour flush toilet - centralized sewerage[1]

[1] Can be simplified or normal sewerage

and will also guide the type of sanitation improvement chosen. These benefits may include: health impacts related to household sanitation and hygiene, local water resource impacts, access time, intangible impacts, house prices, and the value of human excreta reuse.

2. Local level external benefits: these are potentially incurred by all households living in the environment where households improve their sanitation. However, some of these benefits may not be substantial until a critical mass of households has improved their sanitation. These benefits may include: health impacts related to environmental exposure to pathogens (e.g. water sources, open defecation practices on land), aesthetics of environmental quality, and usability of local water sources for productive activities. Given the challenges in designing studies to distinguish these benefits from household direct benefits (in 1.) this study groups local level external benefits together with household direct benefits.
3. Wider scale external benefits: these result from improved sanitation at the macro level. Benefits may include: water quality for productive uses, tourism, local business impact, and foreign direct investment. They can be linked to coverage either in specific areas or zones (e.g. tourist area or industrial zone), or in the country generally (e.g. investment climate). As well as improved management of human excreta, other contributors to environmental improvement such as solid waste management and wastewater treatment need to be considered.

Therefore, the results of economic analysis in this study distinguish between impacts in the local community where the sanitation and hygiene improvements take place, and national level impacts.

Table 3, shows the impacts included in the current study, distinguishing between those impacts that are expressed in monetary units and those that are expressed in non-monetary units.

While the focus of this study is on household sanitation, the importance of institutional sanitation also needs to be highlighted. For example, improved school sanitation affects decisions for children (especially girls) to start or stay in school until end of secondary level, and workplace sanitation affects decisions of the workforce (especially women) to take or continue work with a particular employer. These impacts are incremental over and above the first three above. However, these impacts are outside the scope of this present study.

TABLE 3: BENEFITS OF IMPROVED SANITATION INCLUDED IN THIS STUDY

Level	Impact	Socio-economic impacts evaluated in	
		Monetary terms ($ values)	Non-monetary terms (non-$)
Local benefits	Health	• Health care costs • Health-related productivity • Premature death	• Disease and mortality rates • Quality of life impacts • Gender impacts
	Domestic water	• Water sourcing • Household treatment	• Link poor sanitation, water quality & water source and water treatment practices • Use for income generating activities
	Other welfare	• Time use	• Convenience, comfort, privacy, status, security, gender
	Environmental quality		• Land use changes • Aesthetics of household and community environment
National benefits	Tourism		• Sanitation-tourism link: potential impact of poor sanitation on tourist numbers
	Business		• Sanitation-business link: potential impact of poor sanitation on local business and FDI
	Sanitation markets	• Potential national value of sanitation services	

The next sections describe the study methods for the three major study components: the field level cost-benefit assessment (3.3), the assessment of program effectiveness (3.4) and national level impacts (3.5). Section 3.6 summarizes the main cost-benefit presentations.

3.3 FIELD STUDIES

3.3.1 FIELD SITE SELECTION AND DESCRIPTION

According to good economic analysis practice, the interventions evaluated should reflect the options available to households, communities and policy makers. Therefore, the selected field sites should offer a range of sanitation options typically available in Indonesia, and include both urban and rural sites. Five sites were selected in Indonesia, and in each site two sub-sites were selected: one in an area where many households have received sanitation improvement (intervention) and the other (the control) in an area where few households have benefitted from sanitation projects. The purpose of having a comparator, or control group, was to gather the views, preferences and conditions of households that do not currently have improved private latrines.

The main criterion for site selection applied in this study is that there has been a sanitation project or program implemented in the past five years at a scale that allows the minimum sample size of 30 households to be collected per sanitation option per site. Once this list of projects and programs was established, a further set of criteria was applied to reduce the shortlist to five locations or projects (within the available budget). These criteria are (i) logistical feasibility of the research; (ii) potential for collaboration with projects/programs; (iii) collectively representing Indonesia's heterogeneity of geophysical, climatic, demographic and socio-economic characteristics. Table A9 shows the long list of projects, and how they performed in relation to these three criteria. The final five sites selected are presented below. Table 4 shows the sanitation coverage in the selected field sites compared with national coverage.

TABLE 4: BACKGROUND INFORMATION ON SELECTED FIELD SITES

Variable	Lamongan District	Tangerang District	Banjarmasin City	Malang City	Payakumbuh City
Rural/urban	Rural	Rural	Urban	Urban	Urban
Households (year of data)	338,534 (2007)	828,645 (2006)	154,527 (2006)	250,085 (2007)	24,725 (2007)
Population (year of data)	1,439,886 (2008)	3,585,256 (2008)	602,725 (2006)	816,444 (2007)	104,969 (2007)
Av. household size	4.25	4.32	3.90	3.26	4.24
Covering Area [i)]	79 villages	3 villages	14 villages		
Sanitation % improved [ii)]	45.9%	57.8%	44.1%	69.7%	49.2%
Hygiene % hand washing [iii)]	26.3 % (East Java Province)	24% (Banten Province)	17.9% (South Kalimantan Province)	26.3% (East Java Province)	8.4% (West Sumatera Province)
PROJECT INFORMATION					
Start date	Year 2001	Year 2008	Year 2000	Year 1986	Year 2007
Interventions	WSLIC 2	SANIMAS	Sewerage system/off site system	Community-based sewer system (CBSS)/SANIMAS	CLTS
Target households	33,286 HH	493 HH (2008)	25,364 HH (until 2010)	1,105 HH	9732 HH (status Nov 2009)

References: (1) District Health Office (Dinas Kesehatan) of each district, and The Sanitation White Book of Banjarmasin and Payakumbuh. (2) Community Based Sewer system in Malang, WSP, March 2000 (Field Note). (3) Laporan Nasional Riskesda 2007 (National Report of Basic Health Research, 2007)

Notes:

[i)] Villages received sanitation program interventions as mentioned

[ii)] Statistics Bureau: sanitation improved is percentage of septic tank as the feces final disposal (Percik Magazine, March 2008)

[iii)] Hygiene hand washing means the appropriate hand washing with soap before eating, before preparing food, after defecating, and after cleaning child/babies feces, after touching animal.

[iv)] Dinkes (Health Office), interview

Following is a brief description of the five districts and cities where the study sites were located.

LAMONGAN DISTRICT

Lamongan district is located in the northern part of the province of East Java. The district borders with Java Sea in the north and stretches to a mountainous volcanic area inland. This district has two seasons: the dry season lasts from May to October, and the rainy season from November to April. Temperatures are tropical year round, reaching around 32°C in the dry season. The average rainfall is around 2,670mm/year, falling mainly during the wet season. Passing through Lamongan district is Bengawan Solo, one of Java's largest rivers, which swells annually during rainy season. Its waters inundate rice fields and houses for days or even weeks, causing the area to be prone to waterborne diseases.

Lamongan comprises 27 subdistricts, 476 rural villages and 12 urban wards. The 1,813 km^2 area is home to 1,439,886 people (2008)[7]. Lamongan is a busy hub town, on the northern main road and railway that connect Surabaya, the main sea port of eastern Indonesia, with Jakarta, the capital city. In the southern part, agriculture is the main source of livelihood, with corn as the main crop, as well as vegetables and local fruits. In the northern part, fisheries are the main source of livelihood.

Lamongan District Health Office (2008) noted that the number of households by type of latrine in the program location was as follows: simple pit latrine 305 HH, improved latrine 7,349 HH, pour flush latrine 5,956 HH, and onsite septic tank 12,516 HH.

Although Lamongan District was a WSLIC program site, many people still use hanging toilets over rivers or ponds. As at other sites where open defecation is practiced, people defecate in hanging toilets over ponds to feed their fish. In some areas, people still defecate in bamboo stands, in fields, and in rivers. Some people expressed a reluctance to have a private toilet at home because they were used to defecating in the open. They believe that a toilet in the house makes the house smell unpleasant and requires too much water to clean, particularly during the dry season. Other respondents defecated in simple pit latrines.

The ESI 2 study of the WSLIC 2 intervention was conducted in Turi subdistrict, which comprises four villages. A total of 300 households were interviewed for the survey.

TANGERANG DISTRICT

Tangerang is located about 30 km to the south of Jakarta. Located in Banten Province, to the west of Jakarta, Tangerang District borders the Java Sea to the north. Tangerang is dry from April to September, and wet from October to March. Temperatures range from 23°C to 33°C, and average annual rainfall is around 1,475 mm. Cisadane River passes through this district, and formerly served as the main water supply for agricultural irrigation. However, due to massive industrialization, Cisadane River is now a large wastewater disposal site for both domestic and industrial waste.

Tangerang District comprises 36 subdistricts, and 328 villages. The 1,110 km^2 district is home to 3,585,256 people[8] in 828,645 households, thus the population density is around 3,229 people/km^2 (2008). More than 50% of Tangerang population works in the industrial sector, and only 3.2% work in the agricultural sector and services. Tangerang District is a booming industrial area, but poor housing provision resulting from poor urban settlement planning has led to the growth of slum areas, where sanitation is currently a major problem.

In both 2004 and 2007, Tangerang District experienced diarrheal disease outbreaks as a result of poor sanitation. According to Tangerang District Health Office (2008), around 70% of the district's population – most living on the north coast in subdistricts such as Kresek, Kronjo, Pakuhaji and Mauk – lacks proper toilet facilities.

District health data also show that 7.6% of the population uses no latrine facilities, 3.2% simple pit latrines, 4,2% wet swan-neck pit latrines, 10.4% latrines over fish ponds, 67.4% wet swan-neck latrines with septic tank, and 7.3% other latrine facilities. Tangerang district does not have a sewerage system.

[7] www.lamongankab.go.id, Monday, 16 March 2009
[8] District Health Office Tangerang, 2008

Many industrial areas in Tangerang were developed without proper planning. Textile and garment factories, for example, were not established in planned industrial estates. The district's industrial areas lack adequate infrastructure, including proper sanitation systems. These labor intensive industries attract many people from outside the area to settle nearby, which naturally leads to the creation of local, small-scale economic enterprises. Most newcomers are low-income earners, and they rent simple rooms without private toilets in densely populated areas. As the population grows, the waiting time to use public toilets increases, which triggers open defecation in these areas. Places used for open defecation include empty plots of land around houses, yards, rivers, fields, bushes, bamboo stands, and even the streets. It is not surprising that in 2007 Tangerang experienced a diarrhea outbreak caused by Vibrio cholerae.

The types of toilet used in these densely populated areas include:

- Community toilet facilities with pour-flush toilets and cemented walls. They have two or three toilets and bathing rooms with one 2 x 3 x 2 m^3 septic tank. The facilities were constructed by communities with support from an NGO, including a contribution towards the building materials.
- Roofless hanging toilets over rivers and ponds. Users need to bring a bucket of water with them to cleanse themselves after defecating.
- Private toilets with septic tank within a private plot.

The ESI 2 study of the SANIMAS intervention was carried out in Sarakan, Kayu Agung, Sukasari, and Tanjakan villages in Sepatan and Rajeg subdistricts. A total of 300 households were interviewed for the survey.

BANJARMASIN CITY

Banjarmasin is the capital city of South Kalimantan Province. The climate here is tropical, with temperatures ranging from 25°C to 38°C and an average rainfall of 2,628 mm/year. The city is located on a swampy river delta with a very low average altitude of 0.16 m above sea level. Tidal flooding is common throughout the city. Banjarmasin is also known as 'the city of a thousand rivers' for the many rivers that cross the city.

The city is home to 602,725 people, in 154,527 households.[9] The 72 km^2 city comprises five subdistricts, where 46.2% of the population trade for a living, 18.8% work in services industry, 10% in construction, 9.1% in industry, and the remaining 5.3% works in agriculture.

In Banjarmasin, people who live around the riverbanks (mainly poor communities) habitually use the rivers as "one-stop shops" for many of their daily activities, such as bathing, washing and defecating, and even children's playgrounds. The larger rivers are also used for transportation. The people living in these areas are generally happy with this situation, believing it to be the norm, and a practical way of life. The drawbacks they did note included:

- Having to go to the river as early as possible to be the first to arrive and get the best spot and cleaner water.
- Accidents, such as falling into the river, which can be fatal.

Sanitation has not been communicated well within the communities. Although subdistrict government workers have led occasional informal discussions to promote health and hygiene behavior, these events have not been sufficient to generate understanding of the importance of sanitation.

Some people whose houses are connected to the sewerage system have had unpleasant experiences, such as:

- Wastewater flowing back into the house because the toilet is positioned lower than the wastewater treatment plant.
- Residential areas being inundated with a mixture of wastewater from the sewerage system and seawater whenever there is a tidal flood.

There is no indication as to whether these unpleasant experiences have resulted in people's reluctance to connect their toilets to the sewerage system. Some respondents mentioned that there had been no campaign to build people's awareness about the benefits of connecting to the sewerage system.

The Banjarmasin Sanitation Whitebook (2007) describes access to sanitation facilities as follows: flush toilet to sewerage system, 1.9%; flush toilet to septic tank, 26.8%; flush

[9] Sanitation Whitebook, Banjarmasin Municipal Government, 2007

toilet to pit latrine, 41.8%; flush toilet to ditch/river, 3.4%; non-flush toilet to river, 8.2%; non-flush toilet to pit latrine, 1.8%; and hanging toilet, 12.6%.

The ESI 2 field survey was conducted in Central Banjarmasin subdistrict, in Pekapuran Laut and Kelayan Luar villages, where the sanitation intervention is a sewerage system. A total of 300 households were interviewed for the survey.

MALANG CITY

Malang is located in the highlands of East Java province, 90 km to the south of Surabaya, the provincial capital. The city has a mild climate with an average temperature of up to 24°C. Its beautiful scenery and cool weather make Malang a popular tourist destination in East Java. The hot season runs from May to August, and the rainy season from September to March. Average rainfall is 1,833 mm per year (2006).

Malang comprises five subdistricts (Blimbing, Klojen, Kedungkandang, Sukun and Lowokwaru), 57 urban wards and 10 rural villages. Covering an area of 110.6 km^2, the city is home to 816,444 people (2007). The main livelihoods are small trading, industry, and services. The main transport routes are the roads and railways that connect Malang with other large cities in East Java.

Some people living in the city still defecate in open areas such as yards, fields and rivers. On the riverbanks, some use hanging toilets of cement construction. Like most medium-sized cities in the hilly areas of Java, Malang has fairly deep river valleys dividing the urban area. Most of the older parts of the city are built on ridge lines, while the newer parts, especially the low income areas, spread along the river valleys where land is more available. In general, the riverside location makes disposal of human waste easier than on the ridges, but it also more prone to health risks and less environmentally friendly.

People here prefer to defecate in hanging toilets for much the same reasons as respondents from the other study sites.

Others have simple pit latrines near their houses, which they perceive to be better than open defecation. However, they did report unpleasant experiences, such as:

- Bad smell during defecation
- Many flies around the pit
- Being ashamed when a guest needs to go to the toilet, because the latrine looks very dirty and is smelly

Some people use pour-flush toilet inside their houses. They are proud of owning their own toilets, which do not have the unpleasant side-effects of the simple pit latrines. The problem comes when there is lack of water during the dry season.

In 1985, a diarrhea epidemic occurred in the area that led to the death of several children from poor families. Prior to this outbreak, local children still defecated in open drains right outside their houses. A local volunteer then took an initiative to convince the community to adopt more hygienic defecation practices. He also initiated the construction of a communal sewerage system to encourage people to abandon their habit of defecating in open drains and rivers. Nearly two years later the system was in operation, but it took almost ten years for all members of the community to have their toilets connected to the system.

The ESI 2 field survey was conducted in Kedung Kandang, Lowowaru, Mergosono, Tlogomas, Arjowinangun and Dinoyo subdistricts, where the sanitation intervention is communal sewerage systems. A total of 300 households were interviewed for the survey.

PAYAKUMBUH CITY

Payakumbuh city is located in West Sumatera Province. Batang Agam, Batang Lampasi, Batang Sinama rivers from through the city from west to the east side. Covering an area of 80.3 km^2, the city is located on a plain in the highlands of West Sumatra, at a height of 514 meters above sea level. Its moderate weather, with an average temperature of 26°C and average rainfall of 2,000 – 2,500 mm/year, is ideal for crop and vegetable farming.

Built in 1970, Payakumbuh comprises seven subdistricts, where 104,969 people (2007) live in 24,725 households. The population density is 1,305/km^2. Most of the city's inhabitants are small traders or small farmers.

Open defecation such as in yards, ponds and rivers is still widely practiced in Payakumbuh. Some people use hanging toilets made from wood or bamboo over ponds around their

houses. They prefer to defecate in hanging toilets because:

- it feeds their fishes
- the toilet is in the open air so does not smell bad
- they do not need to think about emptying septic tanks

The Payakumbuh City Sanitation Whitebook describes the domestic wastewater management situation as of the end of 2006, as follows: connected to the sewerage system, 0%; connected to a septic tank, 26%; hanging toilet above a fish pond, 40%; no facility, 34%. The latter two are categorized as open defecation.

The ESI 2 field study in Payakumbuh took place in north Payakumbuh, Talawi, Kotopanjang, Payolinyam, and Kubu Gadang wards, where the sanitation intervention takes a CLTS approach. A total of 300 households were interviewed for the survey..

Table 5 presents an overview of the sanitation and hygiene situations in the five study sites.

3.3.2 COST ESTIMATION METHODOLOGY

This study estimates the comprehensive cost of various sanitation options, including program management costs as well as on-site and off-site hardware costs. Cost estimation was based on information from three data sources (sanitation program or project documents, the provider or supplier of sanitation services, and the ESI household questionnaire, described in 3.3.4). Data from these three sources were compiled, compared, and adjusted, and finally entered into standardized cost tabulation sheets. Capital costs are disaggregated, where possible, into hardware and software costs. In Indonesia, physical or hardware development is the responsibility of the Ministry of Public Works, while software development (promotion, education, monitoring) is the responsibility of the Ministry of Health. Some software costs, such as lobbying, meetings, transport costs, are not properly documented or recorded, so were not included in the cost estimates. Hence, the real program costs may be greater than the figures presented.

The annual equivalent costs of various sanitation options were calculated based on annualized investment cost (taking into account the estimated length of life of hardware and software components) and adding annual maintenance and operational costs. For data analysis and interpretation, financial costs were distinguished from non-financial costs, and costs were broken down by financier. Information from documents of sanitation projects and providers as well as market prices was supplemented with interviews with key resource people to ensure correctness of interpretation, and to enable adjustment where necessary.

3.3.3 BENEFIT ESTIMATION METHODOLOGY

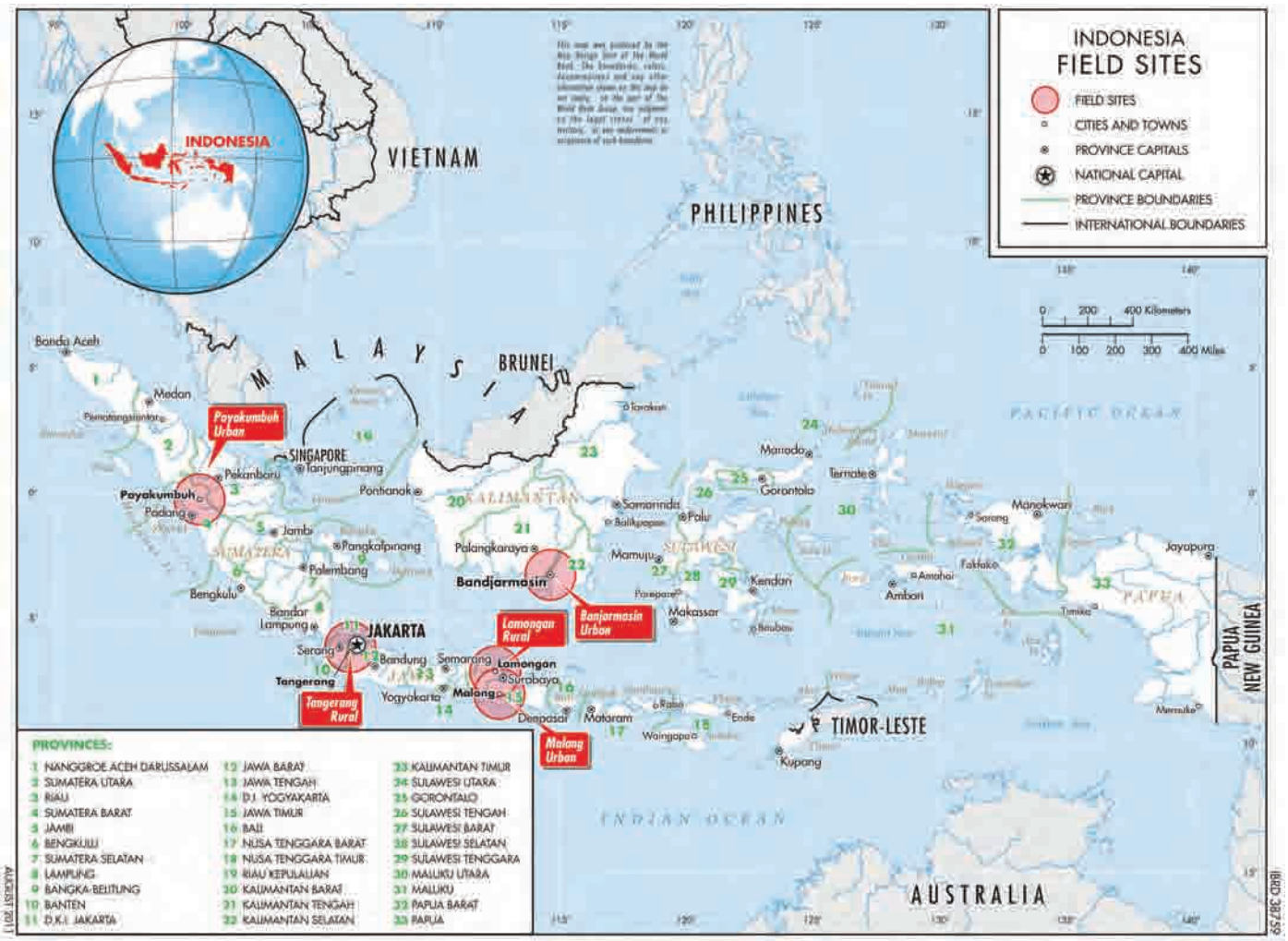
Economic evaluation of sanitation interventions should be based on sufficient evidence of impact, thus giving unbiased estimates of economic efficiency. Hence the appropriate attribution of causality of impact is crucial, requiring a robust study design. Table A3 presents alternative study designs for conducting economic evaluation studies, starting at the top with the most valid scientific approaches, down to the least valid at the bottom. Given that the most valid scientific approach (a randomized time-series intervention study)

TABLE 5: SANITATION AND HYGIENE COVERAGE OF ESI SAMPLE HOUSEHOLDS

Option	Lamongan District	Tangerang District	Banjarmasin City	Malang City	Payakumbuh City
SANITATION					
Sewerage System	-	-	10%	51% (communal)	-
Septic tank	68%	37%	55%	14%	47%
Wet private pit	5%	12%	4%	14%	3%
Dry private pit	0.7%	12%	3%	-	0.3%
Open defecation (on land or water)	27%	42%	30%	20%	50%
HYGIENE					
Hand washing with soap after defecation (always)	45%	11%	6%	11%	23%

Source: ESI Household Survey

FIGURE 6: LOCATION OF STUDY SITES



was not possible within the timeframe and resources of this study, the most valid remaining option was to construct an economic model for assessment of cost-benefit of providing sanitation interventions and of moving from one sanitation coverage category to the next. A range of data was used in this model, reflecting both households with and without improved sanitation, to ensure that before and after intervention scenarios were most appropriately captured. This included capturing the current situation in each type of household (e.g. health status and health seeking, water practices, time use), as well as understanding attitudes towards poor and improved sanitation, and the factors driving decisions. These data were supplemented with evidence from other local, national and international surveys and data sets on variables that could not be scientifically captured in the field surveys (e.g. behavior and risk factors for health assessment).

Figure 7 shows an overview of the methods for estimating the benefits of moving up the sanitation ladder. The actual size of the benefit will depend on the specific sub-type of sanitation intervention implemented and on the initial level of sanitation.

The specific methods for the sanitation benefits are described below. For a mathematical representation of the methodology, refer to the aggregating equations in Table A4.

Health: For the purposes of cost-benefit and cost-effectiveness analysis, three types of disease burden are evaluated: numbers of cases (incidence or prevalence), numbers of deaths, and disability-adjusted life-years (DALYs). Diseases included are all types of diarrheal disease, helminthes, hepatitis A and E, trachoma, scabies, malnutrition and diseases

related to malnutrition (malaria, acute lower respiratory infection, measles) (Table A 5). Health costs averted through improved sanitation are calculated by multiplying overall health costs per household by the relative risk health reduction from the improved sanitation and/or hygiene measures. Health costs are made up of disease treatment costs, productivity losses and premature mortality losses. For cost-effectiveness analysis, DALYs are calculated by combining the morbidity element (made up of disease rate, disability weight and illness duration) and mortality element (mortality rate and life expectancy). Standard weights and disease duration are sourced from the Global Burden of Disease study, and average life expectancy for Indonesia at birth male/female of 66/69 years is used (World Health Statistics 2008[10]).

- Rates of morbidity and mortality are sourced from various data sets for three age groups (0-4 years, 5-14 years, 15+ years), and compared and adjusted to reflect local variations in those rates (Hotez, 2003). National disease and mortality rates were adjusted to rates used for the field sites based on socio-economic characteristics of the sampled populations. As not all fecal-oral diseases have a pathway from human excreta, an attribution fraction of 0.88 is applied for these diseases. Skin diseases are attributed 0.5 due to poor hygiene. Methods for the estimation of disease and mortality rates from indirect diseases via malnutrition are provided in the ESI Impact study report (Economic Impacts of Sanitation in Southeast Asia[11]).
- Health care costs are calculated by applying treatment seeking rates for different health care providers to the disease rates, per population age group. The calculations also take into account hospital admission rates for severe cases. Unit costs of services and patient travel and sundry costs are applied based on treatment seeking.
- Health-related productivity costs are calculated by applying time off work or school to the disease rates, per population age group. The economic cost of time lost due to illness reflects an opportunity cost of time or an actual financial loss for adults with paid work. The unit cost values are based on the average income rates per location. For adults a rate of 30% of the average income is applied, reflecting a conservative estimate of the value of time lost. For children 5-14 years, sick time reflects lost time at school which has an opportunity cost, valued at 15% of the average income. For children under 5, the time of the child carer is applied at 15% of the average income. Values are provided in Table 6.
- Premature death costs are calculated by multiplying the mortality rate by the unit value of a death. Although premature death imposes many costs on societies, it is difficult to value them precisely. The

FIGURE 7: OVERVIEW OF METHODS FOR ESTIMATING FIELD-LEVEL BENEFITS OF IMPROVED SANITATION

BENEFIT CATEGORY	POPULATION WITH UNIMPROVED SANITATION		POPULATION WITH IMPROVED SANITATION		BENEFIT ESTIMATED
HEALTH	Data on health risk per person, by age category & socioeconomic status	→	Generic risk reduction, using international literature	→	Averted health care costs, reduced productivity loss, reduced deaths
WATER	Data on water source and treatment practices	→	Observed changes in practices in populations with improved sanitation	→	Reduced water sourcing and water treatment costs
ACCESS TIME	Data on time to access toilet per person per day	→	Observed reductions in time to access toilet	→	Opportunity cost of time applied to time gains
INTANGIBLES	Attitudes and preferences of householders to sanitation	→	Benefits cited of improved sanitation	→	Strength of preferences for different sanitation aspects and willingness to pay

[10] World Health Organization 2006 at http://www.who.int

[11] Economic Impacts of Sanitation in Southeast Asia, A four-country study conducted in Cambodia, Indonesia, the Philippines and Vietnam under the Economics of Sanitation Initiative (ESI), Water and Sanitation Program - East Asia and the Pacific (WSP-EAP) - World Bank East Asia and the Pacific Region, November 2007

method employed by this study – the human capital approach (HCA) – approximates economic loss by estimating the future discounted income stream from a productive person, from the time of death until the end of (what would have been) their productive life. While this value may undervalue premature loss of life, as there is a value to human life beyond the productive worth of the workforce, the study faced limited alternative sources of value due to lack of studies (e.g. value-of-a-statistical-life[12]). Values are provided in Table 11, including value of statistical life (VOSL) adjusted to Indonesia from developed country studies.

- Risk reductions of illness and death associated with improved sanitation and hygiene interventions are assessed from international literature, and are applied and adjusted to reflect risk reduction in local settings based on baseline health risks and interventions applied. Figure 11 in Section 5.1.5 shows the risk reduction values used in this study.

Water: While water has many uses at community level as well as for larger-scale productive purposes (e.g. industry), the focus of the field study is use for domestic purposes, in particular drinking water. The most specific link between poor management of human excreta and water quality is the safety aspect, which causes communities to take mitigating actions to avoid consuming unsafe water. These include reducing reliance on surface water and increasing use of wells or treated piped water supply. It even involves the need to rely less on shallow dug wells, which are more easily contaminated with pathogens, and to drill deeper wells. As well as from sewage, water sources which communities traditionally relied on for their other domestic needs (such as cooking, washing, showering) are changed in favor of cleaner, but more expensive, water sources. Water quality measurement is conducted as part of this study in representative field sites, to enable detailed analysis of the impacts of improved sanitation on local water quality (see Table A6). This study measures the actual or potential economic impacts of improving sanitation on two sets of mitigation measures:

- Accessing water from the source. Because households pay more or walk further to access water from cleaner sources such as drilled wells, or they pay more for piped water, it would in theory reduce these costs if sanitation improved. For example, traditionally people prefer the taste of water from shallow wells to deeper wells, and hence would likely return to use of shallow wells if they could guarantee cleaner, safer water. Also, providers of piped water have to treat water less if it is less contaminated, thus saving costs. Hence, expected percentage cost reductions are applied to current costs of clean water access to estimate cost savings from improved sanitation.
- Household treatment of water. Traditionally many households treat their water due to concerns about safety and appearance. This is commonly true even for piped, treated water supplies. Boiling is the most popular method because it is perceived to guarantee water to be safe for drinking. However, boiling water can require considerable cash outlays or it consumes their time for collecting fuel. Furthermore, boiling water for drinking purposes is more costly to the environment due to the use of wood, charcoal or electricity, with correspondingly higher CO^2 emissions than other treatment methods. If sanitation is improved and the pathogens in the environment reduced to low levels, then households would feel more ready to use a simple and less costly household treatment method such as filtration or chlorination. Hence, based on observations and expected future household treatment practices under situation of improved sanitation, the cost savings associated with alternative water treatment practices are calculated.

Access time: When households have their own private latrine, many of them will save time every day, compared with the alternative of going to the bush or using a shared facility for their toilet needs. The time used for each sanitation option will vary from household to household, and from person to person, as children, men, women, and the elderly all have different sanitation preferences and practices. Therefore, this study calculates the time savings for

[12] VOSL studies attempt to value what individuals are willing to pay to reduce the risk of death (e.g. safety measures) willing to accept for an increase in the risk of death. These values are extracted either from observations of actual market and individual behavior ('hedonic pricing') or from what individuals stated in relation to their preferences from interviews or written tests ('contingent valuation'). Both these approaches estimate directly the willingness to pay of individuals, or society, for a reduction in the risk of death, and hence are more closely associated with actual welfare loss compared with the HCA.

TABLE 6: UNIT VALUES FOR ECONOMIC COST OF TIME PER DAY AND OF LOSS OF LIFE (US$, 2008)

Technique	Daily value of time			Value of life		
	0-4 years	5-14 years	15+ years	15+ years	5-14 years	15+ years
RURAL						
Human capital approach[1]	0.65	0.65	1.29	8,507	13,314	13,953
VOSL[2]				49,351	49,351	49,351
URBAN						
Human capital approach[1]	0.65	0.65	1.29	8,507	13,314	13,953
VOSL[2]				49,351	49,351	49,351

[1] 2% real GDP or wage growth per year, discount rate = 8%
[2] The VOSL of US$40 million is transferred to the study countries by adjusting downwards by the ratio of GDP per capita in each country to GDP per capita in the USA. The calculation is made using official exchange rates, assuming an income elasticity of 1.0. Direct exchange from higher to lower income countries implies an income elasticity assumption of 1.0, which may not be true in practice.

different population groups of improving sanitation, based on observations of households both with and without improved sanitation. The value of time is based on the same values as health-related time savings (see above).

Excreta reuse: Human excreta, if handled properly, can be a safe source of fertilizer, wastewater for irrigation or aquaculture, or biogas. However, improved human excreta reuse is not commonly practiced in Indonesia. As none of the field sites include excreta reuse, this potential benefit is not valued in this study.

Intangibles: Intangibles are major determinants of personal and community welfare such as comfort, privacy, convenience, safety, status and prestige. Due to the often very private nature of intangibles, it is difficult to elicit reliable responses from individuals, and some may vary considerably from one individual and social group to another. Intangibles are therefore difficult to quantify and summarize from a population perspective, and are even more difficult to value in monetary terms for cost-benefit analysis. Economic tools do exist for quantitative assessment of intangible benefits such as the contingent valuation method and willingness to pay surveys that are commonly used to value environmental goods. However, there are many challenges to the application of these methods in field settings which affect their reliability and validity, and ultimately appropriate interpretation of quantitative results. Furthermore, willingness to pay often captures more than just the intangible variables being examined; it will also capture preferences that have been valued elsewhere (e.g. health and water benefits). This current study therefore attempts only to understand and measure sanitation knowledge, practices and preferences in terms of ranking scales. This enables a separate set of results to be provided alongside the monetary-based efficiency measures.

External environment: Likewise, the impacts of poor sanitation practices on the external environment are also difficult to quantify in monetary terms. Hence, this study attempts only to understand and measure practices and preferences in relation to the broader environment, in terms of ranking scales. Given that human-related sanitation is only one of several factors in environmental quality, other aspects – sources of water pollution, solid waste management, and animal waste – are also addressed to understand human excreta management within the overall picture of environmental quality.

3.3.4 DATA SOURCES

Given the range of costs and benefits estimated in this study, a range of data sources was defined, including both up-to-date evidence from the field sites as well as evidence from other databases or studies. Given the limitations of the field study, some elements of benefits needed to be sourced from other more reliable sources. Routine data systems such as the health information system are often poor quality and incomplete, while larger more reliable nationwide or local surveys may be out of date, or were not conducted in the ESI field locations.

The contents of the field tools applied are introduced briefly below (the tools applied in Indonesia are available from WSP).

Field tool 1: Household questionnaire

The household questionnaires consisted of two main parts: the first was asked to household representatives (the senior male and/or female household member, based on availability at time of interview), while the second was a shorter observational component covering mainly physical water, sanitation and hygiene features of the household. The interview part consisted of sections on:

- Socio-economic and demographic information, and household features
- Current and past household sanitation options and practices, and mode of receipt
- Perceived benefits of sanitation, and preferences related to external environment
- Household water supply sources, treatment and storage practices
- Health events and health treatment seeking
- Hygiene practices
- Household solid waste practices

The household questionnaire was applied to a total of 1,500 households over the five sites, or roughly 300 per site, divided over households with improved and unimproved sanitation. Table 8 presents the sample sizes per sanitation option and per field site. The figure of 300 respondents is greater than the minimum requirement for a statistically valid sample size according to the number of households in each site.

Apart from household questionnaires, complementary field data sources were collected from direct interviews with primary health center officers, doctors, and local public hospital officers. The field study was conducted in 10-12 days in each city/district, from 12 January to 10 February 2009 for all sites.

Before going ahead with the field survey, 1-2 subdistricts were identified in each city/district to be the survey sites. The site selection was based on the following criteria: 1) had sanitation intervention or sanitation development initiatives more than 2 years ago, 2) the availability of households with under-five children, 3) poor community, and 4) area with poor health condition. The poor community attribution is based on general national reference. For cities/districts meeting these criteria, the field survey teams asked officers of local institutions, such as the district health office, ISSDP City Facilitators and local informal leaders, to select appropriate survey sites. The selected subdistricts and villages in each city/district are shown in Table 7.

Field tool 2: Focus group discussion

The purpose of the focus group discussion (FGD) was to elicit behavior and preferences in relation to water, sanitation and hygiene from different population groups, with main distinctions by sanitation coverage (with versus without) and gender (male and female). The topics covered in the FGDs followed a generic template of discussion topics, but the depth of discussion was dictated by the readiness of the participants to discuss the topics. The added advantage of the FGD approach is that it allows discussion of aspects of sanitation and hygiene that may not otherwise be revealed during face-to-face household interviews, and

TABLE 7: LIST OF SUBDISTRICT AND VILLAGES FOR ESI 2 SURVEY AREAS IN FIVE CITIES/DISTRICTS IN INDONESIA

No	City District	Subdistricts		Villages	
			Control area	Intervention area[1]	Control area
1	Payakumbuh City	North Payakumbuh	North Payakumbuh	• Talawi • Koto Panjang	• Payolinyam • Kubu Gadang
2	Banjarmasin City	Central Banjarmasin	Central Banjarmasin	Pekapuran Laut	Kelayan Luar
3	Malang City	• Kedung Kandang • Lowokwaru	• Kedung Kandang • Lowokwaru	• Mergosono • Tlogomas	• Arjowinangun • Dinoyo
4	Lamongan District	Turi	Turi	• Geger • Keben	• Badurame • Turi
5	Tangerang District	Sepatan	Rajeg	• Sarakan • Kayu Agung	• Sukasari • Tanjakan

[1] During the study design phase, the idea of having an "Intervention Area" and "Control Area" was conceived. However, during the actual field study, it was found that no pure intervention areas nor pure control areas actually existed. Hence, the respondents were a mix of those who still practice open defection and those who have or use private toilets, shared toilets or community toilets.
The detail steps of the field survey implementation are described in the Annex.

to either arrive at a consensus or otherwise to reflect the diversity of opinions and preferences for sanitation and hygiene among the population. FGDs were led by a senior sociologist and notes taken by junior sociologists. Three FGD sessions were conducted at each site, each session lasting roughly three hours. The groups constituted:

- A group of four senior female members of households with improved sanitation facilities and four senior female members of households with unimproved sanitation,
- A group of four senior male members of households with improved sanitation facilities and four senior male members of households with unimproved sanitation,
- A stakeholder group consisting of seven people, including local health department officers, local women health cadres, and local NGO activists working on sanitation.

Field tool 3: Physical location survey

A survey of the physical environment was conducted in all field locations – given that there were several locations per site this gave three to five physical location surveys per site. The main purpose was to identify important variables in relation to water, sanitation and hygiene in the general environment, covering land use, water sources and environmental quality. This information was triangulated with the household surveys and FGDs as well as the water quality measurement survey, to enable appropriate conclusions about the extent of poor sanitation and links to other impact variables. This survey was conducted by the health expert of the ESI team.

Field tool 4: Water quality measurement

Given one of the major detrimental impacts of poor sanitation is the impact on surface as well as ground water quality, special attention was paid in this study to identifying the relationship between the type and coverage of toilets in the selected field sites, and the quality of local water bodies. Given the time scale of this present study, it was not possible to measure water quality variables before the project or program was implemented; neither was it possible to compare wet season and dry season measurements. The water quality measurement survey was contracted to SUCOFINDO, a state-owned engineering survey company in Jakarta, and carried out in January 2010. The study enabled assessment of the impact of specific local sanitation features on water quality. It also enabled a broader comparison of water quality between study sites with different sanitation coverage levels. Water sources tested in each site included ground water (dug shallow wells, deeper drilled wells), standing water (ponds, lake, canal), and flowing water (river, wastewater channels). Table C 1 provides a list of water quality tests conducted, showing the type of test and location per parameter, and the number and type of water sources tested. For cost reasons, water testing was not done in all the sites (four of the five study sites). Parameters measured varied per water source, but generally included BOD, COD, DO, nitrate, Chlorine, E Coli, pH, turbidity and conductivity.

Field tool 5: Market survey

For economic evaluation, local prices are required to value the impacts of improved sanitation and hygiene. Selected resource prices, and in some case resource quantities, were recorded from the most appropriate local source: labor prices (average wage, minimum wage) and employment rate, water prices by source, water treatment filters, fuel prices, sanitation improvement costs, soap costs and pharmacy drug costs. One market survey was carried out per field site.

Field tool 6: Health facility survey

Given the importance of health impacts, a separate survey was conducted in two to three health facilities serving each field site. Variables collected include numbers of patients with different types of WSH-related disease, and the types and cost of treatment provided by the facility. Data were supplemented by data collected or compiled at higher levels of the health system, such as district and city health offices.

There were some constraints during secondary data collecting, such as:

- Required data were not available,
- The format of available data/information did not match the required format,
- Hospitals have strict procedures for releasing data. To obtain data, the team needed to specify precisely the data required and present an official letter of recommendation from government.

Other data sources: as well as collection of data from field sites, to support the field level cost-benefit analysis, data and information were collected from other sources, such as reports, interviews with program implementers and project data sets. The complete list of data sources is presented in the Annex A 5.

3.3.5 DATA ANALYSIS

The types of costs and benefits included in the study are listed in section 3.2. This section describes how costs, benefits and other relevant data are analyzed to arrive at overall estimates of cost-benefit.

The field level cost-benefit analysis generates a set of efficiency measures from site-specific field studies, focusing on actual implemented sanitation improvements, including household and community costs and benefits (see Chapter 8). The costs and benefits are estimated in economic terms for a 20-year period for each field site, using average values based on the field surveys and supplemented with other data or assumptions. Five major efficiency measures are presented:

1. The benefit-cost ratio (BCR) is the present value of the future benefits divided by the present value of the future costs, for the 20-year period. Future costs and benefits (i.e. beyond year 1) are discounted to present value using a discount rate of 8% (sensitivity analysis: low 3%, high 10%).
2. The cost-effectiveness ratio (CER) is the present value of the future health benefits in non-monetary units (cases, deaths, disability-adjusted life-years) divided by the present value of the future costs, for the 20-year period. Future costs and health benefits (i.e. beyond year 1) are discounted to present value using a discount rate (see above).
3. The internal rate of return (IRR) is the discount rate at which the present value equals zero – that is, the costs equal the benefits – for the 20-year period.
4. The payback period (PBP) is the time after which benefits have been paid back, assuming initial costs exceed benefits (due to capital cost) and over time benefits exceed costs, thus leading to a point that is break even.
5. The net present value (NPV) is the net discounted benefits minus the net discounted costs.

Results are presented by field site and for each sanitation improvement option compared with no sanitation option (i.e. open defecation). Also, selected steps up the sanitation ladder are presented, such as from shared latrine to private latrine, from dry pit latrine to wet pit latrine, or from wet pit latrine to sewerage. The efficiency ratios are presented both under conditions of well-delivered sanitation programs which lead to well-functioning sustainable sanitation systems, as well as sanitation systems and practices under actual conditions, observed from the program approach analysis (section 3.4). Given that not all sanitation benefits have been valued in monetary units, these benefits are described and presented in non-monetary units alongside the efficiency measures. Gender issues will be particularly central in the presentation of intangible benefits.

Further assessments are conducted to enable national interpretation of efficiency results. This involves entering input values in the economic model corresponding to national averages for rural and urban areas, which is likely to give different results from the specific field sites.

3.4 PROGRAM APPROACH ANALYSIS

The aim of the program approach analysis (PAA) is to show the levels and determinants of performance of sanitation programs. It evaluates the link between different program approaches and eventual efficiency and impact of the sanitation options. It is also used as the basis for adjusting ideal intervention efficiency to estimate actual intervention efficiency. The PAA also shows current practices in relation to sanitation program evaluation, and provides recommendations for improved monitoring and evaluation of sanitation programs.

The PAA is essentially a desk study, assessing sanitation program documents, with additional information gained through interviews with sanitation program managers and implementers. More in-depth studies and data were possible using the field sites for the cost-benefit analysis (see section 3.3). The PAA has six main steps:

1. Listing of in-country sanitation programs and their characteristics, followed by a selection of sanitation programs to include in the PAA (see Annex Table A7). Chapter 7.2 shows the selected programs and their main characteristics.

2. Assessment of specific types of program 'approach' to be compared. Program approaches that are chosen to be included in this study are:
   1) WSLIC 2 (Water and Sanitation for Low Income Communities 2) in Lamongan District,
   2) SANIMAS (Community-Based Sanitation) in Tangerang District,
   3) CBSS (Community-Based Sewer System) Malang City,
   4) CLTS (Community-Led Total Sanitation) Payakumbuh City,
   5) Sewerage system in Banjarmasin City.

   The first four programs above are community-driven projects. The field locations are considered representative for this study. The fifth site is an off-site sanitation system. The sewerage system in the selected location, Banjarmasin, was initiated in 1998 under a city government initiative. Formerly, the sewerage systems were operated by the local water supply utility, and in September 2006, their management was taken over by PD PAL, a special local government-owned enterprise for domestic wastewater management. There were several particular reasons for selecting this program:
   - Its development commenced more than 10 years ago,
   - It has been funded by a variety of sources,
   - Actual uptake is currently only around 14% of capacity, which is too low to reap economies of scale.
3. Evaluation of selected sanitation programs in terms of their program approaches and measurement of outputs and successes (e.g. unit costs, coverage, and uptake). For the assessment of actual efficiency, key indicators of program effectiveness are selected.
4. Analysis of factors that determine program performance, focusing on economic variables.
5. Evaluation of selected sanitation programs in terms of their programming approach and measures of output and success (e.g. unit costs, coverage, uptake). For the assessment of actual efficiency, key indicators of program effectiveness are selected.
6. Analysis of factors determining program performance, focusing on economic variables.

The PAA is constrained by lack of input data available from programs evaluated, which limits the number of programs that could be included in the study. The results of the analysis are interpreted taking into account setting-specific conditions, which are partially responsible for the performance results; hence findings are not definitive, but instead illustrative and instructive.

3.5 NATIONAL STUDIES

These studies have two main purposes: to assess the impacts of improved sanitation outside the field study sites, for a more comprehensive benefit assessment (tourism, business and sanitation markets); and to complement data collected at field level for better assessment of local level impacts (health and water resources).

3.5.1 TOURIST AND VISITOR SURVEY

There is an unarguable link between sanitation and tourism, however only very little evidence can be found. Poor sanitation and hygiene affect tourists in two ways:

- Short-term welfare loss and expense. Tourists get sick from diarrhea, intestinal worms, hepatitis, and so on, which directly affect health care costs. Tourists are also exposed to poor sanitation, which means they do not enjoy their holiday to the full.
- Reduced numbers of tourists. In the longer term, tourists will avoid tourist destinations that are deemed unsafe (from a health perspective) or unpleasant, due to dirty water, malodorous environment or lack of proper toilets, for example. Tourists may stay away either because they themselves have had an unpleasant experience at a particular tourist destination and choose not to come back; or they have been advised not to visit a tourist destination due to, among other things, poor sanitation.

This study attempts to explore these two impacts through a survey of non-resident foreign visitors and holidaymakers. Business visitors were also included to get their views from a business perspective. A total of 144 holiday tourists and 110 business visitors were interviewed at Soekarno-Hatta International Airport in Jakarta, as they were leaving Indonesia.

Table 8 shows the sample size by major category of nationality and type of visitor (holiday or business), disaggregated into first time and repeat visitors.

The survey at Soekarno-Hatta airport was conducted in English. Tourists were approached and the purpose of the questionnaire explained to them. If they agreed, they were given a questionnaire to fill out. Survey staff were on standby to answer any questions while the survey respondents were filling in the form. On average, the questionnaire took 10 to 15 minutes to complete. Questions covered the following topics:

- Length of trip, places stayed and hotel category,
- Level of enjoyment at different locations visited, and reasons,
- Sanitation conditions at places visited, and availability of toilets,
- Water and sanitation-related sicknesses suffered, perceived sources, days of sickness, and type and cost of treatment sought,
- Major sources of concern for spending holidays in Indonesia,
- Intention to return to Indonesia, recommendation to friends, and reasons.

3.5.2 BUSINESS SURVEY

Besides affecting tourism, poor sanitation also has the potential to affect businesses. Two types of impacts were assessed: local-level impacts on the day-to-day functioning of businesses, and the broader impacts on business location decisions:

- Businesses located in areas with poor sanitation may pay higher costs e.g. having to pay more to access clean water or lose income from customers' unwillingness to visit the location. It should be noted, that the loss of customers assessed in one area does not necessarily mean an absolute loss for business sector, as customers may choose to go elsewhere, such as other business located in other areas.
- Poor sanitation may affect a foreign company's decision to open a base in Indonesia, due to: (a) the health condition of local employees, based on actual data or business perceptions of the health conditions of the country's workers; (b) perceived poor quality of water for business purposes and its related costs; (c) general poor environmental condition, including poor solid waste management and filthy and unhygienic conditions, which may affect the company's ability to do business in Indonesia; and (d) objections from foreign personnel about being based in Indonesia due to, among other things, its poor sanitary conditions.

To assess these hypothetical effects, ten businesses were surveyed through face-to-face interviews and, in some cases, in-depth discussions. Table 9 shows the number of firms by sector, and by ownership (local or foreign). These firms were selected based on the link between sanitation and their business, and the importance of the sector and the specific firm to the economy of Indonesia. The surveyed foreign firms were those that already have a presence in Indonesia and hence a key category of firm – those that have decided against opening a base in Indonesia – were not part of the sample. However, the foreign firm, a garment producer, was asked about the factors affecting their decision to be based in Indonesia, as well as their experiences with the country.

TABLE 8: SAMPLE SIZES FOR TOURIST SURVEY, BY MAIN ORIGIN OF TOURIST

Tourist nationality	Holiday tourists			Business visitors			Holiday and business total
	First time visitors	Repeat visitors	Total	First time visitors	Repeat visitors	Total	
Europe	8	26	34	2	20	22	56
USA and Canada	6	7	13	1	4	5	18
Asia	15	39	54	10	54	64	118
Australia and New Zealand	6	36	42	2	16	18	60
Africa	0	1	1	0	1	1	2
Total	**35**	**109**	**144**	**15**	**95**	**110**	**254**

TABLE 9: SAMPLE SIZE FOR BUSINESS SURVEY, BY MAIN SECTORS OF LOCAL AND FOREIGN FIRMS

Main business or sector of firm	Local business	Foreign firm	Total
Hotel	2	0	**2**
Restaurant	4	0	**4**
Garment producer	1	1	**2**
Food producer (traditional medicine)	1	0	**1**
Convention hall	1	0	**1**
Total	**9**	**1**	**10**

The questionnaire covered the following topics:

- Ownership, sector, activities, employees and location of the firm.
- Perceptions about the sanitation condition at company's location.
- Factors affecting the decision to be based in a particular country or area, and plans to relocate.
- The production and sales costs related to various aspects of poor sanitation, such as health, water, and environment.
- Potential costs and benefits of improved sanitation to the business.

3.5.3 NATIONAL SANITATION MARKETS

Sanitation markets include both input markets (the market value of expenditures to improve sanitation) and output markets (reuse of human excreta; animal excreta is also included as biogas is commonly produced using a mix of human and animal excreta).

Assessment of sanitation input markets has three main aims:

1. To contribute to the estimation of intervention costs, for inclusion in the cost-benefit analysis and cost-effectiveness analysis.
2. To examine how much interventions cost at field, project and at national level, and the main contributors to cost, to assess in detail how to finance these costs.
3. To explore what the beneficial economic impacts might be to the local and national economy, based on the estimated size of the sanitation inputs market.

Details of sanitation inputs and costs are sourced principally from the field studies (household questionnaire, local market survey) where the specific toilet types and related input needs and costs have been assessed. Project and program costs have also been collected from the program approach analysis (see 3.4). To estimate the overall potential market size of increasing sanitation coverage at national level, generic unit costs per sanitation option are applied to the likely options demanded by the population. Two scenarios were included: the market size of reaching the MDG target by 2015, and the market size of achieving and maintaining 100% coverage.

The calculation of national potential market size is based on the following assumption:

- The unit cost of the sanitation ladder is based on provision costs of a private septic tank for urban areas and costs of a simple pit latrine for rural areas.
- The cost components consist of costs for increasing coverage of those currently without toilets and also costs of replacement of existing sanitation facilities according to their technical lifecycle assumptions.

The TTPS, in the 2010 revised version of the Roadmap to Sanitation Development 2010-2014, has calculated generic unit costs and the total investment costs requirement to achieve and maintain 100% coverage. The figure will then automatically reflect the 100% coverage sanitation market size.

In Indonesia the reuse of sanitation 'outputs' (as fertilizer, soil conditioner, biogas) is very limited. It is useful to estimate the potential economic benefits of these. Such an analysis will help support policy makers and the private sector to assess whether reuse options could be economically and financially viable to stimulate investment in this area. However, due to insufficient data, this study did not calculate the potential economic value of this opportunity.

3.5.4 NATIONAL HEALTH STATISTICS

The field surveys provide data from the sampled households and health facilities on disease incidence for selected diseases related to poor sanitation. For some sites, other studies conducted in the same locality provided alternative sourc-

es of disease incidence data. However, constraints in data robustness at field level requires supplementation of these data with estimates of disease incidence and mortality rates from other sources, and adjustment to the health conditions of the specific field sites. Data were therefore sourced from national surveys (e.g. Demographic and Health Survey) and research studies, as well as internationally compiled statistics for Indonesia or the Southeast Asia region (World Health Organization; Disease Control Priorities Project 2). The data from these different sources were compared in terms of quality and applicability to the field sites, to finally select the most appropriate values for use in the cost-benefit analysis and the national health overview.

3.5.5 NATIONAL WATER STATISTICS

National water quality data were collected and presented in the sanitation 'impact' study, covering mainly surface water of major lakes and rivers. Hence, this present study updates those data to provide a national level picture of the quality of water resources, including ground water quality. The secondary data collection was mainly obtained from water and sanitation related documents at AMPL, a national level water and sanitation working group, and the Indonesia Sanitation Sector Development Program (ISSDP). Other sources are official websites of related government bodies such as provincial and city/district level environmental control bodies.

An increase of 1 mg/liter of BOD pollution will lead to an increase of about 25% in the national average of drinking water production costs.[13]

Poor or non-existent drainage systems in urban areas have received a high public profile due to regular flooding (e.g. Jakarta, where some parts of the city are regularly flooded during the rainy season, and occasionally there is severe flooding). Poor sanitation such as insufficient drainage or unimproved solid waste disposal (thus blocking drains) can lead to avoidable flooding in rainy season. Also, inappropriate sanitation options in seasonally flooded rural areas can lead to avoidable surface water pollution and health hazards. Therefore, this study collected secondary evidence from government and donor assessments, university research, and media reports of flooding incidents, focusing on cities, such as the Sanitation Whitebooks of ISSDP participants, Sanitation Fast Track Assessment of the ISSDP, and sanitation-related fact sheets provided by AMPL.

The links between poor sanitation, water quality and inland fish production were assessed in the ESI sanitation 'impact' study. Where sewage is a significant contributor to degraded water resources – affecting biological oxygen demand as well as toxicity (e.g. bacteria, parasites) – it was concluded, based on limited scientific evidence, that fish reproduction, fish growth and fish survival is affected by poor sanitation.

[13] ISSDP Phase 1 Documentation, 2006.

IV. Local Benefits of Improved Sanitation and Hygiene

This chapter presents the following impacts of improved sanitation and hygiene at local level – covering household and community impacts:

- Health (section 4.1)
- Water (section 4.2)
- Access time (section 4.3)
- Intangibles (section 4.4)
- External environment (section 4.5)

4.1 HEALTH

4.1.1 DISEASE BURDEN OF POOR SANITATION AND HYGIENE

In rural sites, it is estimated that there are 3.59 cases of disease per person annually, 0.02 DALYs, and an annual risk of death of 0.38 per 1,000 people due to poor sanitation and hygiene (see Table 10). In urban areas, the rates are 2.63 cases of disease per person annually, 0.011 DALYs, and an annual risk of death of 0.44 per 1,000 people. The main burden comes from direct diseases i.e. diarrheal disease, respiratory infection (ALRI) and helminthes. Site-specific rates used are presented in Table 10.

To some extent, quality of life impacts associated with morbidity are reflected in the DALY calculations above, and in the estimates of health care and productivity costs (see later sections). Besides the significant burden on households indicated by the economic values in the cost-benefit analysis, diseases have a number of welfare effects on people, such as physical pain, mental suffering and inconvenience. The focus group discussions did reveal, however, that diseases caused by poor sanitation and hygiene are not perceived to be too serious compared with other diseases, and medicines to treat these diseases are available at an affordable price.

According to available health data, young children are more susceptible to diarrheal diseases than older children (over five years of age) and adults. Figure 8 presents annual cases/person of mild diarrhea and severe diarrhea prevalence for children under-five in the study sites. Mild and severe diarrhea will have a higher magnitude in rural sites, such as Lamongan and Tangerang, than in urban sites.

4.1.2 HEALTH CARE COSTS

Health care costs are estimated based on disease cases (Table 10), the proportion of illnesses treated by each provider (Table 11), inpatient admission rates and practices (Table 12) and the unit costs associated with each provider (Table 13).

TABLE 10: DISEASE RATES ATTRIBUTABLE TO POOR SANITATION AND HYGIENE, 2009

Disease	Rural sites			Urban sites		
	Cases/person	Deaths/1000 people	DALYs/person	Cases/person	Deaths/1000 people	DALYs/person
Direct diseases						
Mild diarrhea	1.69	0.30	0.01	0.63	0.34	0.004
Severe diarrhea	1.06		0.01	0.48		0.003
Helminthes	0.37	-	-	0.37	-	0.002
ALRI	0.48	0.08	0.00	0.42	0.09	0.003
Total	**3.59**	**0.38**	**0.02**	**2.63**	**0.44**	**0.011**

FIGURE 8: COMPARISON OF ANNUAL DIARRHEA CASE PER PERSON FOR UNDER-FIVES, BETWEEN STUDY SITES

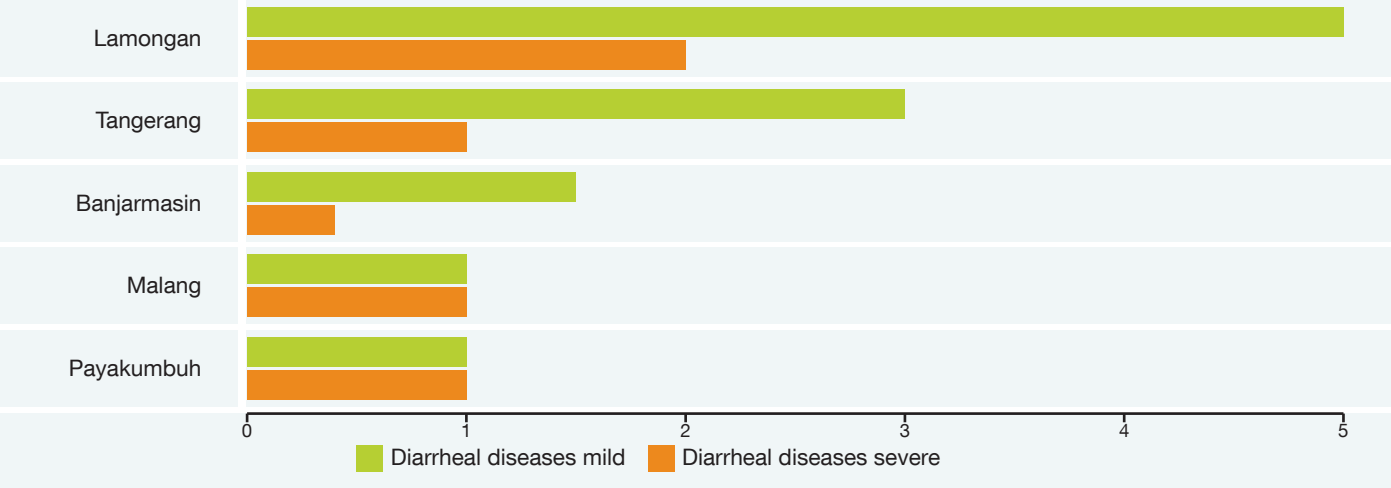


TABLE 11: PROPORTION OF POPULATION SEEKING HEALTH CARE FOR MILD DIARRHEAL DISEASE, BY AGE GROUP

	Rural			Urban		
	Age group			Age group		
	0-4 Years	5-14 Years	15+ Years	0-4 Years	5-14 Years	15+ Years
Public health facility	11%	8%	3%	21%	11%	10%
Private formal health facility	24%	16%	6%	21%	13%	9%
Pharmacy	0%	2%	0%	0%	1%	1%
Private informal provider	3%	3%	1%	1%	0%	3%
Self-treatment	1%	3%	12%	2%	2%	3%
Others	0%	1%	1%	0%	0%	0%

TABLE 12: AVERAGE RATE OF INPATIENT ADMISSION

Disease	Rural			Urban		
	Age group			Age group		
	0-4 Years	5-14 Years	15+ Years	0-4 Years	5-14 Years	15+ Years
Diarrheal disease	32%	8%	10%	12%	6%	11%
Indirect: ALRI	10%	7%	6%	7%	5%	3%

TABLE 13: UNIT COSTS ASSOCIATED WITH TREATMENT OF SEVERE DIARRHEAL DISEASE (US$, 2009)

Health provider	Outpatient cost (US$)		Inpatient cost per day (US$)		
	Health care	Incidentals[1]	ALOS[2] (days)	Health care[3]	Incidentals[1]
Public/NGO					
Rural	9.63	1.85	0.39	33.41	0.48
Urban	9.63	1.94	0.42	33.41	0.48
Private formal					
Rural	19.25	1.85	0.39	45.92	0.48
Urban	19.25	1.94	0.42	45.92	0.48
Informal	4.81				

Source: Ronnie Rivany. Indonesian – Diagnosis Related Group (INA-DRG). Department of Health Policy and Analysis. SPHUI. 2008.
[1] Incidentals: indirect costs borne by patients such as transport, food, and incidental expenses, per outpatient visit and per inpatient stay.
[2] ALOS: average length of stay [days].
[3] Inpatient health care costs are presented per stay.

Table 11 shows a summary of treatment-seeking rates for mild diarrheal disease based on the household survey. The evidence suggests that the majority of the population seeks care from public and private formal health facilities, with higher rates of treatment seeking of public facilities in urban areas. In rural sites, there are more people who prefer to be self-treated than in urban sites. The treatment-seeking behavior also varies by age. People are more eager to bring younger children (under five years of age) than older children to formal health facilities whenever they get diarrheal disease. Annex B shows treatment-seeking behavior for other diseases related to sanitation and hygiene.

The average rate of inpatient admission (% of overall cases admitted to hospital) for each disease is presented in Table 12, sourced from the household survey. The data suggest a significantly higher rate of admission for young children, especially in rural areas.

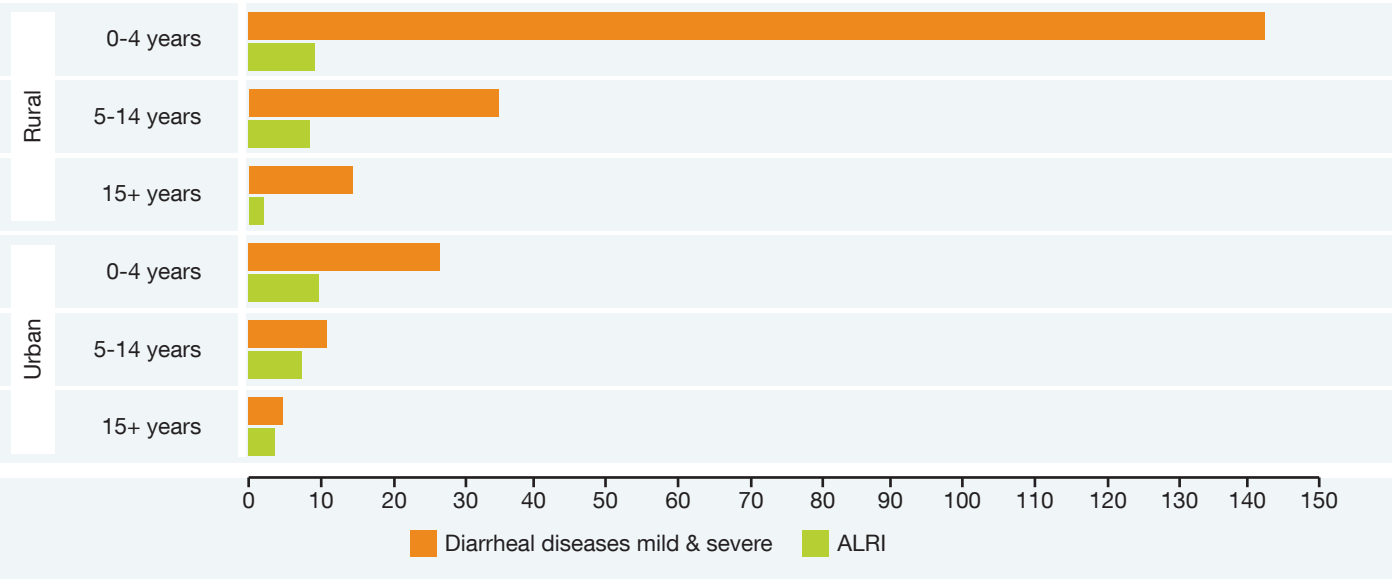
Unit costs for treatment of diarrheal disease are provided in Table 13, by health care provider. The health care cost figures are taken from a secondary data source (Rivany, 2008). The inpatient room rates are for public hospital type B, with no available estimates distinguishing rural and urban hospitals. Private formal care costs are more expensive than public health provider and informal care costs. The health care costs in public facilities are paid by the government as part of health subsidy.

Table 14 shows the annual costs per person (by age group) attributed to poor sanitation and hygiene in Indonesia, by disease. Costs in rural areas range from US$17 for adults to US$151 for young children. In urban areas, costs per person are lower, ranging from US$8 for adults to US$37 for young children. Significantly higher costs for young children in rural areas compared to urban areas is a combination of higher numbers of cases per child, higher inpatient admission and outpatient visit rates.

TABLE 14: AVERAGE HEALTH CARE COST PER PERSON PER YEAR IN FIELD SITES, BY DISEASE, AGE GROUP AND RURAL/ URBAN LOCATION

Disease	Rural			Urban		
	0-4 Years	5-14 Years	15+ Years	0-4 Years	5-14 Years	15+ Years
Diarrheal disease	142	35	15	27	11	5
ALRI	9	9	2	10	7	4
Total	**151**	**44**	**17**	**37**	**18**	**8**

FIGURE 9: AVERAGE HEALTH CARE COST PER PERSON PER YEAR IN FIELD SITES FOR DIARRHEAL DISEASE (MILD AND SEVERE IN US$)



4.1.3 PRODUCTIVITY COSTS

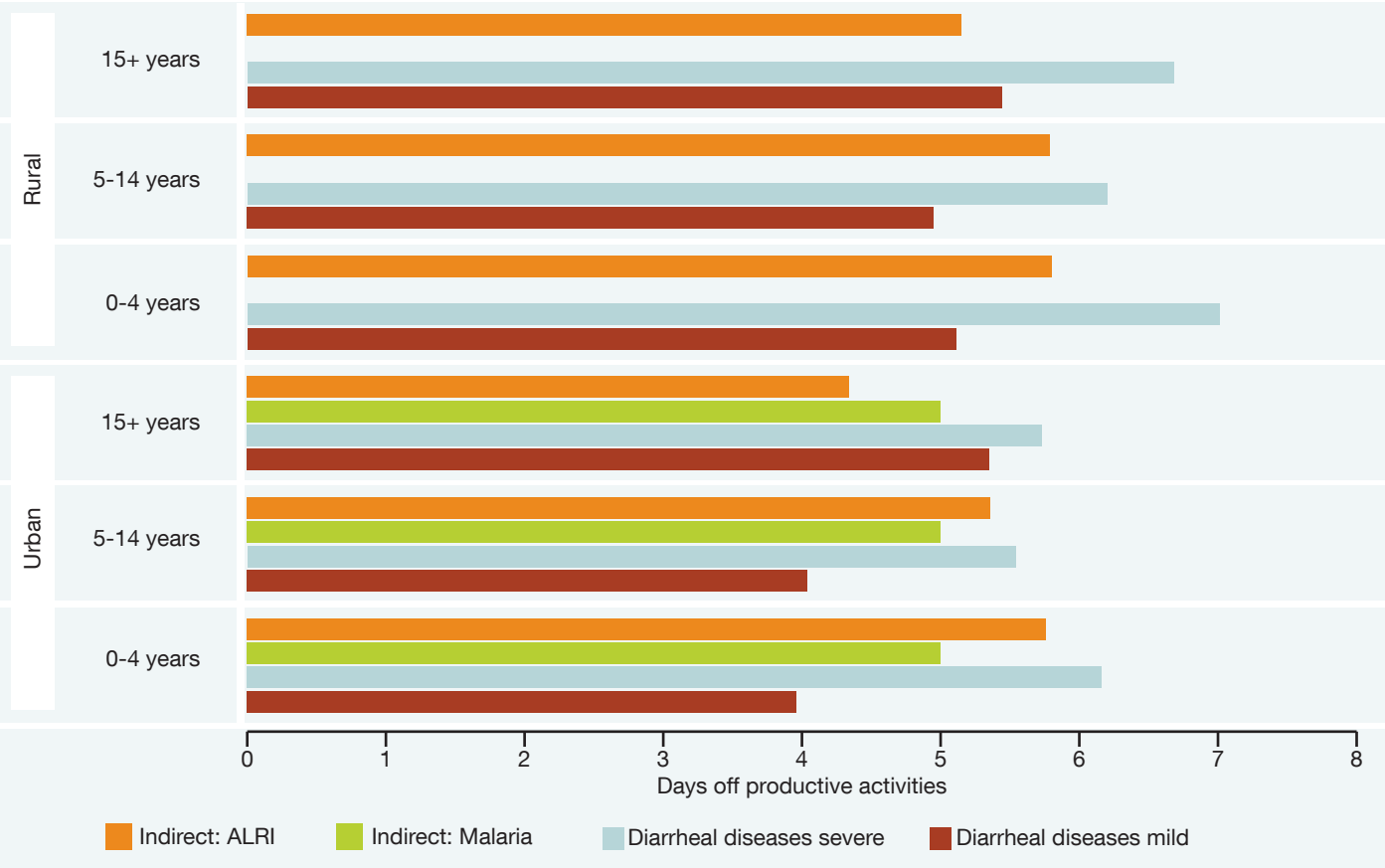
Health-related productivity costs are calculated by multiplying time off of work or school to the disease rates, per population age group. The economic cost of time lost due to illness reflects an opportunity cost of time or an actual financial loss for adults with paid work. The unit costs for all locations are based on the national average wage. In order to take into account variations in employment patterns, a conservative value is given for adults – at a rate of 30% of the average income – reflecting a conservative estimate of the value of time lost. For children 5-14 years, sick time reflects lost time at school, which has an opportunity cost, valued at 15% of the average income. For children under 5, the time of the child carer is applied at 15% of the average income.

The household survey also revealed practices related to carers looking after the sick people. The average number of days to take care for the sick person in rural areas is 3.4 days, at 13.7 hours/day, while the average number of days in urban areas is 4.3 days, at 13.3 hours per day. Table 15 shows that the greatest productivity costs are incurred due to illness of children under five, in both urban and rural areas. This is because the disease prevalence for children under five years is higher than for other age groups. The actual figures may be even greater as the children's parents are also involved in the care of their ill children, causing additional loss of productive time.

4.1.4 MORTALITY COSTS

For the mortality cost estimation, this study adopted data from some international studies, which are compiled and presented in the Table 16. The figures are estimated by combining the annual risk of death per age group with the average value of life. Poor sanitation, through its important implications for child nutritional status, is associated with higher rates of diarrheal disease and acute lower respiratory infection (ALRI), as well as increased mortality from a range of childhood diseases. However, there is no adequate national data source that provides precise information on the link between diarrheal disease and other diseases.

FIGURE 10: NUMBER OF DAYS AWAY FROM PRODUCTIVE ACTIVITIES, PER DISEASE WITH RESPECT TO PERSON'S AGE



4.1.5 AVOIDED HEALTH COSTS

Central to the arguments of improving sanitation and hygiene are the health improvements. Limited evidence exists on the actual health impact of sanitation or hygiene programs on health outcomes in Indonesia and this study draws on international evidence. Figure 11 shows the different risk exposure scenarios being compared in this study, and the reduced risk of fecal-oral disease and helminthes infection associated with movements 'up' the sanitation ladder. The left-hand scenarios (basic improved sanitation) are relevant mainly for rural areas, while the right-hand scenarios (moving to treatment of sewage and wastewater) are relevant mainly for urban areas where sewerage systems are currently only available at urban areas.

The answers given by household respondents to the question, "Have you noticed an observable change in the rate of diarrheal disease in any household members since you received the new latrine?", are shown in the Table 17. At least 80% of respondents in all categories answered that they do not feel any observable change in diarrheal disease rates in any household member since they received a new latrine. A

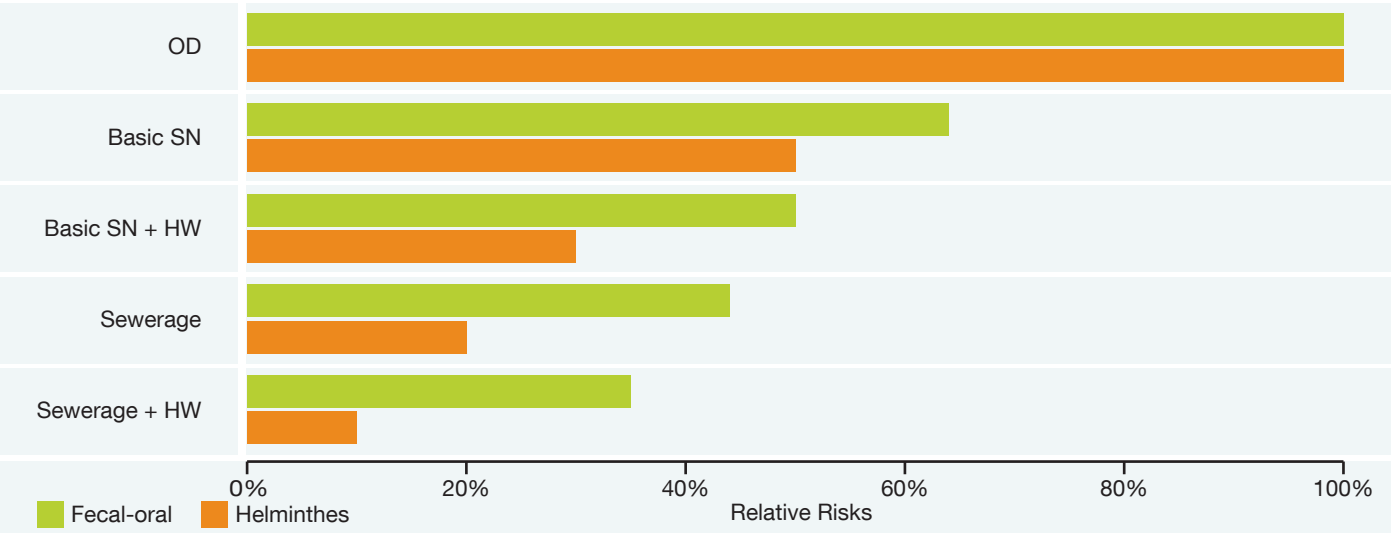
TABLE 15: AVERAGE PRODUCTIVITY COST PER PERSON PER YEAR IN FIELD SITES, BY DISEASE, AGE GROUP AND RURAL/URBAN LOCATION (US$)

Disease	Rural			Urban		
	0-4 Years	5-14 Years	15+ Years	0-4 Years	5-14 Years	15+ Years
Diarrheal disease mild	11.73	6.22	6.80	2.69	1.91	3.07
Diarrheal disease severe	5.82	4.23	6.82	2.32	1.71	1.33
Malaria	0.00	0.00	0.00	0.02	0.02	0.03
ALRI	2.31	3.67	2.40	3.14	2.97	2.53
Total	**19.86**	**14.11**	**16.02**	**8.17**	**6.60**	**6.96**

TABLE 16: AVERAGE MORTALITY COST PER PERSON PER YEAR IN FIELD SITES, BY DISEASE, AGE GROUP AND RURAL/URBAN LOCATION

Disease	Rural			Urban		
	0-4 Years	5-14 Years	15+ Years	0-4 Years	5-14 Years	15+ Years
Diarrheal disease	11.49	0.50	0.52	11.49	0.50	0.52
Malaria	0.04	-	-	0.04	-	-
ALRI	3.23	-	-	3.23	-	-
Total	**14.76**	**0.50**	**0.52**	**14.76**	**0.50**	**0.52**

FIGURE 11: RELATIVE RISK OF FECAL-ORAL DISEASES AND HELMINTHES OF DIFFERENT RISK EXPOSURE SCENARIOS



Key: OD – open defecation or unimproved sanitation; SN – sanitation; HW – hand washing, reflecting basic hygiene interventions

small proportion perceived that receiving new latrine leads to "Probably less" or "A lot less" diarrheal disease. Note that many of those answering from the septic tank and sewerage categories were moving up from other improved sanitation options, and hence the health effects are expected to be relatively fewer than for those previously practicing open defecation. These data are considered to be weaker than the international evidence presented in Figure 11, which are based on more rigorous scientific studies.

Table 18 summarizes the total costs of poor sanitation and hygiene in Indonesia, per household for the selected field sites, and total costs at national level. Health care is the main contributor to cost averted of improved sanitation, representing between 60% and 70% of total health costs in both rural and urban sites (Figure 12). The costs averted in this table are utilized in the cost-benefit calculations in Chapter 8. Each study site has different costs averted values according to their sanitation development situations.

4.2 WATER

Water is abundant in most parts of Indonesia. In 2004, internal freshwater resources per capita were 15,500 m^3, which is significantly higher than other Asian countries such as India (1,185 m^3) and China (2,183 m^3). In terms of major water resources, Indonesia has a large number of small and medium-sized rivers. A major characteristic of most Indonesian rivers is the high variability of runoff due to the distinct separation between rainy and dry season. Most of the rivers are located in the more humid western half of the

TABLE 17: PERCEIVED DIFFERENCE IN DIARRHEAL INCIDENCE SINCE IMPROVED SANITATION, IN ALL FIELD SITES

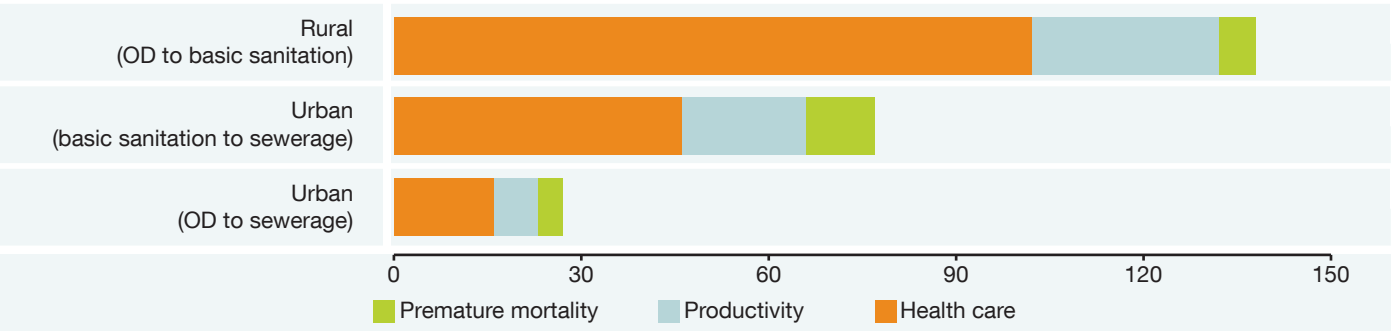
Sanitation coverage	Households in sample	Answer to question "have you noticed an observable change in diarrheal disease rates in any household members since you received the new latrine?"			
		A lot less	Probably less	No	Probably more
Shared/public	36	0%	0%	97%	3%
Dry pit	5	0%	20%	80%	0%
Wet pit	71	7%	8%	83%	1%
Septic tank	187	5%	11%	80%	4%
Sewerage with treatment	121	2%	3%	95%	0%

Note: Total responses for this question were 452 out of 1,500 respondents; the remaining respondents did not give any answer.

TABLE 18: ANNUAL COSTS PER HOUSEHOLD OF POOR SANITATION AND HYGIENE, AND ANNUAL COSTS AVERTED OF IMPROVED SANITATION (IN US$, 2008)

Costs	Costs (baseline risk)		Costs averted		
	Rural	Urban	Rural (OD to basic sanitation)	Urban (OD to sewerage)	Urban (basic sanitation to sewerage)
Health care	202	74	102	46	16
Productivity	80	33	30	20	7
Death	10	15	6	11	4
Total	**292**	**123**	**138**	**76**	**27**

FIGURE 12: HEALTH COSTS AVERTED OF IMPROVED SANITATION OPTIONS



Indonesian archipelago, i.e. the islands of Sumatra, Java and Kalimantan. Some of the rivers of major importance for human settlements include[14] Cisadane (Banten, West Java), Ciliwung (Jakarta), Citarum (West Java) (prior to construction of the Saguling Reservoir), Kali Brantas (East Java), and Bengawan Solo (Central Java). The first four of these rivers run through highly densely populated areas, where human activities – both domestic and industrial – release large quantities of wastewater to Indonesia's great rivers. Kali Brantas, for example, receives about 150 tons/day of wastewater, 60% originating from domestic wastewater and the remaining 40% from industries[15]. Citarum River in West Java, is also indicated to be highly polluted with domestic and industrial waste, with E. coli in the water reaching 50,000/100 ml[16].

Biochemical oxygen demand (BOD) is high due to intakes from agriculture, industry and domestic sources. The ESI Phase 1 study estimated that in 2005, domestic sources contributed to 2.1 million tons of BOD per year to inland water sources. The BOD came from an estimated 6.4 million tons of feces and 64 million m^3 of urine countrywide, plus at least 854 million m^3 of gray water from urban areas. As well as BOD, water resources are also contaminated by bacteriological and pharmaceutical elements.

With small populations and abundant water resources, pollutants would be diluted naturally. However, given the high density of population in many parts of Indonesia such as JABODETABEK[17] area, Bandung, Surabaya and Medan, the natural dilution process is not sufficient. Water quality indicators presented below suggest that significant pollution is taking place in some parts of the country. Furthermore, over-extraction of water from some rivers and other water sources for irrigation purposes leads to reduced flow, thus greater pollution as well as depletion of the water resources.

4.2.1 WATER RESOURCES

Table 19 presents a summary of water sources in the two rural and three urban field sites used to take water samples. In Tangerang District, although Cisadane river passes through the area, the local population do not identify the Cisadane as their source of water. However, Cisadane River is the source of water supply for the local water supply utility in Tangerang City. Similarly, in Lamongan District, despite the presence of a large river, local people tend to use ground water as their water source.

The outskirts of Payakumbuh and Malang are upstream of several rivers, which are also the water sources for the local water supply utility in each area. The households interviewed in the ESI study sites generally identified their sources of drinking and clean water, in declining order of importance, as: 1) ground water, 2) spring water, and 3) surface water. Ground water is extracted from dug wells and pump wells, while spring and surface water are treated, then transferred to and distributed by local water supply utilities. The samples of water from Payakumbuh and Mergosono showed low turbidity, although the samples were taken during rainy season on January 2010 in rivers laden with wastewater and solid waste.

TABLE 19: NUMBER OF WATER SAMPLES TAKEN IN FIELD SITES, BY WATER SOURCE

No.	Sample site	Surface	Dug well	Borehole	Piped water	Total
1	Banjarmasin City	1	-	-	5	**6**
2	Payakumbuh City	5	2	-	1	**8**
3	Malang City	5	1	2	9	**17**
4	Lamongan District	3	2	2	-	**7**
5	Tangerang District	-	6	-	-	**6**
TOTAL		**14**	**11**	**4**	**15**	**44**

[14] Source: *Status Lingkungan Hidup Indonesia*, 2004, KLH; Puslitbang SDA
[15] *Badan Pengendalian Lingkungan Hidup Daerah*/BPLHD (Environmental Control Agency) East Java, 2008
[16] *Pusat Penelitian dan Pengembangan Sumber Daya Air* (Research Center for Water Resources), MPW, 2006
[17] 'Jabodetabek' is an acronym for the conglomerate of the 5 cities of Jakarta, Bogor, Depok, Tangerang and Bekasi, which more and more grow together to one huge metropolitan area in the 20+ million inhabitants.

4.2.2 WATER QUALITY AND ITS DETERMINANTS

Ground water and surface water quality are affected by soil condition and the practices of the surrounding communities. Payakumbuh and Malang are located on upland plains. Water quality is good in almost all rivers, as the fast flowing water allows for natural dilution.

In Banjarmasin, the quality of river water is poor. The color and turbidity of the water are not as good as in Payakumbuh and Malang. Local people use rivers as disposal sites for solid waste and domestic wastewater, leading to occasional outbreaks of diarrheal disease. It is common for people to use rivers as "one stop shops", to dispose of waste, as a source of water for bathing and washing, and children's playgrounds. The larger rivers are used for transportation. Learning from larger cities like Jakarta, 'clean river action' has become a major issue for local governments and communities. Floating solid waste in rivers and poor water quality lead to higher treatment costs for water supply companies, and dirty and poor maintained rivers and lakes spoil the aesthetic view and affect aquatic life.

There are two regulations on water quality standards in Indonesia. Government Regulation 82/2001 on Water Quality Management and Water Pollution Control classifies water by its designated use – for example, raw water that is designated to be processed for drinking water is Class 1 – and sets water quality standards for each class of water. Ministry of Health Decree 907/Menkes/SK/VII/2002 on the Criteria for and Monitoring of Drinking Water Quality sets forth more specific criteria for drinking water quality standards. Table 20 shows water quality standards established by these two statutes.

The water quality measurements in the ESI study were performed based on the type of water source and its designated use, as follows:

- **Piped water.** The measured parameter is residual chlorine, which protects users from water borne disease. Ministry of Health Decree 907/Menkes/SK/VII/ 2002 states that the adequate level of residual chlorine from outlet reservoir to the farthest consumers is ≥ 0.2 mg/l (see Table 26).
- **Surface water.** The water quality measurement for surface water covers physical parameters (turbidity, temperature, conductivity), chemical parameters (nitrate, ammonia, COD, BOD, and DO), and bacteriology (E. coli). People use surface water mainly for bathing and washing, and spring water for drinking (after boiling). Also, some local water supply utilities source raw water from springs.
- **Groundwater.** The water quality measurement parameters for ground water consist of E. coli, turbidity, conductivity, and ammonia. The samples were taken from both dug wells and boreholes. Water samples from boreholes were tested only for conductivity and ammonia content.

TABLE 20: WATER QUALITY STANDARDS REGULATION

Parameters	Ministry of Health (MoH) Decree No. 907/2002	Government Regulation No.82/2001	Unit
E Coli	0	250	in 250ml
Biochemical Oxygen Demand (BOD)		2	mg/liter
Chemical Oxygen Demand (COD)		1	mg/liter
Turbidity	5		NTU
Conductivity			microS/cm
Dissolved Oxygen (DO)		6	mg/liter
Nitrate	50	10	mg/liter
Ammonia	1.5	0.5	mg/liter
Temperature	±3°C	±3°C	°C
pH	6,5 – 8,5	6-9	
Chlorine (Cl)	≥0.2	0.03	mg/liter

The water quality surveys were performed by PT Sucofindo Laboratories. The results show that some of the values are above or below the thresholds for drinking water or raw water that is designated to be processed for drinking water, set by the water quality standards regulations. These figures indicate pollution or inadequate levels of certain parameters in water bodies. For example, the piped water results show that samples from Banjarmasin, Payakumbuh, and Malang have inadequate levels of residual chlorine. People therefore need to treat this water for drinking using techniques such as boiling, coagulant, filtration and/or disinfectant.

The results for E. coli existence could not be verified and were therefore inconclusive. However, many surface water sources reportedly showed visual contamination with human feces, which are likely to contain E. coli bacteria.

Decree 907/Menkes/SK/VII/2002 sets the maximum acceptable level of turbidity at 5 NTU. For this parameter, the water samples from almost all rivers and dug wells were well above this threshold. For example, water from Kalayan River in Banjarmasin had a turbidity of 19 NTU, water from Batang Lampasi River in Payakumbuh had a turbidity of 11 NTU, water from a dug well at a site in Payakumbuh had a turbidity of more than 200 NTU, and water from Bengawan Solo River in Lamongan District, a turbidity of 916 NTU. Such high turbidity levels result from the large volumes of waste disposed of into these water bodies.

Ammonium content in water comes from organic degradation or human excreta. The acceptable maximum ammonium content for drinking water is 1.5 mg/l. Almost all water samples had an ammonium content below the threshold value, with the exception of water from a dug well in Payakumbuh, which had an ammonium content of 2 mg/l.

Biochemical processes in water bodies such as nitrification lower the pH level of the water. The ideal pH value is 7 (neutral), and the acceptable range is between pH 6.5 and pH 8.5. The pH level of almost all the water samples was within the acceptable range, except for the water samples from Batang Lampasi River in Payakumbuh and spring water from Karangan River in Malang.

Biochemical oxygen demand (BOD) and chemical oxygen demand (COD) are parameters indicating the existence of organic materials that lead to water pollution. The higher the BOD and COD concentrations, the greater the water pollution. The maximum threshold value is 2 mg/l for BOD and 10 mg/l for COD (Government Regulation 82/2001). Water samples from Bengawan Solo River, Dusun Badurame Lake, and Anyar Lake in Lamongan District had BOD and COD concentrations in excess of these thresholds.

Dissolved oxygen (DO) is also a parameter indicating the presence of organic materials that lead to water pollution. The higher the DO value, the lower the water pollution, and vice versa. The minimum threshold for DO is 6 mg/l. Water samples from Kelayan River in Banjarmasin and a dug well in Mergosono, Malang had DO values below the minimum. Low levels of DO adversely affect aquatic life and may result in foul smelling water.

The acceptable water temperature range is ± 3°C from ambient temperature. All water sample temperatures were within the acceptable water temperature range.

The following figures provide a graphical presentation of selected water quality readings. Water samples were taken from piped water, surface water, dug wells and boreholes. As shown in Table 21, a total of 44 samples were taken across the study sites. All the results portrayed in the figures correspond to the sample numbers shown in Table 26. Detailed results of the water quality measurements are presented in the Annex, in Table F 6.

TABLE 21: WATER SAMPLE NUMBERS AND SAMPLE SITES

No.	Sample site location	Sample No.
1	Banjarmasin City	1 - 6
2	Payakumbuh City	7 - 14
3	Malang City	15 - 31
4	Lamongan District	32 - 38
5	Tangerang District	39 - 44

Figure 13 shows that water turbidity was generally below the maximum set by law, with the exception of the samples from a dug well from Payakumbuh and of surface water in Lamongan, which had turbidity in excess of 200 NTU. All surface water samples contained high levels of nitrate.

Figure 14 presents the COD and BOD readings. Again, all surface water samples had BOD and COD readings in excess of the legal maximum.

Figure 15 shows the extent of isolation of sewage at the field sites. Use of non-flush latrines (over rivers, ponds or ditches), hanging latrines, defecation in bushes, wrap and throw are categorized as open defecation. Many people in Payakumbuh, Lamongan and Tangerang still defecate in hanging latrines over rivers or ponds to feed their fish. In Banjarmasin and Tangerang, people living on riverbanks defecate in hanging latrines over rivers. Hence, the rates of open defecation in these field sites is high.

Despite these views, using rivers for latrines and disposing of household wastewater has unarguably led to serious surface water pollution. This not only damages the environment, but also spoils the scenery. Cleaning up rivers is becoming a major concern to governments and communities. In a metropolitan areas such as Jakarta, deterioration of water quality resulting from disposal of solid waste and domestic wastewater in rivers means that water supply utilities have to spend more on water treatment.

FIGURE 13: TURBIDITY AND NITRATE CONTENT READINGS

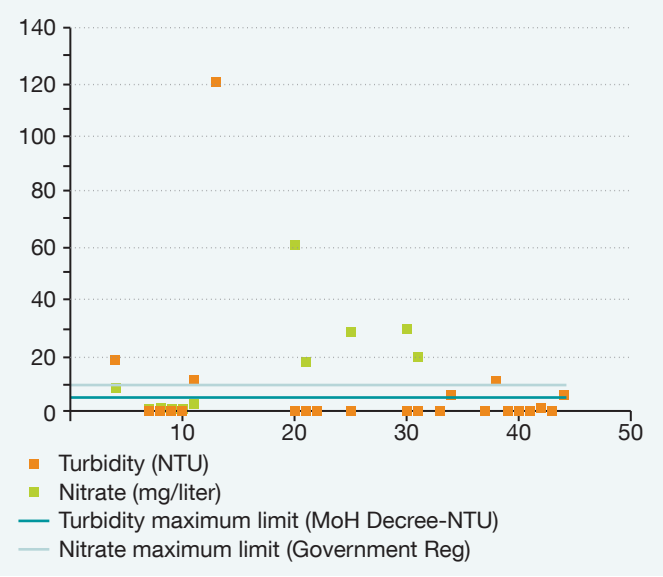


FIGURE 14: BOD AND COD READINGS

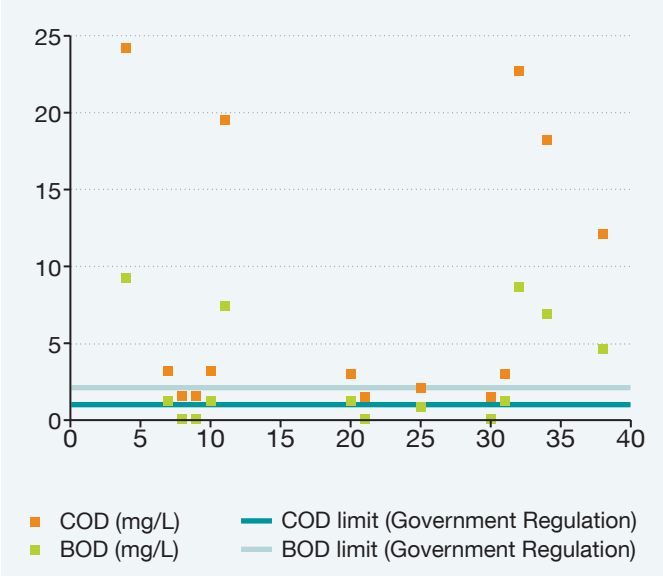
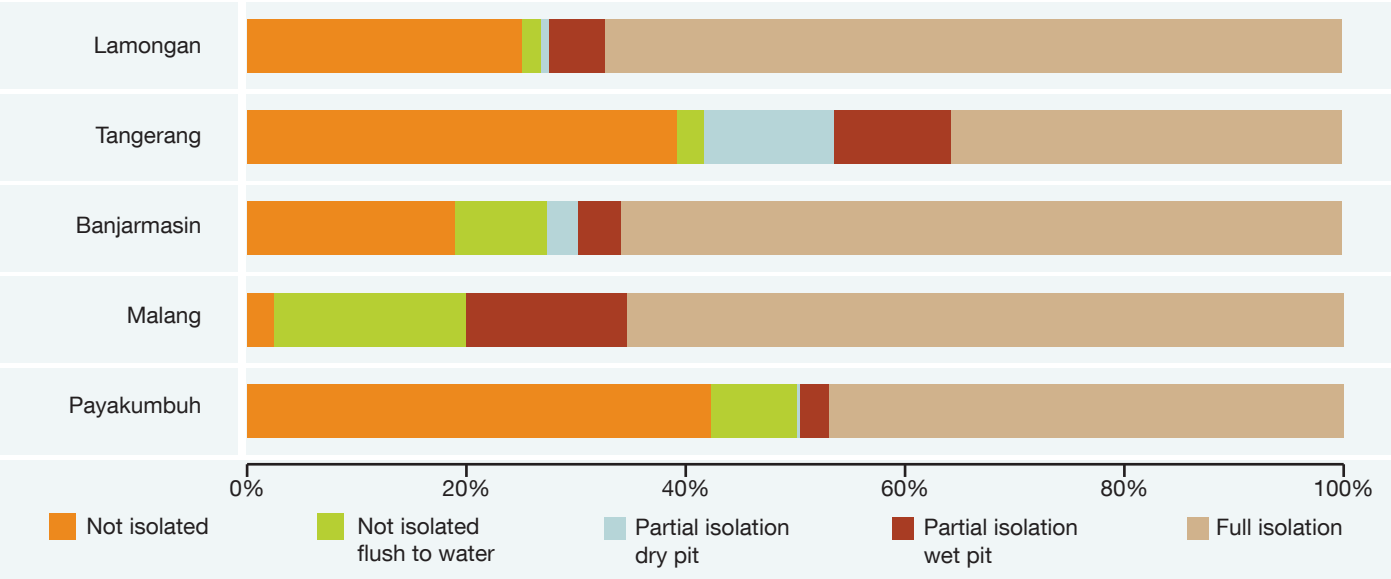


FIGURE 15: EXTENT OF ISOLATION OF HUMAN EXCRETA IN FIELD SITES



4.2.3 HOUSEHOLD WATER ACCESS AND TREATMENT COSTS

One of the major impacts of polluted water sources such as wells, springs, rivers and lakes is that it requires more intensive water treatment, which increases costs for human activities. According to the national development planning agency, BAPPENAS, for every 1 mg/liter additional BOD concentration in a river from which water supply utilities source water, average water treatment cost increases 25%.[18] As well as causing financial loss, pollution of rivers and lakes also spoils the scenery and adversely affects aquatic life. Accessing cleaner water from other, more distant sources increases the access costs to households and water supply utilities. Households that do not take precautionary measures to treat their drinking water are exposed to higher risk of infectious disease or poisoning due to the chemical content of the polluted water. Figure 16 shows household water sources (primary sources of drinking water). Piped water service coverage is currently only available in urban areas.

According to the household survey, average monthly cost of accessing water costs per household ranges from US$0 to US$1 for rural sites and US$0 to US$3.62 for urban sites. Zero payment is for unprotected water sources, as users can access the water free of charge (Figure 17). The average monthly cost of accessing water in urban areas, even for non-piped water (protected and unprotected), tends to be higher than in rural areas. This may be because people living in urban areas purchase water from vendors or, where access to wells is restricted, from well owners. People living in rural areas, however, have greater access to land to make dug wells. Access to piped water in rural areas is almost zero because they are not covered by water supply utilities.

Figure 18 presents a data summary of the responses by households to the question about the characteristics of poor quality water, for three major water sources in rural and urban areas. Respondents mentioned that non-piped protected water has the best quality for daily water consumption, especially in urban areas. Less than 10% of respondents using non-piped protected water in urban areas complained about bad appearance, and less than 5% complained about bad smell, bad taste, and solids content of their water. In rural areas, the characteristics of non-piped protected water appear to be adequate, except for solids content (turbidity), with which almost 15% of the respondents were dissatisfied. Respondents in urban areas are generally not satisfied with their water, mainly because of its poor appearance; while for those in rural areas, the greatest concern was about the solids content (22% of respondents). Piped water in urban areas appears to provide no guarantee of better water quality, as about 15% of respondents were not satisfied with the turbidity of their water.

FIGURE 16: MAIN HOUSEHOLD WATER ACCESS (%)

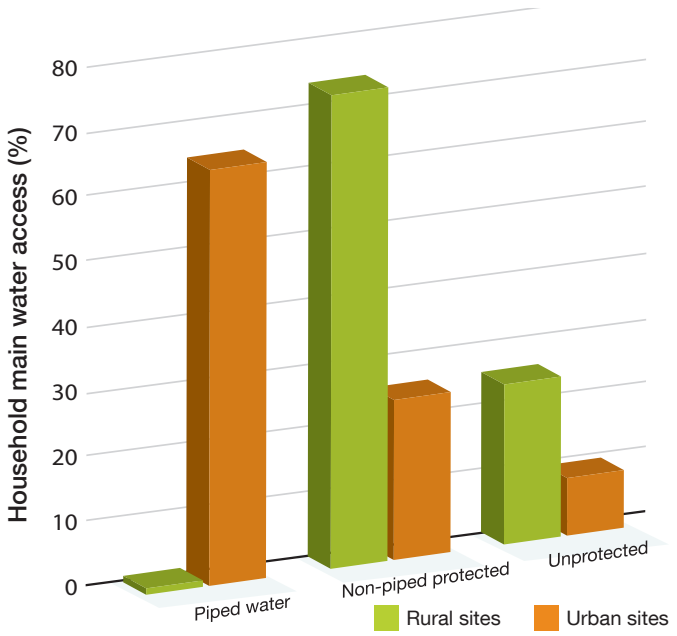
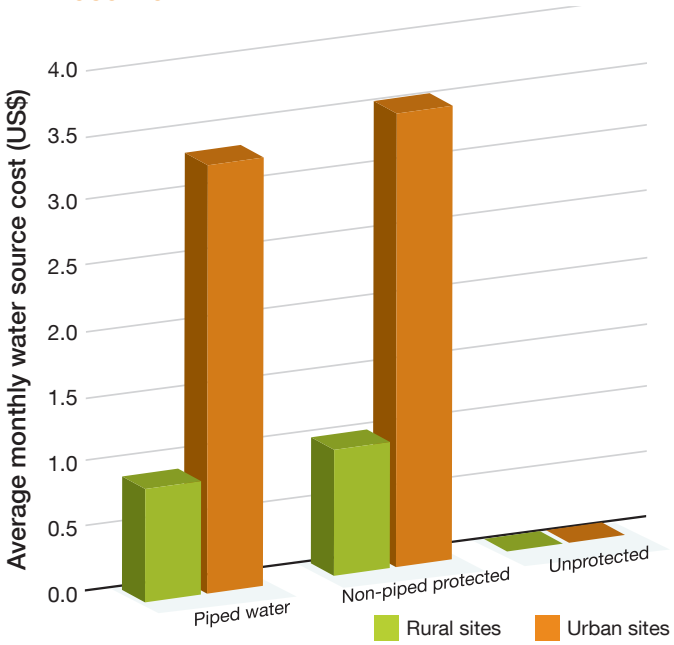


FIGURE 17: WATER ACCESS COSTS, MONTHLY AVERAGE PER HOUSEHOLD



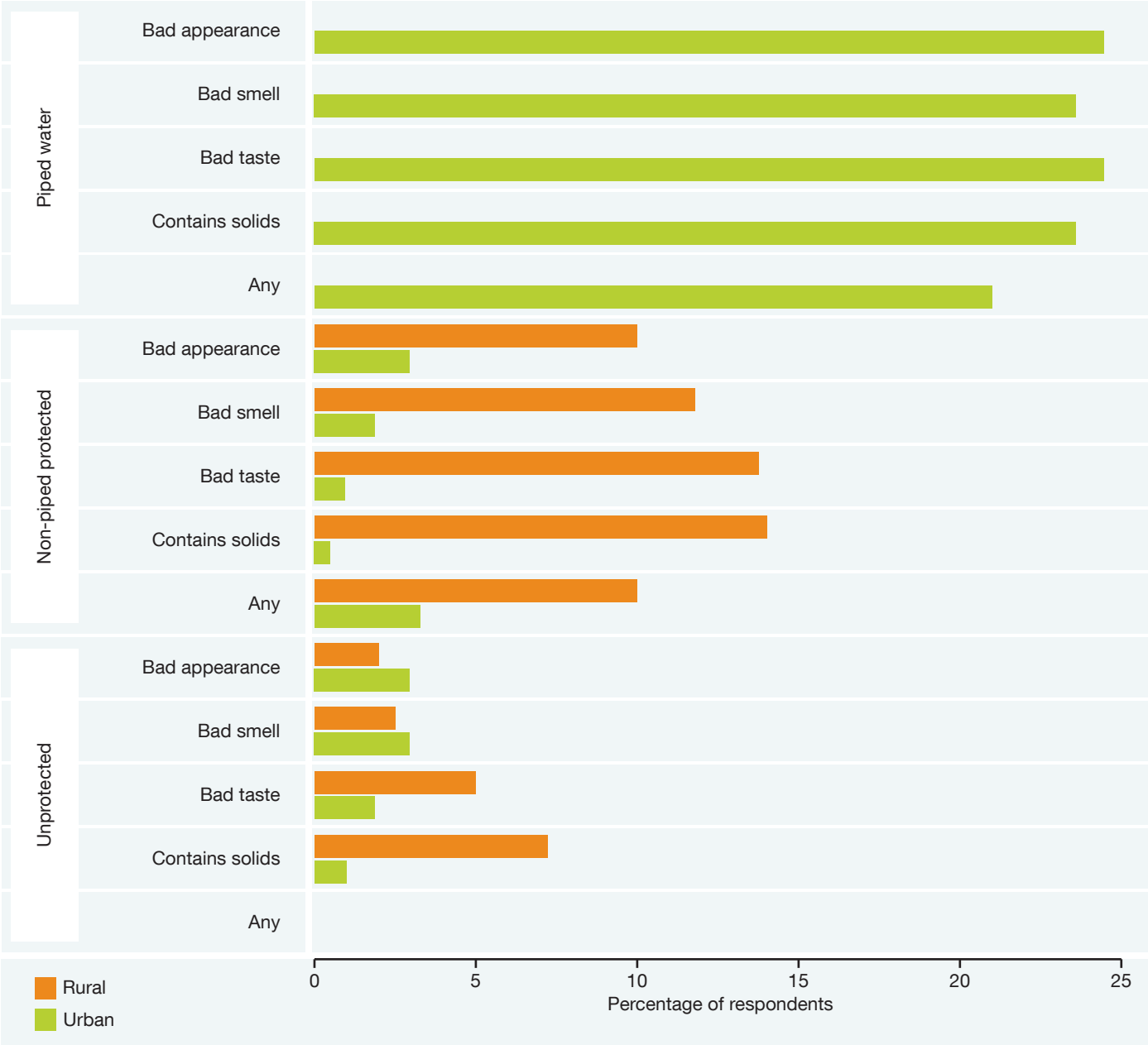
[18] ISSDP Advocacy Materials, Sanitation Development Technical Team (TTPS) of the National Development Planning Agency (BAPPENAS), 2007.

4.2.4 HOUSEHOLD RESPONSE TO POLLUTED WATER, AND RELATED COSTS

The ways in which households respond to polluted water sources vary from changing their water seller (if they purchase water) to walking further to get free water, or treating their water. In urban areas, households tend to switch to piped water – if available and affordable – harvest rainwater, purchase bottled water, and bring in water tankers. For daily consumption, about 40% of the respondents in urban areas use piped water, while less than 1% of rural respondents enjoy this privilege. The vast majority (more than 90%) of rural households use protected or unprotected wells as their main source of water.

The results of the survey indicate that people in both urban and rural areas consider water quality, quantity and cost to be equally important. Water quality indicators consist of better taste, less turbidity, clearer color and safer for health, and the indicator of water quantity is continuous water supply. In rural areas, people prefer to use protected water sources than unprotected ones because the water is better quality and safer for health.

FIGURE 18: CHARACTERISTICS OF POOR QUALITY WATER CITED BY RESPONDENTS



As well as the various ways of coping with polluted water, the respondents also practice water treatment. The household survey found various water treatment practices: more than 80% of the respondents said that boiling water is their most regular method treating water, although the proportion of respondents doing so is slightly higher in urban areas than in rural areas (Figure 19). Boiling water before drinking is customary and people believe that raw water is not potable. Therefore, households are used to boiling water (except bottled water) at home for drinking, even if their water is of good quality.

A new market for drinking water is emerging in urban and rural areas. Small-scale enterprises process raw water into drinking water packaged in 19-liter bottles. The raw water is sourced from water tankers supplied by the local water supply utility or from bore wells or dug wells. The water is treated using a serial filtering system and disinfected using ultraviolet, ozone, or reverse osmosis, or a combination thereof. Consumers can bring their own gallon jars to the treatment plant to be refilled, or have the water delivered to the home. At around US$0.3 per gallon, this water is much cheaper than branded ready-to-drink bottled water from large water producers, which costs US$1.1 per gallon. The government has set quality standards for the treatment methods as well as quality of the treated water. Hence, these two types of bottled water are commonly perceived to be of the same quality.

The way households source their water suggests that people in urban areas are more concerned than rural households about all aspects of their water sources, including water quality, water supply continuity and availability, and time savings accessing the water.

Figure 20 presents the respondents' answers to the question: "Have you changed your water treatment practices since improved latrines have been installed?". In all almost sites, more than 80% of respondents stated that they had not changed their water treatment practices. The only exception was in Tangerang, where more than 60% of respondents had not changed their water treatment practices. The responses are closely linked to the main method of treating water (boiling water). As noted above, except in the case of ready-to-drink bottled water, households would not stop boiling water at home regardless of whether they have better quality water.

4.2.5 HOUSEHOLD WATER COSTS AVERTED FROM IMPROVED SANITATION

Table 22 shows the effect of sanitation improvement on the costs of accessing water sources and on the costs of water treatment. Household water treatment costs are higher than water access costs in all study sites. In Banjarmasin, the city with many rivers, households spend significantly more on treating and accessing water compared with the other study sites.

Annual average costs averted per household are calculated based on the assumption that after total improved sanitation, boiling water is not theoretically necessary anymore and a cheaper treatment method can be used instead. How-

FIGURE 19: HOUSEHOLDS WATER TREATMENT, BY METHOD AND RURAL/URBAN LOCATION

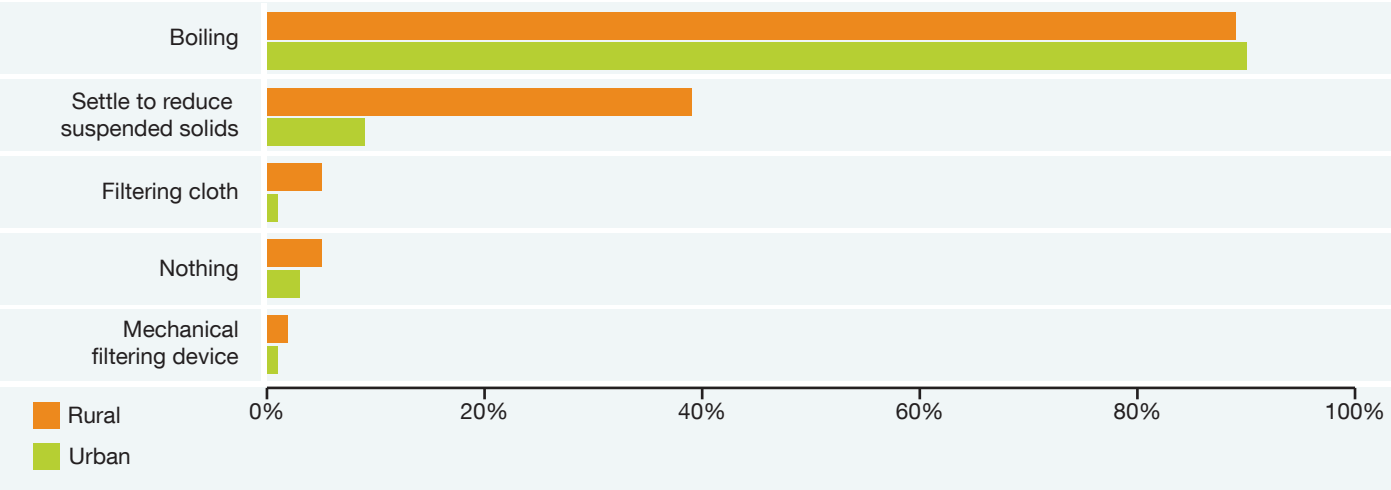


FIGURE 20: CHANGE IN WATER TREATMENT PRACTICES SINCE IMPROVED LATRINES HAVE BEEN INSTALLED

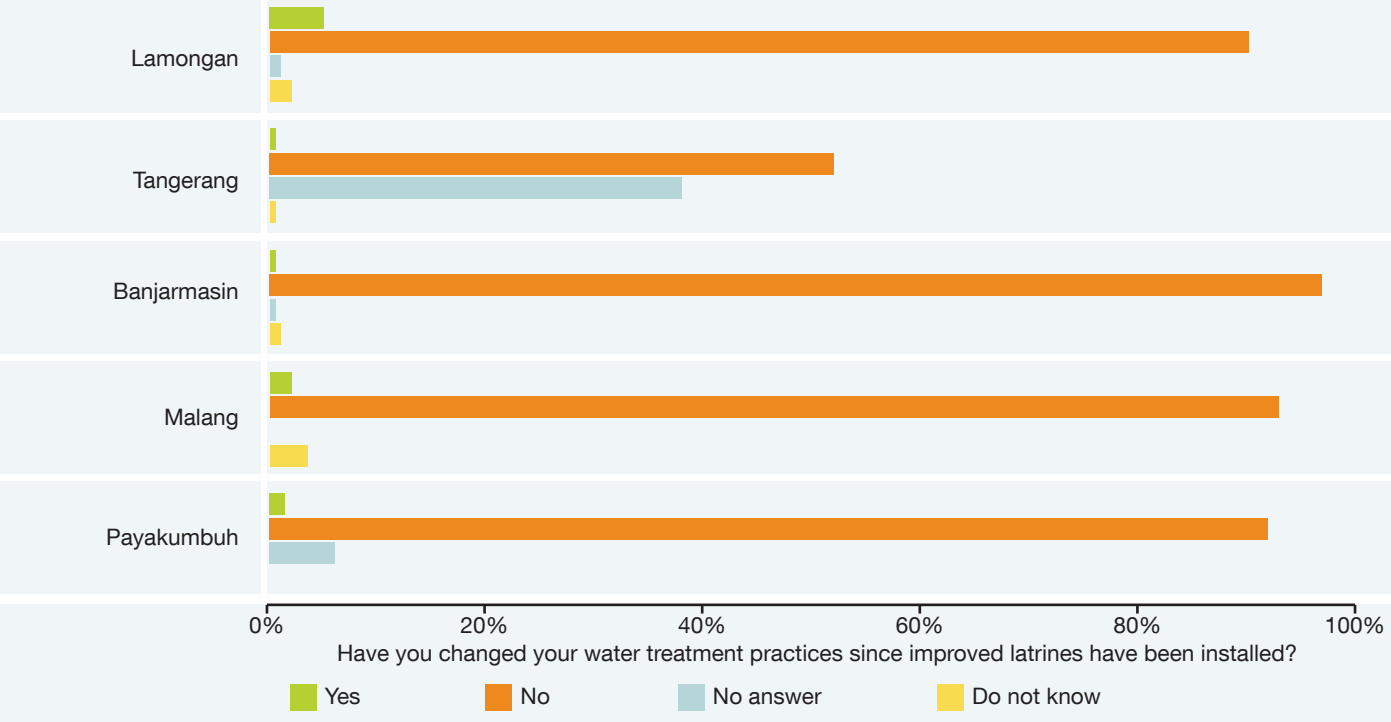


TABLE 22: WATER ACCESS AND HOUSEHOLD TREATMENT COSTS INCURRED AND AVERTED (US$)

Variable	Annual average costs per household		Annual average costs saved per household following 100% sanitation coverage	
	Water source access	Water treatment	Water source access	Water treatment
Lamongan	6	14	1	1
Tangerang	8	15	1	1
Banjarmasin	12	34	2	11
Malang	8	21	1	3
Payakumbuh	10	23	1	2

ever, given that very few households appear to be willing to change their water treatment practices, a conservative estimate for change in household practices is made. Table 22 shows that the annual costs averted per household range from US$2 to US$13 following total improved sanitation.

4.2.6 WATER USE COSTS IN NON-DOMESTIC ACTIVITIES

As well as for drinking, washing, bathing and cooking, water is also crucial for other daily activities in households and communities. In rural areas, these include water for irrigation, for agriculture and livestock and fish farming, and in urban areas include water for offices, factories, and so on. Where sanitation is poor, water treatment companies have to pay more to treat the water, although in most cases this cost is passed on to consumers, or covered by the local government budget. Table 23 presents the impacts of polluted water on water use.

TABLE 23: WATER USES AND IMPACTS OF POLLUTED WATER

Water use	Impacts of polluted water
Water treatment companies	Increased production cost
Fish farming	Additional pre-flow water treatment before entering fish ponds
Factories	Increased water treatment cost for operational purposes and for employees' use
Restaurants and hotels	Additional water treatment cost to ensure water for cooking is clean

The impact of poor water quality on these productive activities has an economic value. For example, a 1 mg/liter increase in BOD in a river that is a source of raw water for a water supply utility will increase in average national water production cost by 25%. The impacts on businesses are presented in the section on National Impacts in Chapter 5. Impacts on agriculture have not been examined because this was outside the scope of this study.

4.3 ACCESS TIME

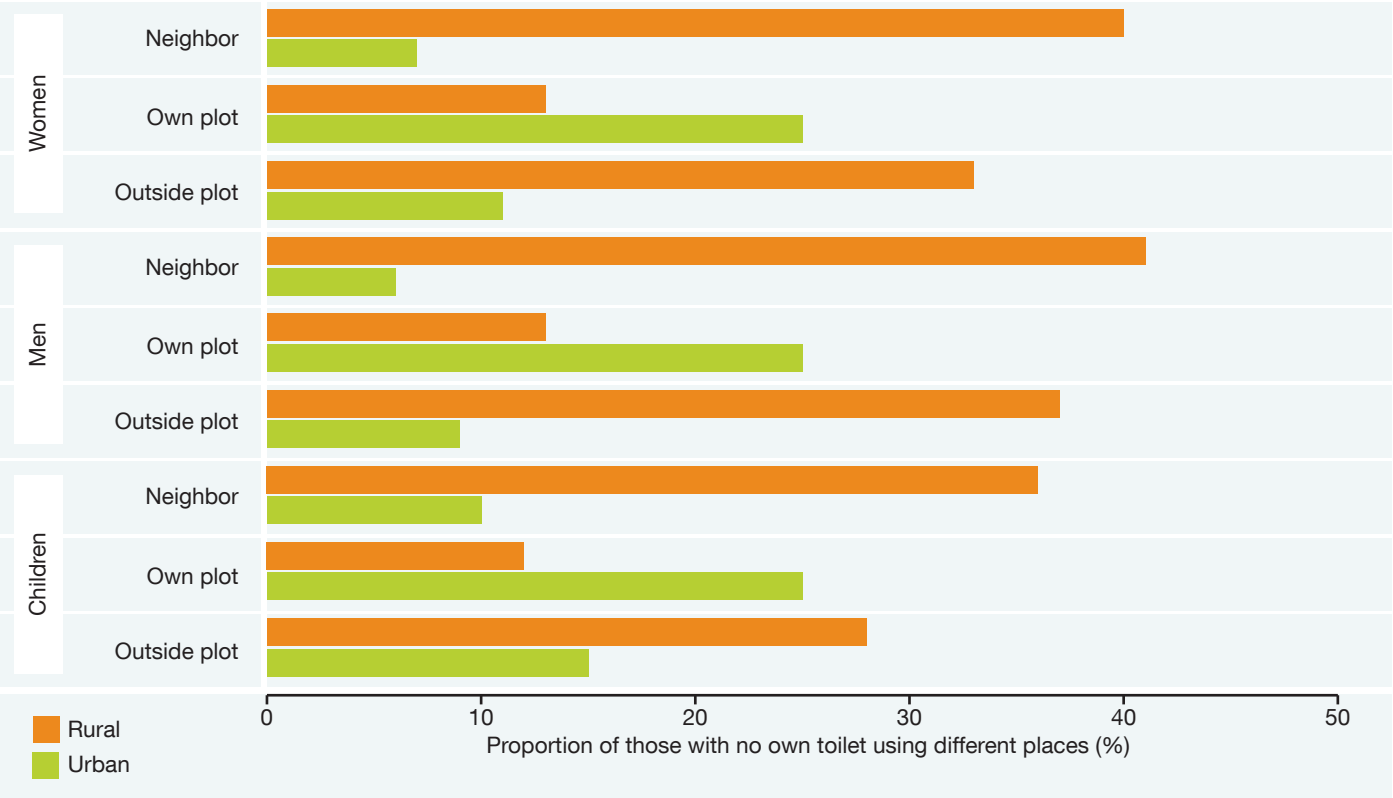
4.3.1 ACCESS TIME AND TIME SAVED

Figure 21 presents the main places of defecation of households in rural and urban areas. Compared with urban dwellers, a higher proportion of rural dwellers use a neighbor's toilet. Conversely, a larger proportion of urban households use their own plot than use a neighbor's toilet. Patterns tend to be similar for men, women and children.

Figure 22 shows that, compared with people in rural areas, people in urban areas who do not have a toilet need more time to access a toilet or a place for defecation. The higher population density of urban area means that people have to queue longer to access a toilet if they use shared or community toilets, compared with those in rural areas. In case of open defecation, people in rural areas generally have more places for defecation available to them and find it easier than urban dwellers to find "a private site" for defecation. Urination is excluded from the calculation and it is assumed that defecation takes place once a day, hence the access times are a minimum and the estimates of time savings conservative.

Figure 23 shows the proportion young children under five defecating outside the household plot. The average number of events is between 1 and 2 per day. In general, the proportion is more than 70%, except in Banjarmasin where it is 65%. This figure indicates that the majority of children under five years old, whether or not the family has own toilet, go outside the household plot to defecate. In Banjarmasin, the percentage of young children defecating outside the household plot is lower, and the number of defecation events per day is higher, compared with the other study sites, because the many rivers flow through Banjarmasin provide children with a place do defecate close to home.

FIGURE 21: PLACE OF DEFECATION OF HOUSEHOLDS WITHOUT THEIR OWN TOILET



4.3.2 TIME SAVING AND UNIT VALUES OF TIME

Figure 24 summarizes the respondents' level of satisfaction with the proximity of their place of defecation and how important proximity is to them. In both rural and urban areas, having a place to defecate within their own plot is important. Those who do not have their own toilet are not satisfied with the proximity of, and the access time associated with, their current place of defecation. Time saving, which is closely related to toilet proximity, has a value.

People who defecate in the open or use public toilets generally spend a long time queuing or finding a private place to defecate. Even people living near rivers that they use for defecating prefer to get the best spot with the cleanest water, which means getting up and going to the river early in the morning. Hence, this is time saved for households that have their own toilets. Table 24 presents the results of focus group discussions, comparing male and female perceptions of the convenience of and time savings from having a private toilet.

FIGURE 22: TIME SPENT ACCESSING TOILET FOR THOSE WITH NO TOILET, PER TRIP

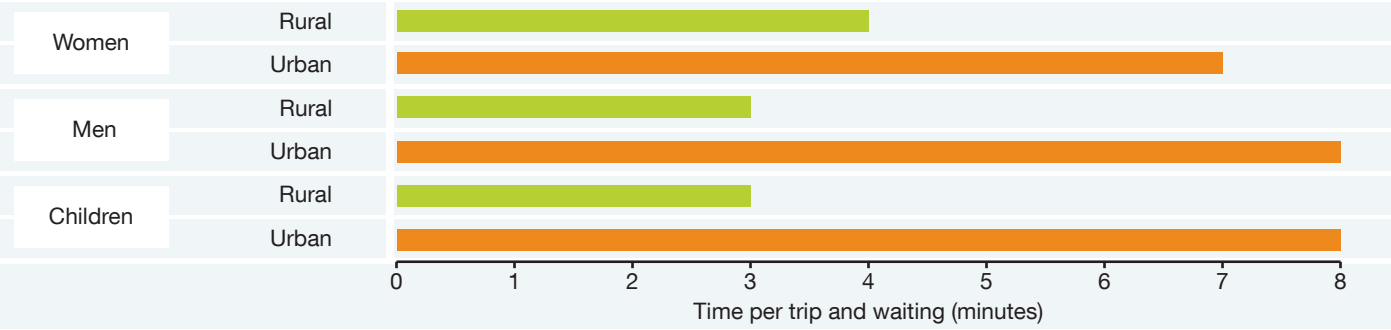


FIGURE 23: DEFECATION OUTSIDE THE HOUSEHOLD PLOT FOR CHILDREN UNDER FIVE YEARS

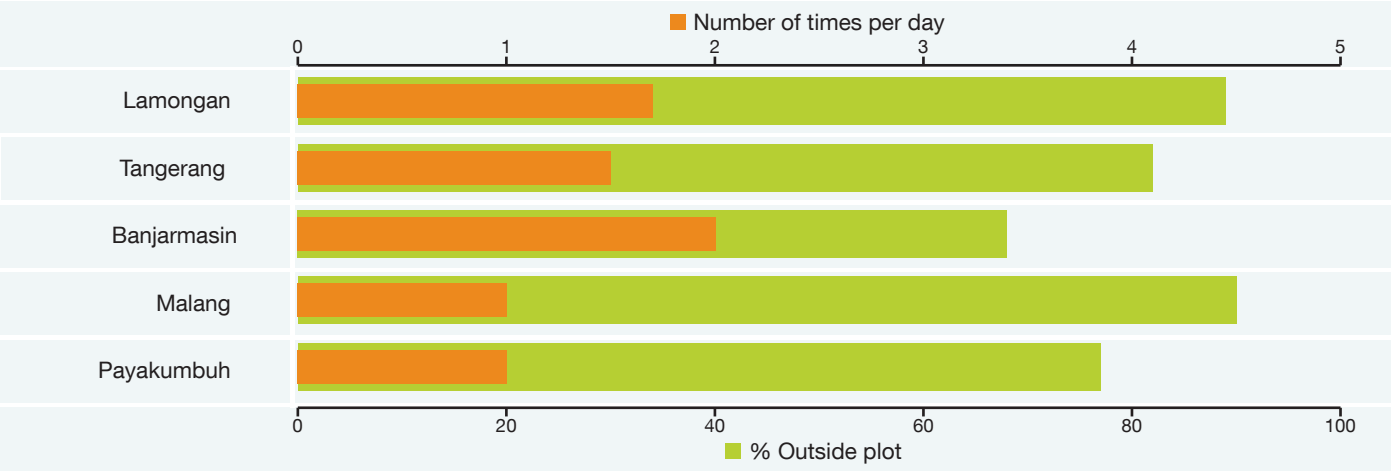


FIGURE 24: PREFERENCES RELATED TO TOILET PROXIMITY FOR THOSE WITHOUT A TOILET (%)

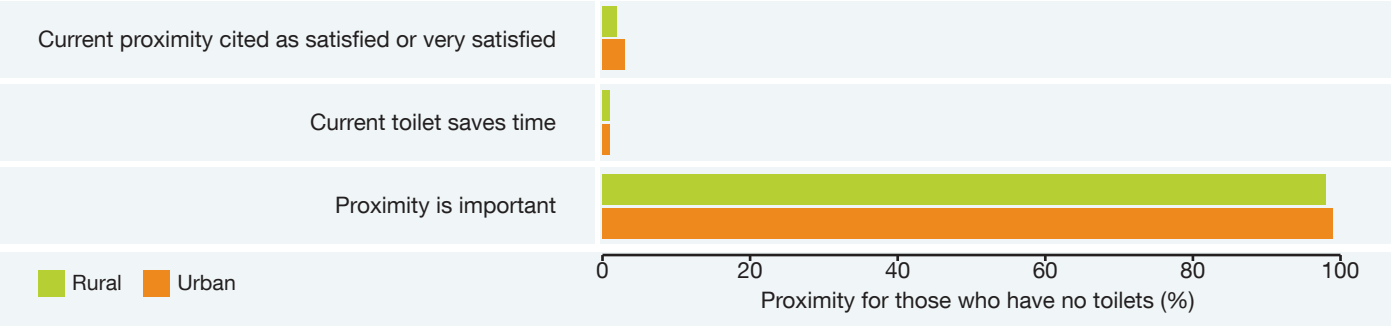


TABLE 24: MALE AND FEMALE PERCEPTIONS ABOUT TIME SAVING

Male preferences	Female preferences
• No need for queuing and save more time • Spend more time for more productive activities	• Spend less time than going to public toilets or OD • Take better care of their under-five children and babies, as well as their cooking • Children need toilet any time. They want to defecate without going too far

Figure 25 shows how female respondents would spend the extra 30 minutes a day if they had a private toilet, selected from ten activities listed in the questionnaire. Bathing and washing, which women prefer to do in privacy, are activities that are closely linked to toilet ownership, while resting and cooking are activities that women would spend more time doing if they had their own toilet. This suggests that women who do not have private toilets have less time to spend resting and cooking because they spend more time doing other time-consuming activities, including going to the toilet. The FGDs revealed that the majority of men – especially those living in urban areas – would use the time saved to do business. A similar pattern in the use of time saved was indicated across rural and urban sites, with 'bathing' (personal hygiene) and 'resting' ranked top of the list of activities people would do if they had an extra 30 minutes a day.

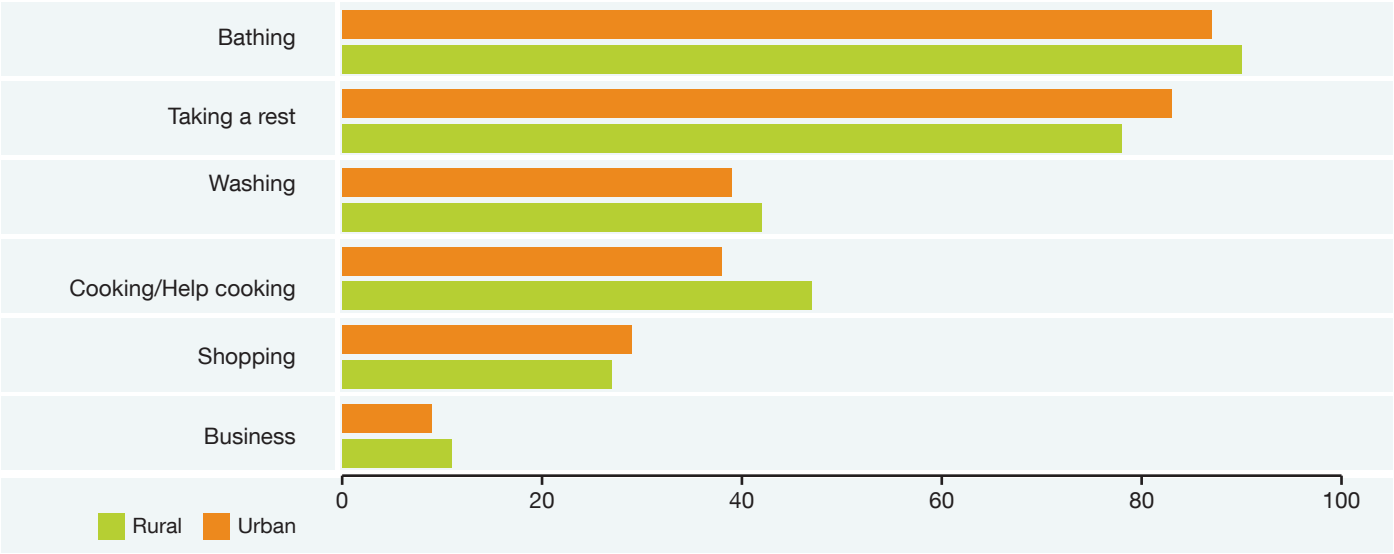
4.3.3 TOTAL VALUE OF TIME SAVED

Time is saved when people use their own toilets as they do not have to look for safe places to defecate in the open nor spend time waiting or queuing to go to the toilet. Hence, they spend less time going to the toilet. The value of time saved is calculated in the cost-benefit analysis.

The ESI Phase 1 Study calculated on a national scale the time lost from using unimproved sanitation by having to make trips to defecate in the open or waiting to use shared latrines. The population – 10% using shared toilets and 15% practicing open defecation, equal to 25% of households – was assumed to experience suboptimal access time. For these households, open defecation was assumed to require 15 minutes per day extra to find a secluded spot for defecation, while for shared latrines the extra time queuing varied from 15 minutes in rural areas to 30 minutes in urban areas. It was also assumed that access time in urban areas in Indonesia is relatively long because toilets are shared with many people, and because it is common for people to wash themselves while in the latrines, thus prolonging queuing time.

The ESI Phase 2 Study also calculated time lost, on individual basis as well as household basis, based on the household survey findings. Compared with those in the other field sites, households in Tangerang and Malang spent more time going to places to defecate in the open or in toilets outside their plots. The average time spent making trips to

FIGURE 25: HOW FEMALE RESPONDENTS WOULD SPEND AN EXTRA 30 MINUTES A DAY (%)



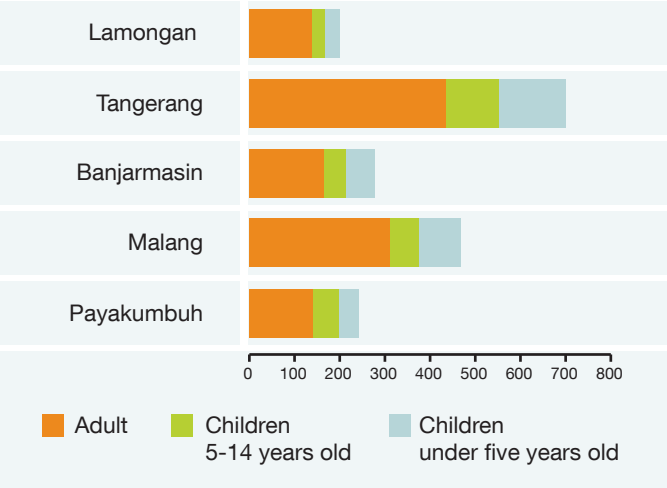
and/or waiting to defecate in these two sites was more than 8 minutes per round trip, compared with 6 minutes in the other sites. Hence, the value of the potential time saving of having private toilets is greatest in Tangerang and Malang.

Table 25 shows the average time lost per household per day at each field site. Similar to the results of ESI 1 study, these figures constitute the average time lost per household member per year, as depicted in the Figure 26. A household that shifts from open defecation to using a private toilet has the greatest potential time saving.

TABLE 25: AVERAGE TIME LOST PER HOUSEHOLD PER DAY

Study sites	Average time lost per household per day (minutes)
Lamongan	33
Tangerang	115
Banjarmasin	46
Malang	77
Payakumbuh	40

FIGURE 26: AVERAGE TIME LOST PER YEAR PER HOUSEHOLD MEMBER (HOURS)

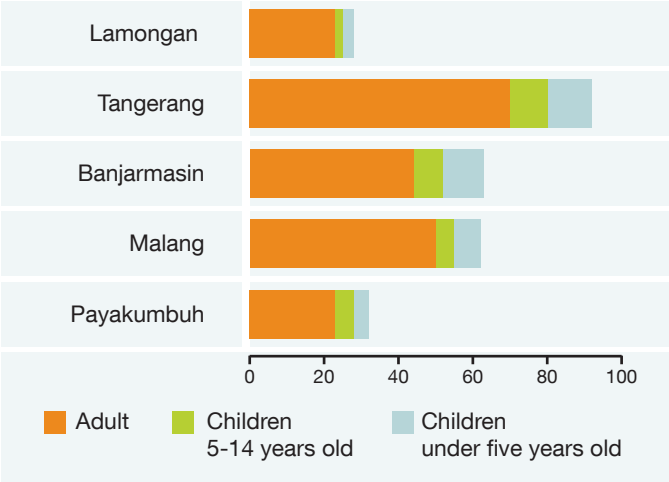


Assuming that the value of time saved per year is equivalent to 30% of the average annual income of an adult and a child's time is worth half that of an adult's, the average annual value of time saved per household member and per household is as shown in Figure 24. Calculation of the annual value of time saved uses the economic loss (in US$) of open defecation as the baseline. Such that:

- A household (HH) can save a certain amount of time – valued in monetary terms (US$X) – if the individuals in the HH use a private toilet (within their own plot area) regularly.
- A HH that uses communal toilets incurs some access time costs (US$X1) but still saves (US$X - US$X1) by not defecating in the open.
- A HH that uses shared toilet incurs some access time costs (US$X2) lost but still saves (US$X - US$X2) by not defecating in the open.

Figure 27 shows the average annual value of time savings per household and household member, for households without a private toilet that receive their own toilet.

FIGURE 27: AVERAGE ANNUAL VALUE OF TIME SAVINGS (US$)



4.4 INTANGIBLES

In the absence of studies examining the intangible aspects of sanitation in Indonesia, the data presented here are entirely from field work conducted as part of the ESI Phase 2 study. The data are from two main sources: a close-ended household questionnaire, which was answered by the most senior household member available for interview, and focus group discussions (FGDs). At each of the five main sites, three FGDs were conducted with three groups of eight: one group of women, one group of men, and one group of stakeholders (health office officials, NGOs, and community or informal leaders).

These two surveys collected perceptions, opinions, and preferences from a representative section of the communities (see section 2.3 for methods and sampling approach). Four sets of results are described here: (a) understanding of what sanitation is; (b) reason for current sanitation option; (c) satisfaction with current sanitation option; and (d) for

those without toilets, reasons to get a toilet, characteristics of a toilet, and willingness to pay for improved toilet.

In general, respondents have a good understanding of what sanitation is, although in some focus groups, their understanding was limited. They perceive sanitation as something that has to do with toilets, wastewater disposal, solid waste, drainage, and environmental health. Their knowledge of sanitation ladders varies according to the sanitation ladder options that are available locally. For instance, respondents in Payakumbuh and Lamongan were very familiar with dry pits, wet pits and septic tanks, but had little knowledge about sewerage systems. Respondents in Banjarmasin are very familiar with almost all the options on the sanitation ladder because a wide range of these options are available locally, including community toilets, shared toilets, private dry pit, private wet pit, private septic tank, and sewerage systems.

The FGDs revealed that land availability is an issue in urban areas but less so in rural areas. People in urban areas perceived the provision of toilets in public places as important due to the lack of space available for private toilets on their own plots. People in rural areas tend to perceive that provision of toilet in public places as unimportant because land for building toilets is readily available, and many households have their own toilets, albeit a simple dry or wet pit latrine. In rural areas, problems can arise when a household unknowingly digs a well close to a pit latrine currently or previously used by a neighbor.

Most parents of schoolchildren entrust provision of school toilets to the school principal, and they believe that the toilet facilities in schools are satisfactory.

Intangibles for households without their own toilets include:

- Feeling uncomfortable and insecure, and lack of privacy
- Feeling ashamed being seen by others when defecating
- Dirty toilet bowls
- Long queuing times
- Having to bring water with them to cleanse themselves after defecating
- Wet and muddy paths to the toilets
- Problems associated with defecating when it is raining or at night
- Dirty environment around the toilet area because the facilities are not kept clean
- Accidents in unstable toilets
- When busy cooking, women worry if their young children leave the house to go to the toilet

These are not issues for people who have their own toilet inside their house.

Respondents across the field sites held these general perceptions of their sanitation situation:

- It is the norm, and there is no reason to change the habits of generations. Hence, they have no awareness of what are good and bad sanitation practices.
- Due to financial constraints, sanitation is not high on their list of spending priorities.
- They believe that diseases caused by poor sanitation, such as diarrhea, are not serious and can be self treated with readily available over the counter medicines.

The FGDs revealed that the opinions of men and women about having their own toilet differed in some respects, as shown in Table 26. Women are more concerned about safety, for themselves and for their children, while men are more concerned about practicality (proximity of the toilet). However, men and women did share the same opinions about access time and cleanliness.

Hanging toilets on rivers or ponds are common in all the field sites. As well as being practical and comfortable, people defecate in these toilets to feed their fish in the ponds. Using a hanging toilet on a river means there is no need to flush as the feces are washed away by the river. Respondents also said that because these toilets are in the open air, they are able to breathe more easily and there are few or no unpleasant odors.

However, the respondents did mention several drawbacks of using hanging toilets, including :

- The risk of accident, especially for children and elderly using the toilet at night or in the rainy season
- Lack of privacy
- The time taken to go from the house to the toilet. Women are concerned about leaving their house-

hold chores, such as taking care of their children and cooking, to go to the toilet

Table 27 summarizes the FGD findings on the risks and problems associated with using hanging toilets at the field sites.

Figure 28 shows the respondents' level of satisfaction with their current toilets. Compared with those using unimproved sanitation, respondents with improved sanitation have a higher level of satisfaction for every aspect assessed.

For the household interviews, the respondents were asked to score each aspect on a scale of 1 (not satisfied) to 5 (very satisfied). Visual aids were used to help the respondents express their opinion of their current toilet (see Figure 29). Respondents were asked about their level of satisfaction in terms of :

- toilet position
- toilet cleanliness (free from dirt, smell, and insects)
- toilet ownership (status)
- being able to offer a clean facility for visitors
- health (avoiding diseases related to poor hygiene and sanitation)
- avoiding conflict
- convenience for children
- convenience for elderly
- night use of toilet
- use of toilet when raining
- using toilet for bathing as well as defecating
- avoiding attacks by dangerous animals (snakes, etc.) and insect bites

TABLE 26: PREFERENCES RELATED TO TOILET CONVENIENCE FROM THE FOCUS GROUP DISCUSSIONS

Preferences (rural and urban unless stated otherwise)	
Male preferences	**Female preferences**
• Land is available, but need to ensure adequate distance from neighbor's pit latrine • A source of pride • No need to bring water for cleansing after defecation (rural) • No need to queue for public toilets or arrive early to get the best spot for open defecation (rural) • Clean and comfortable facility (rural) • Environment around toilets is not dirty (rural)	• Safe to go any time, even at night and during rainy season • Offers greater privacy • No need to negotiate wet, muddy paths to toilets • No risks of accidents • No need to worry about children if they want to defecate • No flies • No need to queue for public toilets or arrive early to get the best spot for open defecation • Can keep the facilities clean and comfortable • Environment around toilets is not dirty (urban)

TABLE 27: RISK OF HANGING TOILETS

Variable	Payakumbuh	Banjarmasin	Lamongan	Malang	Tangerang
Current toilet	Hanging toilet on a pond	Hanging toilet on a river	Hanging toilet on a large pond	Pit latrine & hanging toilet on a river	Hanging toilet on a river and open defecation
Toilet quality	Simple structure made from bamboo or wood	-	Simple structure made from bamboo or wood	Simple structure made from bamboo or wood	Open defecation in yards, rivers, fields and public places
Reasons for current toilet	To feed the fish	In the fresh air, and water available to cleanse after defecating	In the fresh air, and water available to cleanse after defecating	Shared toilet beside a river, drains straight into river	Convenient to defecate into a plastic bag and dispose of anywhere
Risks of toilet	Risk of accident, especially the elderly and children	Need to get there before others & risk of accident (once led to a death)	Risk of accident	Having full latrine hole	Risk of accident
Problems with toilet	Defecating when it is raining or at night	Competing with others for space at the river	Defecating when it is raining or at night	Defecating when it is raining or at night	Long queues
	Lack of privacy	River used for bathing and washing as well as defecating	Lack of privacy	Never think of emptying septic tank	Dirty
	Women have to leave their children and cooking	Women have to leave their children and cooking	Women have to leave their children and cooking	Women have to leave their children and cooking	Women have to leave their children and cooking

FIGURE 28: LEVEL OF SATISFACTION WITH CURRENT TOILET OPTION, IMPROVED VERSUS UNIMPROVED AT ALL SITES (1 = NOT SATISFIED, 5 = VERY SATISFIED).

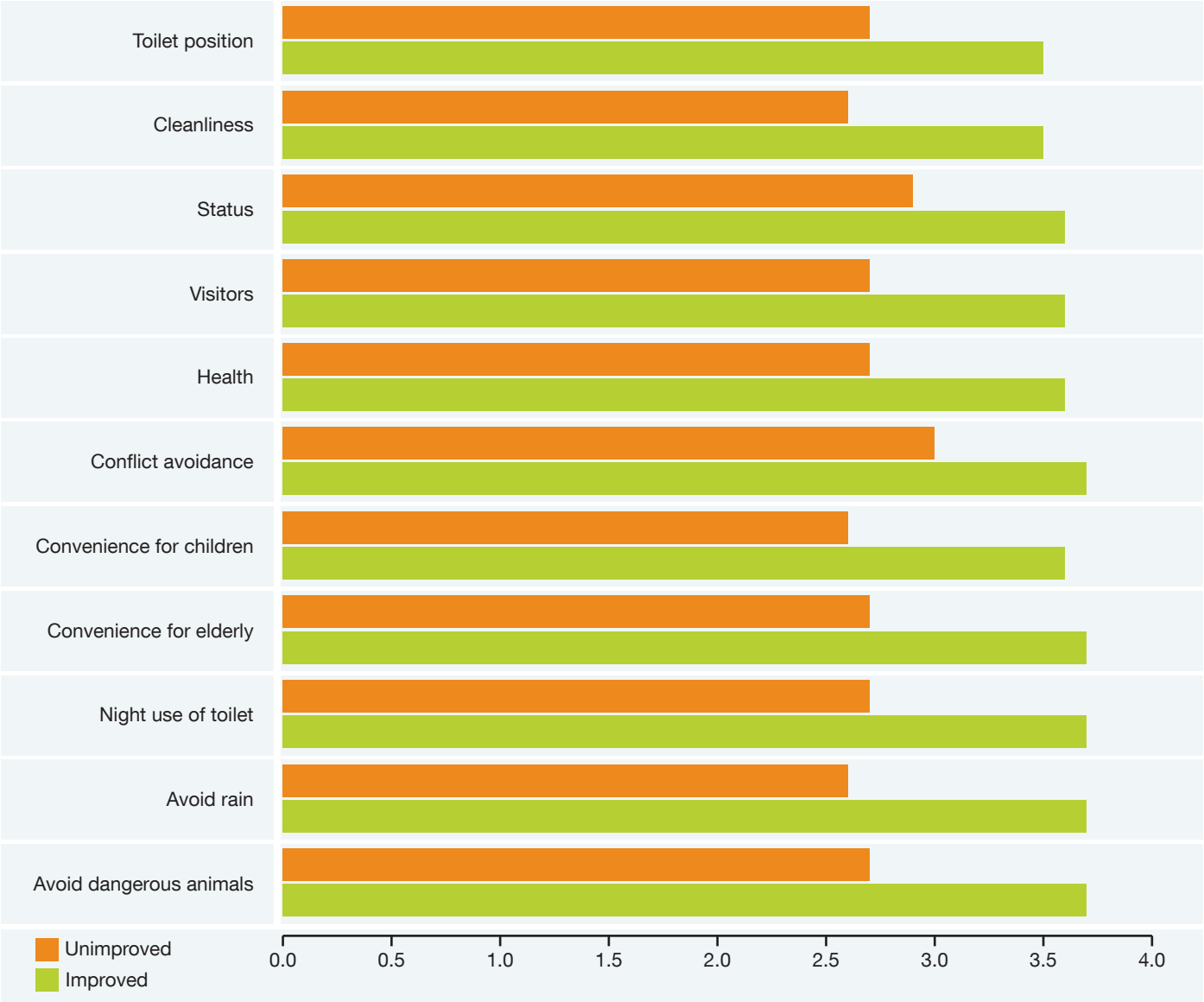


Figure 29 is an example of the visual aids used during the household interviews to answer the question: "How satisfied are you with your current sanitation option with regard to the following aspects?"

Figure 30 shows the main reasons from the focus group discussions that respondents who practice open defecation gave for not having a toilet. Across the field sites, 21% of all respondents had no toilet. Figure 30 shows that almost 60% of respondents said they had no toilet because it was too expensive. Due to financial constraints, sanitation is not high on their list of spending priorities. The second main reason for not having their own toilet was lack of space, particularly for those living in densely populated areas.

Figure 31 shows which household members have the most influence in the decision whether or not to build or upgrade a private toilet. The respondents were senior female household members (wives). They had the most influence in these decisions in only 7% of households, while in 63% of households it was the senior male member (husband) who made these decisions. Hence, it is the senior male household members who need to be convinced that that investment on sanitation is economically viable.

This information helps to answer practical questions about how sanitation programs can be delivered more effectively – that is by increasing the value of benefits by raising the awareness and participation of beneficiaries. It provides valuable input for program design and program implementation.

Respondents who currently have no private toilet were asked about reasons they would build their own toilet if they were able to do so. Each aspect given a score ranging between 1 (not important) and 5 (very important). Intangibles all scored 4 or more out of 5 (Figure 32). The top three intangible benefits of having a private toilet were proximity, cleanliness and not sharing.

Respondents who do not have their own toilets and practice open defecation had the following concerns (see Table 28):

- 37% felt sometimes in danger and 14% often in danger, from going to defecate in the open
- 19% had heard about someone being attacked by animals in the open defecation areas
- 72% expressed concern about the safety of their children when they go to defecate in the open.

These results indicate that safety is an issue when defecating in the open.

4.5 EXTERNAL ENVIRONMENT

External environment refers to the area outside the toilet itself and not related to a toilet trip, and may include living area, public areas, and private land, which can all be affected by open defecation practices and open conveyance of sewage or flooding of unimproved toilets. The consequences of water pollution have already been covered in section 4.2.

FIGURE 29: A VISUAL AID IN THE HOUSEHOLD INTERVIEW

FIGURE 30: MAJOR REASONS FOR NOT HAVING A PRIVATE TOILET

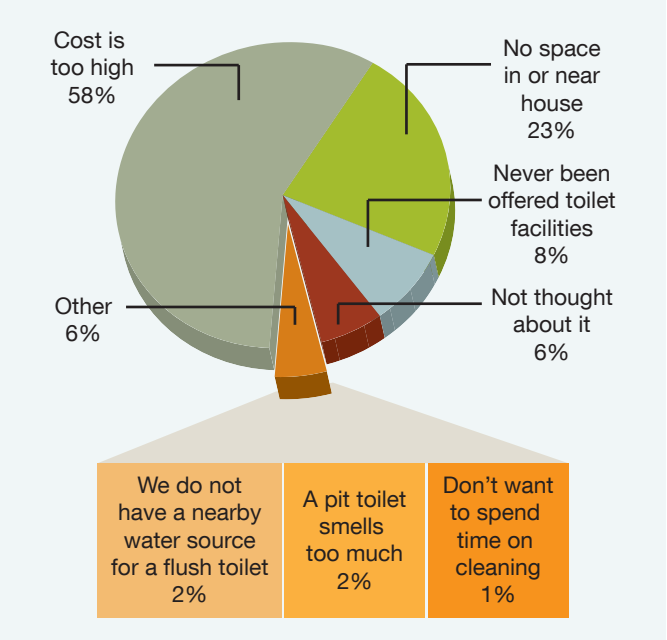
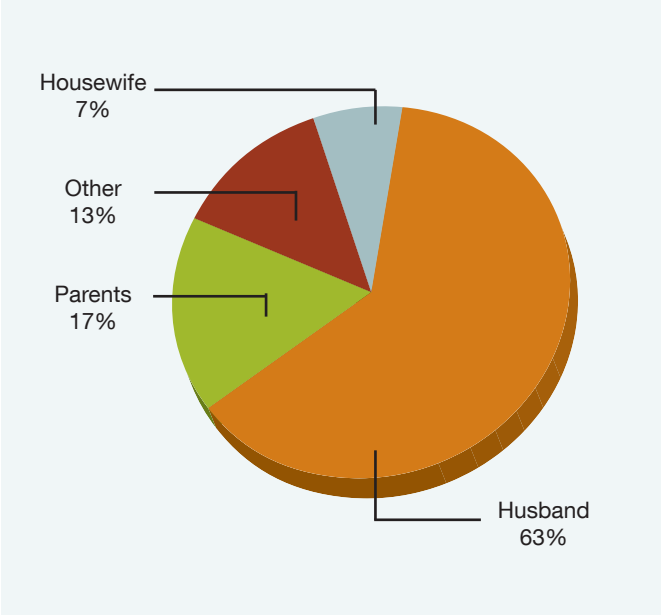


FIGURE 31: HOUSEHOLD MEMBERS THAT INFLUENCE DECISIONS ABOUT BUILDING OR UPGRADING A PRIVATE TOILET



The sources of data are mainly the ESI surveys: physical location surveys, household interviews, and focus group discussions. Given that poor solid waste management practice and its impact on the external environment is also part of poor sanitation, these have also been assessed to understand the contribution of each, and relative preferences regarding their improvement.

Physical location surveys were conducted in 5 study sites:

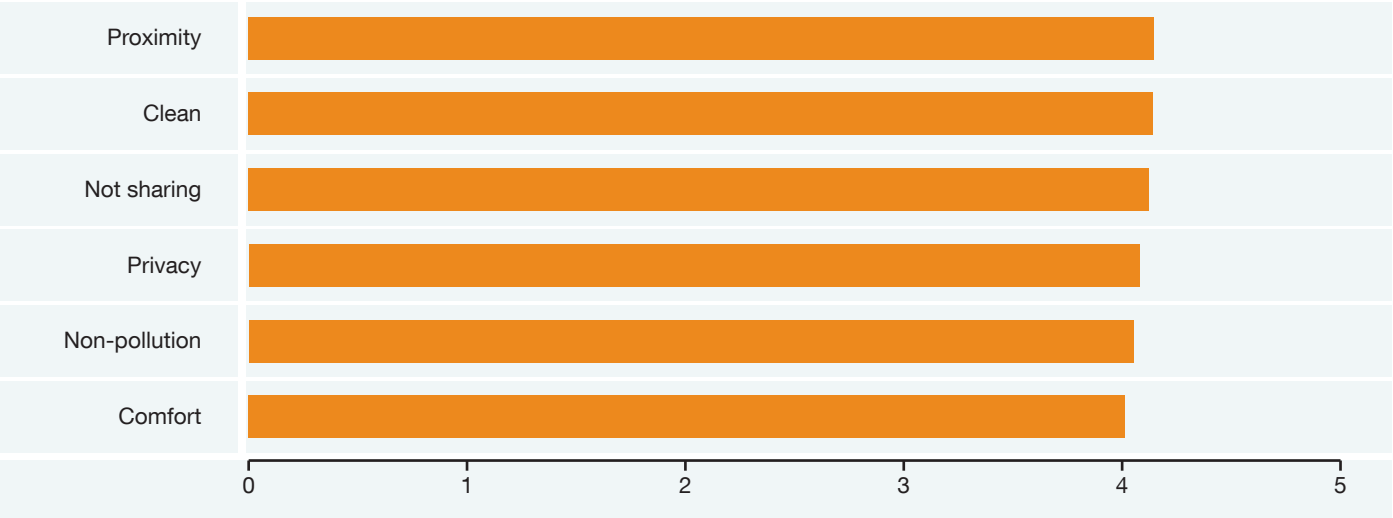
- Payakumbuh is located in a hilly area of West Sumatra. Most of the residential areas of the city are not densely populated. The city has a functioning public cleaning service which is organized by the local municipal government. Almost no piles of garbage were found along the tributaries.
- Tangerang District has an inadequate garbage collection service, so garbage is piled up everywhere. The district has many public toilets.
- Lamongan District has well maintained residential areas. Like most rural areas, population density is low. Housing is well maintained.
- Malang city is in good physical condition. Garbage is collected by the city cleaning service. Housing is well maintained.
- Banjarmasin city is located in a low plain near the estuary of Barito river. The external environment is poor. Many households dispose of their solid waste into the rivers.

Figure 33 shows the scoring of the quality of environmental sanitation in private plots based on the household surveys. On average, almost all sites are moderately dirty, but urban sites tend to be dirtier than rural sites. The detailed results presented in Figure 33 show that Tangerang had the lowest score for cleanliness from solid waste, compared with the other sites. Malang scored highest in all categories compared with the other sites, which is also consistent with the qualitative environmental assessment.

Even households that have improved toilets may continue practicing poor sanitation behaviors. Figure 34 shows sanitation practices for households that have a toilet. While very few household members practice open defecation, in some sites – notably Tangerang and Payakumbuh – people still urinate in the open, dispose of feces in hanging toilets, and dispose of children's stools in the environment. As revealed during the FGDs, some people in Payakumbuh prefer to defecate in hanging toilets in order to feed their fish (as well as preferring the open air and absence of bad smells).

Figure 35 summarizes the responses of households that use septic tanks and pits to the question: Has your septic tank or pit ever been emptied? The majority of the respondents – more than 90% in in Lamongan and Tangerang – said they had never emptied their septic tank or pit. In Malang and Payakumbuh, between 30% and 40% of respondents stated that they did not know whether their septic tanks had ever

FIGURE 32: REASONS TO GET A TOILET FOR THOSE CURRENTLY WITHOUT (1 = NOT IMPORTANT, 5 = VERY IMPORTANT)



been emptied, mainly because they had just recently moved into the property. It is likely that septic tanks that have been emptied are wet pit latrines, which are not waterproof and could potentially pollute the groundwater.

Figure 36 shows how satisfied households are with their current toilet option with regard to its perceived impact on the external environment. For all categories, the respondents are, in general, fairly satisfied with their current option. In general, there is no significant difference in the levels of satisfaction for sewerage, septic tank and wet pit latrine.

Compared with the other field sites, households in Banjarmasin that practice open defecation were more satisfied with the perceived impact of their current toilet option on the environment. As discussed elsewhere in this report, these households see nothing wrong with using the rivers that run through the city for washing, bathing and defecating.

Perceptions of the condition of the external environment are shown in the Figure 37. Again, respondents scored this aspect on a scale of 1 (not satisfied) to 5 (very satisfied). In general, they perceived the condition of the external environment to be good. The FGDs revealed that open defecation areas are perceived to be dirty. While urban sites score slightly higher than rural sites, there was little difference between the perceptions of households with improved sanitation and those without, except regarding the presence of rodents and insects.

4.6 SUMMARY OF LOCAL IMPACTS

Table 29 summarizes the local quantitative and qualitative benefits of improved sanitation and hygiene.

TABLE 28: CONCERNS OF THOSE PRACTICING OPEN DEFECATION

Concern	No. responding	Responses	
		Never	Yes
Have you felt in danger when going for OD?	348	50%	50%
Are you worried about the safety of your children?	351	28%	72%
Have you heard about someone being attacked by animals?	352	81%	19%

FIGURE 33: SCORING OF THE QUALITY OF ENVIRONMENTAL SANITATION BY GENDER OF RESPONDENT (SCORE: 5 = CLEAN, 1 = VERY DIRTY)

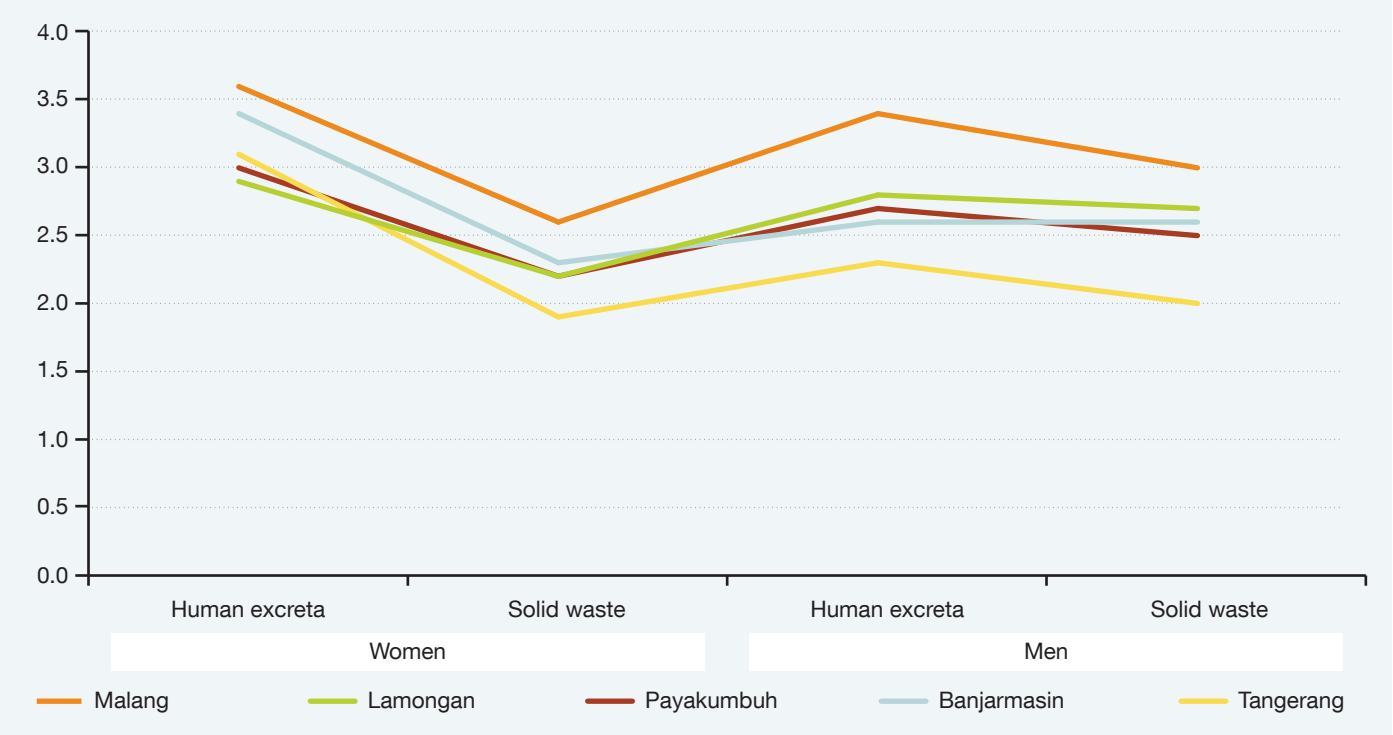


FIGURE 34: UNIMPROVED SANITATION PRACTICES BY HOUSEHOLDS THAT HAVE TOILETS

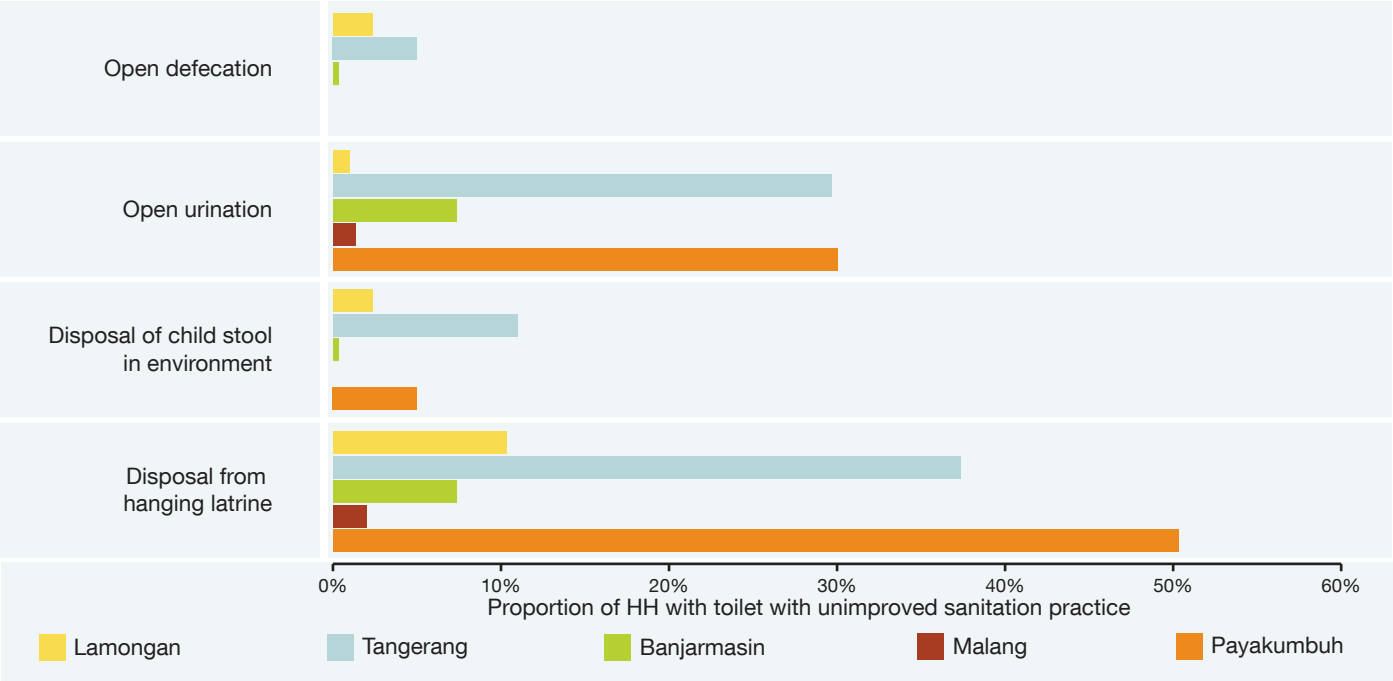


FIGURE 35: EMPTYING OF SEPTIC TANKS AND PITS (%)

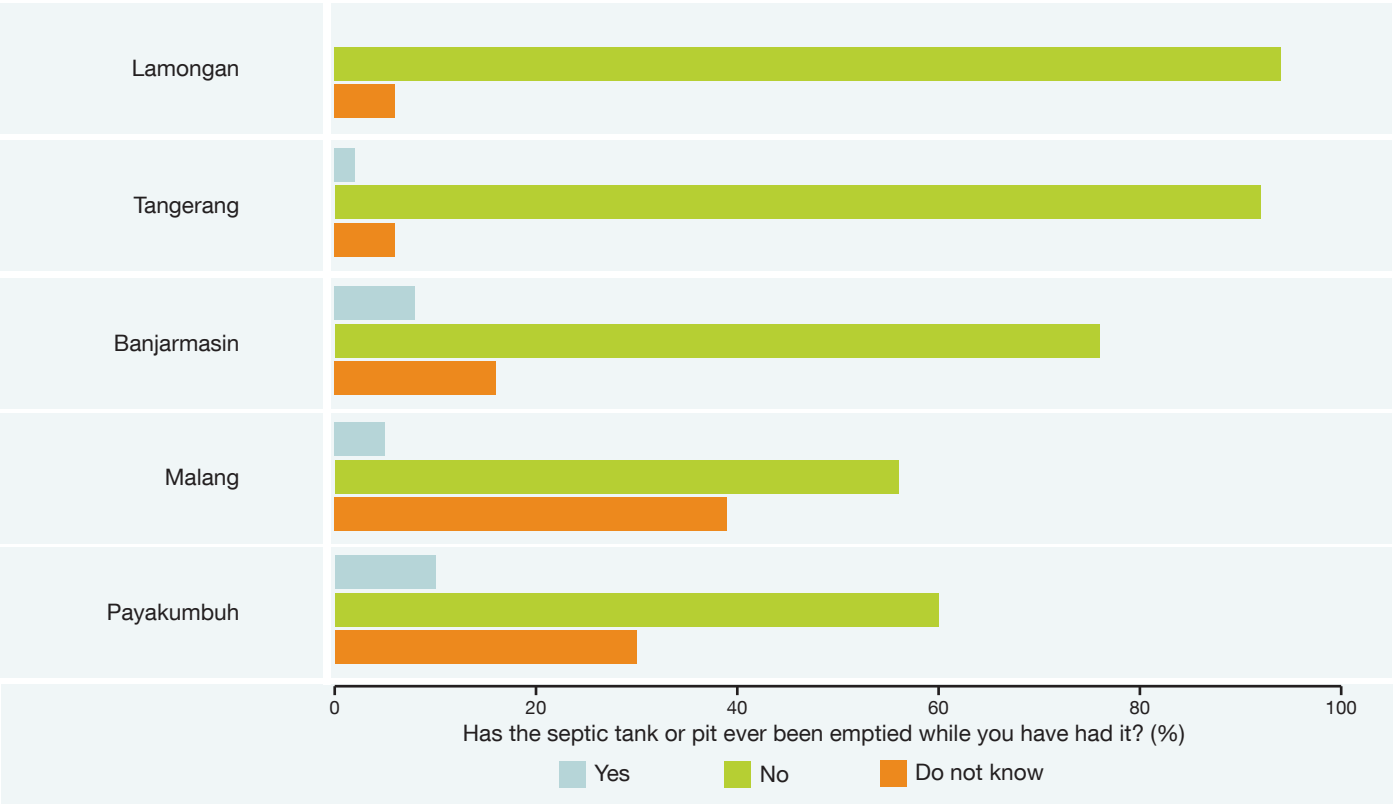


FIGURE 36: LEVEL OF SATISFACTION WITH IMPACT OF CURRENT TOILET OPTION ON THE QUALITY OF THE EXTERNAL ENVIRONMENT (SCORE: 5 = VERY SATISFIED, 1 = NOT SATISFIED)

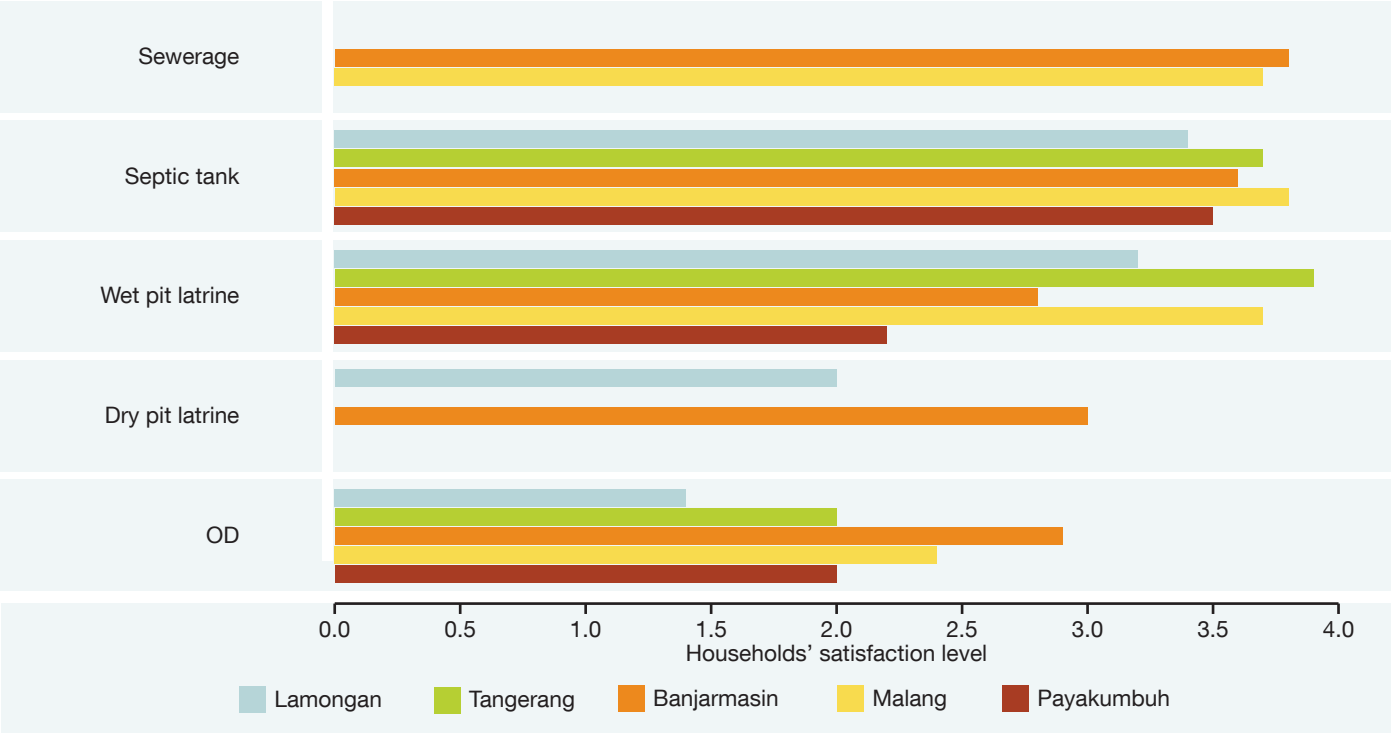


FIGURE 37: PERCEPTIONS OF THE EXTERNAL ENVIRONMENTAL (SCORE: 5 = VERY GOOD, 1 = VERY POOR)

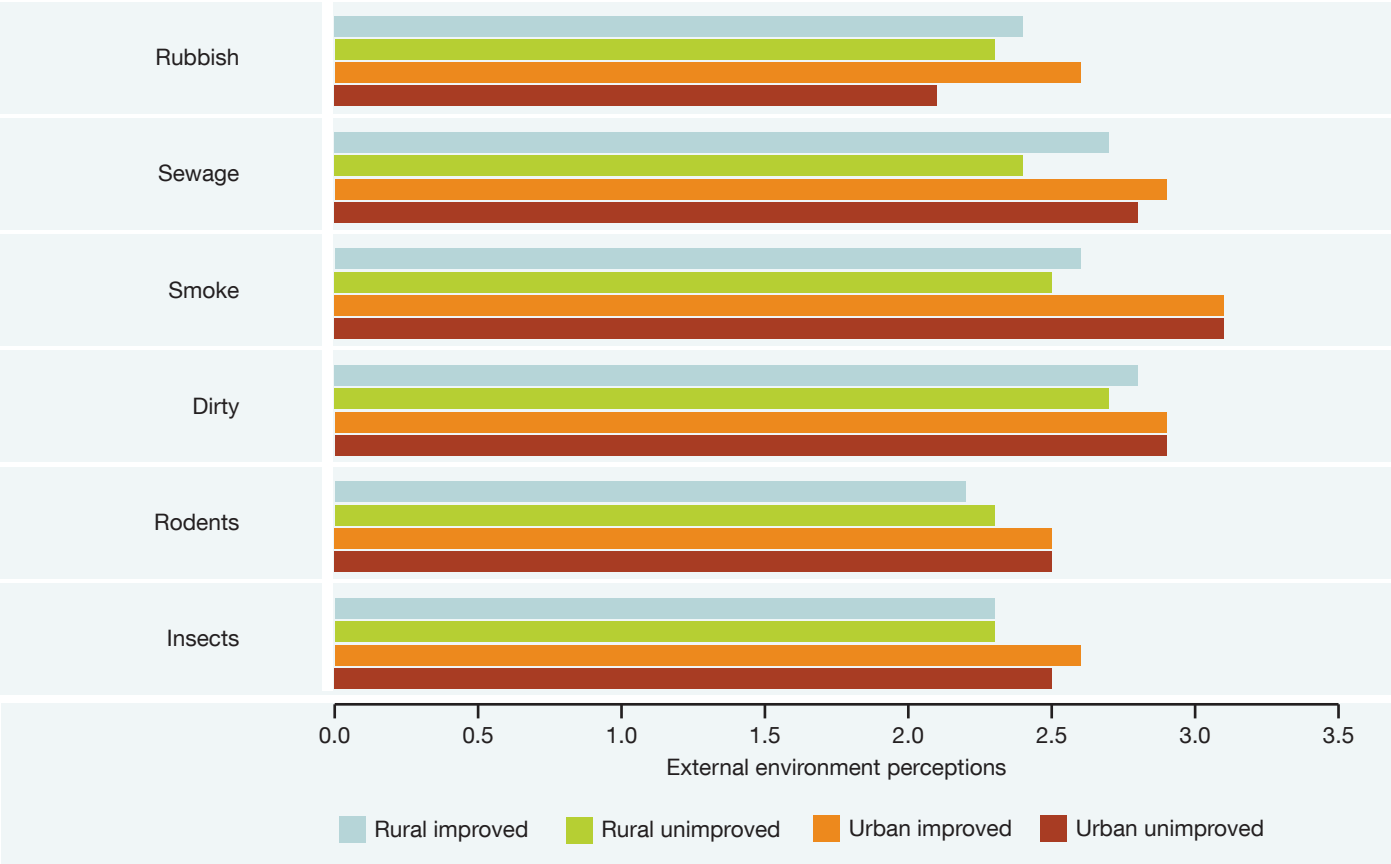


TABLE 29: SUMMARY OF LOCAL IMPACTS OF SANITATION IMPROVEMENT

Benefit	Benefits of improved sanitation and hygiene	
	Quantitative benefit	**Qualitative Benefit**
HEALTH		
Health burden/quality of life	Rural sites: • Disease per household: 18 cases • DALYs: 0.12 • Annual risk of death: 1.88 in 1,000 Urban sites: • Disease per household: 13 cases • DALYs: 0.06 • Annual risk of death: 2.19 in 1,000	• Less pain and suffering • Reduced inconvenience of lost time • Parents worry less and take less time off productive activities to care for sick children
Health care benefit per person per year	Rural sites: • 0-4 years: US$151.34 • 5-14 years: US$43.62 • 15 + years: US$16.65 Urban sites: • 0-4 years: US$36.70 • 5-14 years: US$18.50 • 15 + years: US$8.50	Households do not need to spend so much on health care and health-seeking costs
Productivity benefit per person per year	Rural sites: • 0-4 years: US$19.86 • 5-14 years: US$14.11 • 15 + years: US$16.02 Urban sites: • 0-4 years: US$8.17 • 5-14 years: US$6.60 • 15 + years: US$6.96	People are more productive when they are healthy and are more willing to pay to be healthy
Mortality benefit per person per year (only under-five children)	Rural: US$19.86 Urban: US$8.17	People become more aware of the risks of sanitation when they understand the links, and are more willing to pay to save lives
WATER		
Overall quality		Better quality and more aesthetically pleasing environment
Average costs saved per household for domestic uses	Rural: US$2 Urban: US$6	Better water quality: better taste, less turbidity, better color, and safer; continuous water supply at affordable price
Non-domestic uses	Preventing an increase of BOD by 1 mg/liter in a source of raw water for clean water company will avoid 25% increase in national average clean water production costs	Reduced costs to obtain clean water for other productive activities such as livestock and fish farming, factories and restaurants
ACCESS TIME (annual value of time savings)	Rural: US$60 Urban: US$52	• Adults have more time for more productive activities • Children can go to the toilet any time without having to go far and spending a lot of time
INTANGIBLES	• Respondents with improved sanitation have a higher level of satisfaction (more than 70%) for every assessment aspect than those without unimproved sanitation (average 50%) • No need to be concerned about the safety of their children when they go to defecate (72% of respondents)	• Private toilets eliminate queuing • Women take better care of their children and babies, as well as their cooking • Safe to go any time, especially at night and during rainy season • Having more privacy and pride • No wet (slippery) and muddy path along the way to toilets • Reduced risk of accidents • No need to worry about children if they want to defecate • No flies • No need to go earlier to queue for the public toilets or get a good spot for open defecation • Can keep the facilities clean and comfortable • No dirty environment around toilets
EXTERNAL ENVIRONMENT	• Improved sanitation areas have higher scores of perception on environmental sanitation states than unimproved sanitation areas • Also have higher level of satisfaction with the external environment	No dirty environment and unpleasant odors around living areas, public areas, and private land

V. National Benefits of Improved Sanitation and Hygiene

This chapter presents the potential impacts of improved sanitation on:

- Tourism (section 5.1)
- Businesses and foreign investment (section 5.2)
- Sanitation markets (section 5.3)
- National health (section 5.4)
- National water resources (section 5.5)

5.1 TOURISM

Tourism is an important economic activity in Indonesia and provides a significant source of foreign exchange revenues. In 2008, it provided US$7.4 billion of revenue, the third highest contributor of foreign exchange revenues, after oil & gas and palm oil. It also provides an important source of local government tax income, as well as jobs for 6.7 million Indonesians[19].

In 2008, Indonesia was visited by almost 6.5 million foreign visitors, which was a significant increase from 4.8 million foreign visitors in 2006 and 5.5 million visitors in 2007. The tourist industry is expected to grow by 6.4% annually from 2008 to 2015[20].

The preference of tourists to choose Indonesia for their holiday destination is influenced by many factors. One set of factors is related to the sanitary conditions of the country, such as the quality of water resources, quality of outdoor environment (cleanliness and freedom from unpleasant odors), food safety and hygiene, general availability of toilets offering comfort and privacy in hotels, restaurants, and bus stations; and the related health risks of all the above. Experience shows that better sanitary conditions will attract 'high-value' tourists, i.e. those who are willing to pay more for their holiday. Currently foreign tourists spend on average US$137 per day and stay for an average 8.6 days, giving average revenue per tourist visit of US$1,180.

The ESI Phase 2 study attempts to explore the impacts of the sanitary condition of the country generally, and tourism resorts specifically, on tourists' preferences to visit Indonesia and recommend Indonesia to their family and friends when they return home. As well as tourists going on holiday, business visitors were also included. A total of 144 holiday tourists and 110 business visitors were interviewed in Soekarno-Hatta international airport at the departure gate before leaving Indonesia. The survey was conducted in English and was also available in Malay to include more Asian tourists. It took 10 days to reach the target sample population of 250 visitors. Tourists were approached and explained the purpose of the survey. If they agreed, they would be given a questionnaire form to fill out. On average, each respondent took about 10 to 15 minutes to complete the questionnaire.

Table 30 shows the profile of the respondents of the business and tourism survey.

On average, tourists rate their enjoyment at between 3.0 and 3.5, out of a maximum score of 5.0, while visiting places such as Jakarta, historical/temple sites, beaches, and natural or forest areas (Figure 38). Most of the respondents who answered 1 or 2 (least enjoy) said that the historical site/temples and natural/forest areas that they visited were dirty and polluted.

[19] President's speech at the opening of Visit Lombok Sumbawa 2012 and the International Ecotourism Business Forum, Mataram, West Nusa Tenggara, 6 July 2009
[20] Statistical Report on Visitor Arrivals to Indonesia

TABLE 30: BACKGROUND CHARACTERISTICS OF RESPONDENTS

Region of origin		Asia	Australia and New Zealand	Europe	North America	Africa	Total
Number of tourists interviewed		118	60	56	18	2	254
Gender (%)	Male	79%	68%	54%	56%	50%	61%
	Female	21%	32%	46%	44%	50%	39%
Average number of previous trips to Indonesia		5	8	6	3	9	6
Average length of stay of current trip		10	14	13	12	15	13
Purpose of visit (%)	Tourist	46%	70%	61%	72%	50%	60%
	Business	54%	30%	39%	28%	50%	40%
Hotel daily tariff in US$	< 30	3%	10%	16%	6%		8%
	30-59	25%	10%	18%	44%		21%
	60-89	34%	35%	27%	22%		32%
	90-119	23%	22%	7%	22%		19%
	120-149	12%	13%	16%	6%		13%
	150 +	4%	10%	16%	0%	100%	9%

FIGURE 38: PLACES VISITED BY TOURISTS (% RESPONDENTS) AND ENJOYMENT OF STAY (SCORE: 5 = VERY MUCH, 1 = NOT AT ALL)

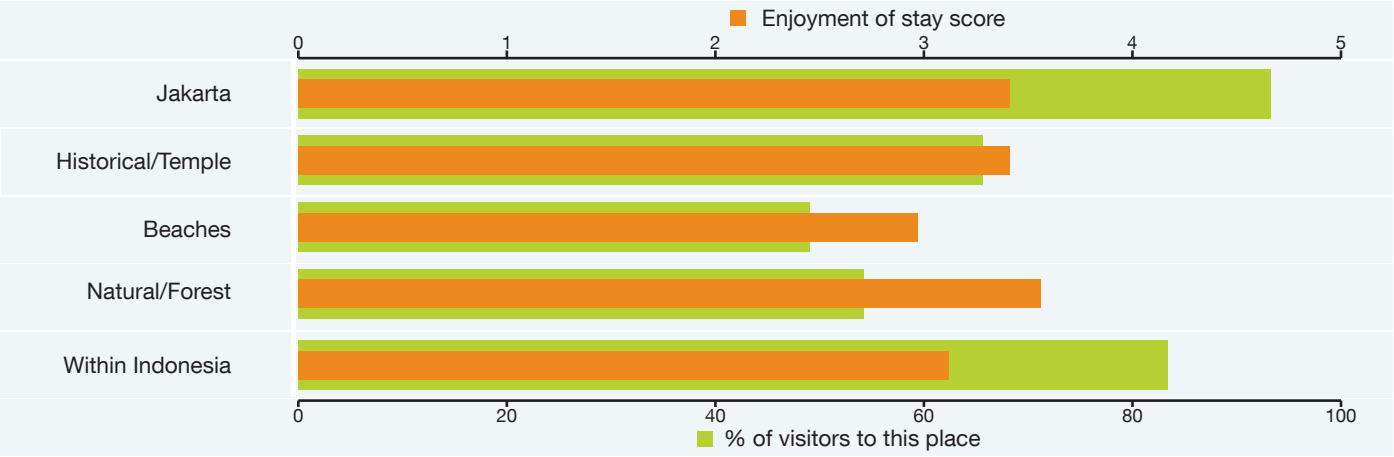


Figure 39 shows that on average, respondents perceived that general sanitary conditions of public places, such as open water and areas in the capital and other cities, to be poorer than those in private places, such as hotels, swimming pools, and restaurants. 'High-value' visitors who spend more than US$90 per night in a hotel said that the sanitary conditions are very good (average score is 4). This shows that in Indonesia sanitary conditions differ from place to place.

Figure 40 show respondents' perceptions of the quality of toilets in airports, bus stations, and other places around the city, which were poorer than their perceptions of toilets in private places, such as hotels and restaurants.

In terms of toilet availability, fewer than 1% of respondents said they could not find a toilet when needed. Figure 41 shows the sanitation issues of most concern to the respondents (3 responses per respondent). The top four concerns were with food, drinking water, unsanitary toilets and tap water quality.

Out of 254 respondents, there were 80 occurrences of gastro-intestinal illness, or 31% of respondents. More tourists were sick (52 people or 36%) than business visitors (28 people, or 26%). Out of different possible causes, both tourists and business visitors perceived food to be the number one cause of gastro-intestinal illness. For tourists this

FIGURE 39: GENERAL SANITARY EXPERIENCE (SCORE: 5 = VERY GOOD, 1 = VERY POOR)

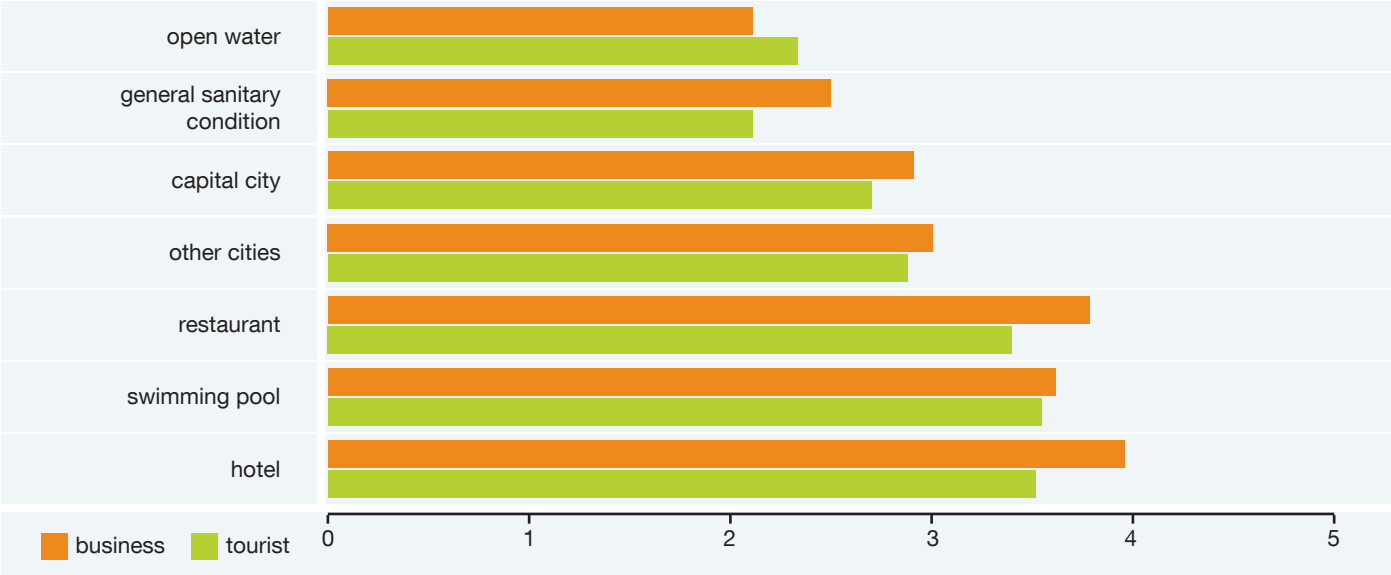


FIGURE 40: SANITARY EXPERIENCE IN RELATION TO TOILETS AND HAND WASHING (SCORE: 5 = VERY GOOD, 1 = VERY POOR)

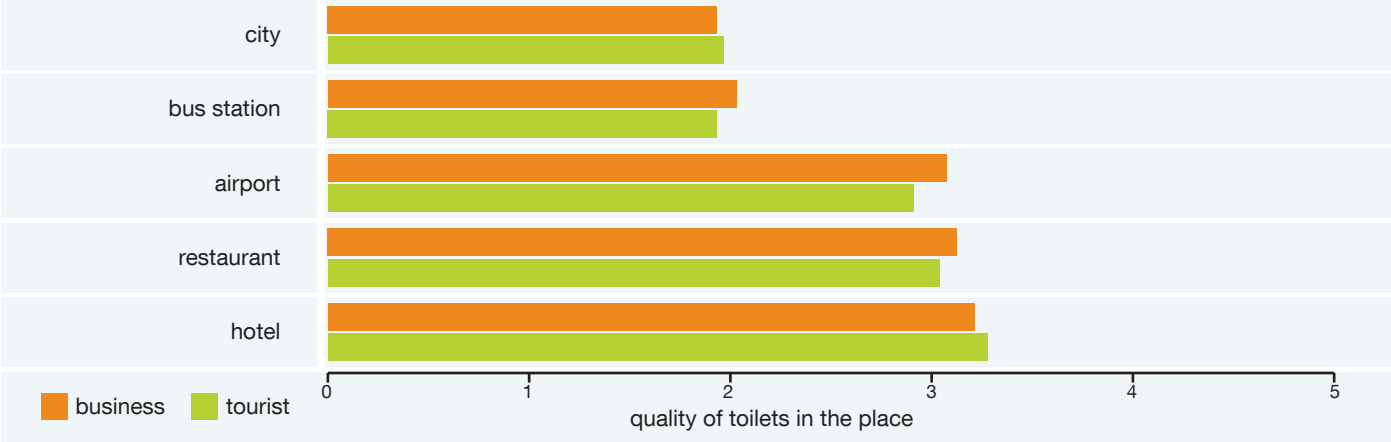
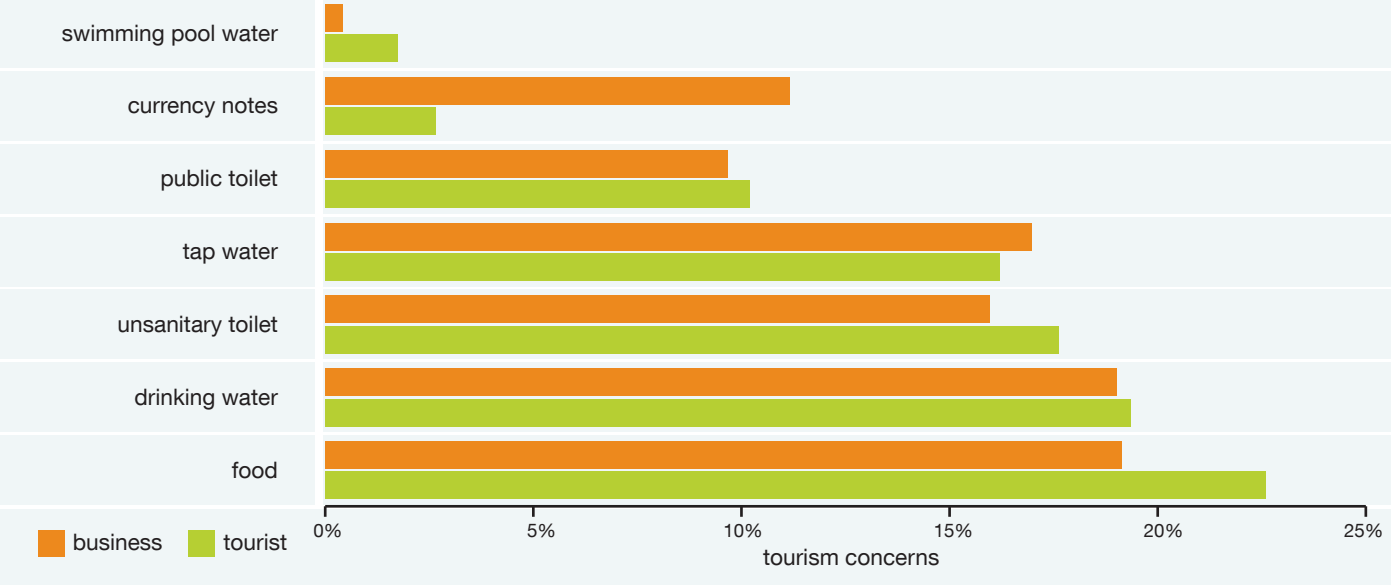


FIGURE 41: WHAT FACTORS WERE MOST CONCERNING? (% CITING, 3 RESPONSES PER RESPONDENT)



was followed by drinking water and dirty environment, and for business visitors this was followed by water for washing and drinking water. Respondents stated that they suffered on average 3 days of symptoms and 2 days of being too unwell to conduct normal activities. 35% of those sick went to a medical clinic while 26% chose to buy medicines in a shop/drug store. The remaining 39% did not seek medical care. On average, business visitors who got sick spent more on treatment (US$68) than tourists, who spent on average US$25.

Most respondents said that they were willing to return to Indonesia (85%), while only 3% said they would not return, and 13% were not sure about it. The majority of respondents said they would advise friends to come (74%), while others said they would not advise friends to come (9%), and 16% were not sure about it (Figure 42).

When they were asked the reasons for their hesitance to return to Indonesia, almost 50% of visitors mentioned sanitation condition as the main factor, followed by safety and cost (Figure 43). This is a strong indication to tourist agencies and government departments of the need to pay more attention to improving sanitary conditions in Indonesia.

5.2 BUSINESS AND FOREIGN DIRECT INVESTMENT

The business survey was conducted in Jakarta and Bandung. Jakarta was selected because it is the capital city and the location of many international and national companies; and Bandung because it is a major tourist destination with many international and national restaurants and hotels. Bandung is also a city with many textile factories: textiles and their related products are estimated to contribute approximately 10% to exports and are one of Indonesia's top

FIGURE 42: INTENTION OF VISITORS TO RETURN TO INDONESIA

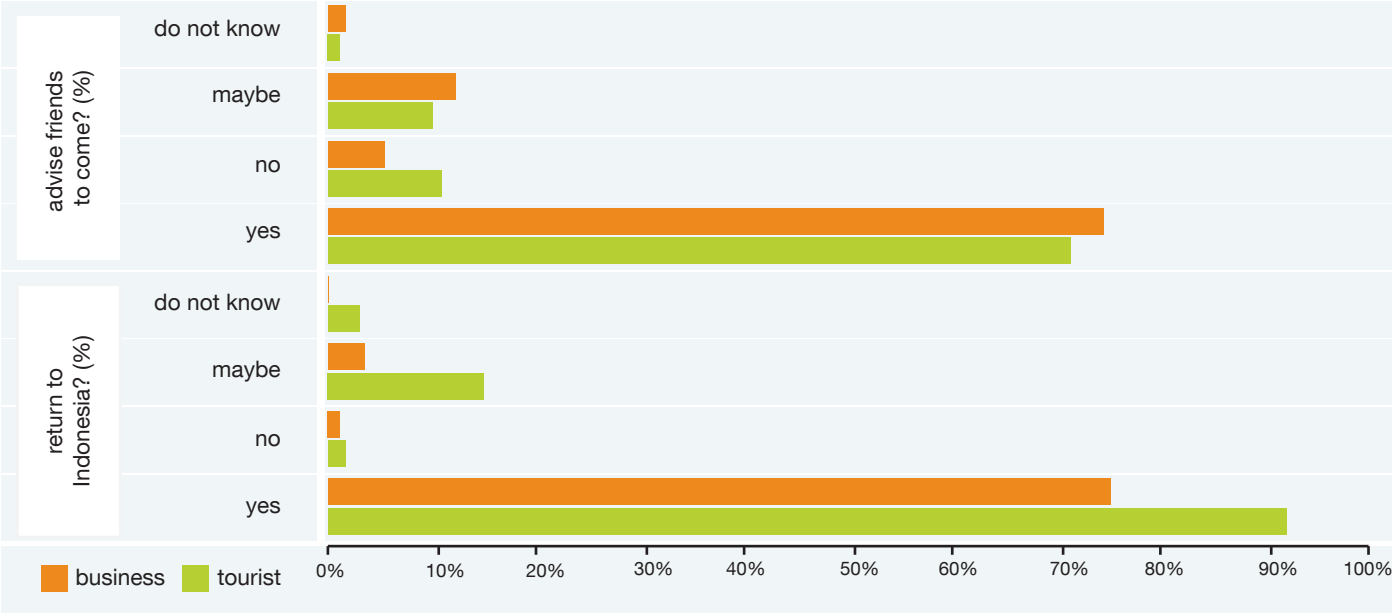
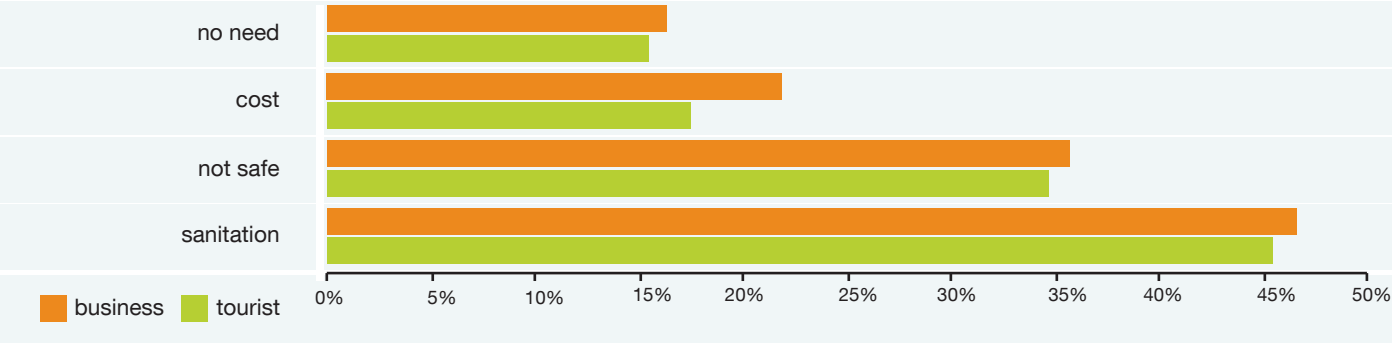


FIGURE 43: REASON FOR HESITANCY TO RETURN



ten non-oil and gas export commodities[21]. Also, the city experienced a major garbage disposal problem a few years ago.

As reported in Chapter 5.1, on average visitors rated their enjoyment at around 3.0 (out of 5.0) while visiting various places in Indonesia (Figure 44).

A separate survey conducted in a small selection of restaurants, hotels, garment factories and food processing companies in Jakarta and Bandung gathered opinions and preferences about environmental sanitation. The respondents were asked about the quality of river water, the state of canals and rainwater drainage, management of sewage, management of industrial wastewater, household coverage with private toilets, toilets in public places, household/office solid waste, management of industrial solid waste, air quality from vehicles, air quality from solid waste, and air quality from excreta. Figure 45 shows the respondents' concerns about the environmental sanitation condition. They were most concerned about water pollution in rivers, followed by the poor state of canals and rainwater drainage, poor management of industrial solid waste, and lack of adequate toilets in public places.

A pleasant environment for staff – one that is clean with good air quality and good sanitation – was a top priority for companies that are considering locating their business, especially for the food industry (food processing and restaurants). Figure 46 also shows that other important factors influencing company location include workers' health and quality of water available. As well as these factors, the development of the city's infrastructure and supportive public policies in their sector are important influencing factors.

FIGURE 44: PLACES VISITED BY BUSINESS VISITOR (% RESPONDENTS) AND ENJOYMENT OF STAY

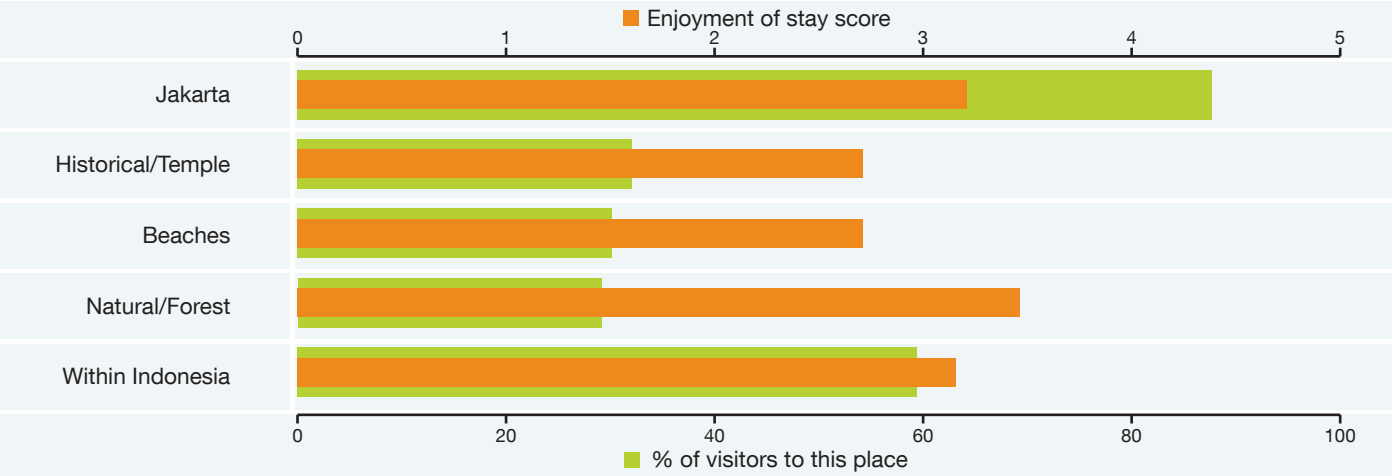
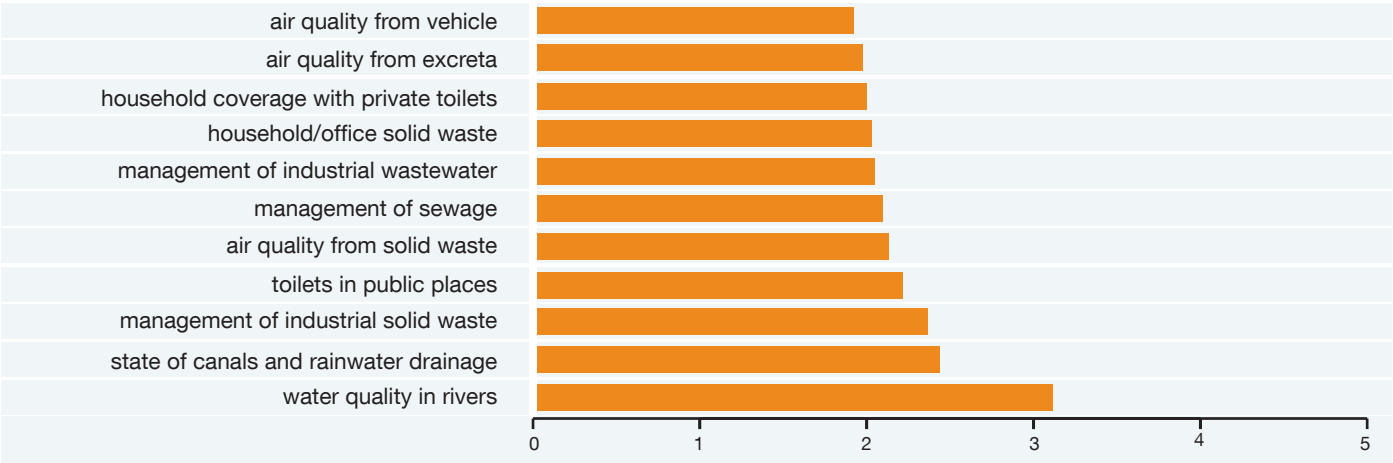


FIGURE 45: RATING OF ENVIRONMENTAL SANITATION CONDITIONS IN THE LOCATION OF THE BUSINESS SURVEY INTERVIEW (1 = BEST; 5 = WORST)



[21] Ministry of Trade (http://www.depdag.go.id), 2009

FIGURE 46: IMPORTANCE OF INFLUENCING FACTORS FOR COMPANY LOCATION (1 = UNIMPORTANT; 5 = IMPORTANT)

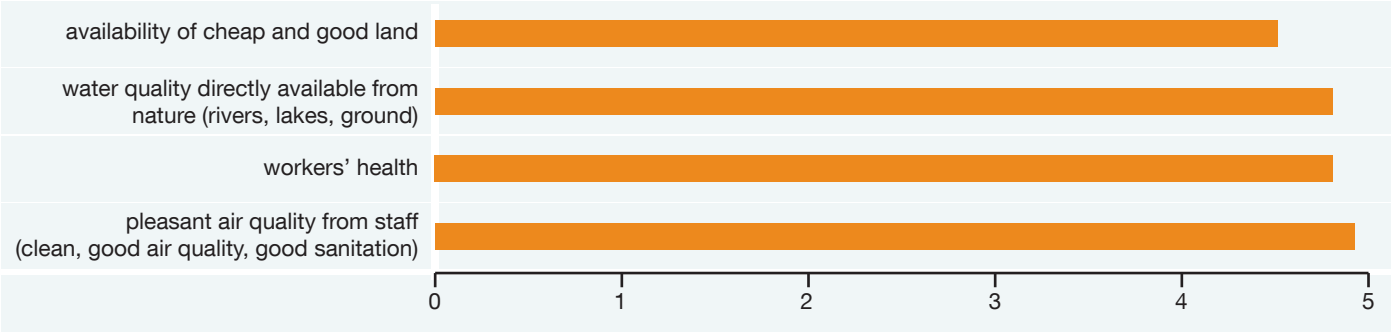


TABLE 31: INDONESIA HOUSEHOLD SANITATION PROFILE – JMP MARCH 2010

	Urban		Rural	
	Proportion	Number of HH (Million)	Proportion	Number of HH (Million)
Improved	67%	13	36%	9
Shared	9%	2	11%	3
Unimproved	8%	2	17%	4
Open Defecation	16%	3	36%	9

5.3 SANITATION MARKETS

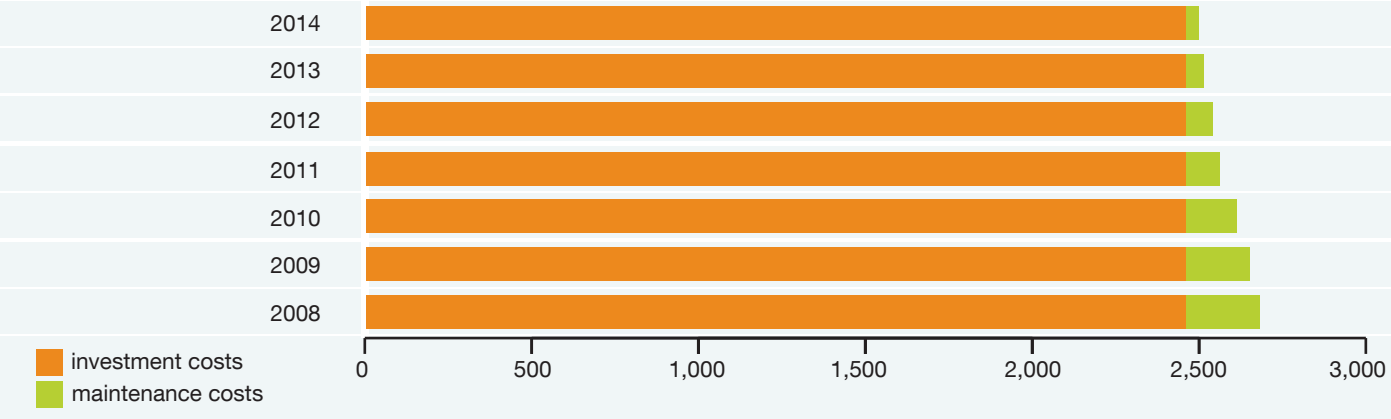
The Government of Indonesia has set targets to make Indonesia free from open defecation by 2014. It means that households that still practice open defecation will have to use toilets, either private, shared or community toilets. The number of households practicing open defecation accounts for a major share of the overall sanitation market potential. The calculation of the sanitation market size is based on the following assumptions:

- The market potential covers initial investment costs (sanitation material as well as related services such as mason services) and annual maintenance costs.
- The initial sanitation ladders consist of moving from open defecation or an unimproved or shared toilet, to an improved private toilet with septic tank.
- The unit price of a septic tank is adopted from the "Sanitation System & Technology Option Reference Book – TTPS, 2010", which is US$1000 for a private toilet with a technically standardized septic tank.
- The annual maintenance cost is the average annual maintenance costs of private toilet found in study sites (see Chapter 6).

The Joint Monitoring Programme for water supply and sanitation estimates the use of improved sanitation facilities in Indonesia (the March 2010 update reports 2008 figures). A summary of coverage rates and populations benefitting is shown in Table 36. These figures serve as the baseline to calculate the total potential market size to achieve the PPSP target by the end of 2014 with additional costs of moving up from shared and unimproved toilets to private toilets with septic tank.

According to the above assumptions and the sanitation profile (Table 31), the total potential sanitation market size is 16.67 million new toilet units, which are worth US$17.3 billion. This figure includes new toilet investment costs of US$16.8 billion and cumulative maintenance costs of US$500 million from 2008 until 2014. Figure 47 shows the market size projection, assuming equal coverage gains in each year until 2014. For planning and budgeting purposes, it will be necessary to select sanitation technologies and models that are affordable and demanded by the populations they serve – the actual unit costs may be lower than these values (especially in rural areas) or indeed higher, for more advanced sewerage and treatment systems in large, densely-populated and higher-income urban centers.

FIGURE 47: PROJECTION OF INDONESIA SANITATION MARKET SIZE (US$ MILLION)



5.4 HEALTH

The ESI Phase 1 Study reported that poor sanitation and hygiene caused significant burden of disease in Indonesia through illness and premature death. Table 32 shows the estimated number of episodes and deaths attributed to poor sanitation for these selected diseases: diarrheal diseases, helminthes, scabies, trachoma, hepatitis A, hepatitis E, malnutrition and other diseases related to malnutrition.

Using the national DHS data as a data source, it is estimated that 89 million cases of diarrhea were attributed to poor sanitation and hygiene,[22] while 28 million cases of scabies were estimated to be attributed to poor hygiene practices. The national health information system reported that 3 million malnourished children, a million cases of helminthes, and an additional 1 million cases of illness related to malnutrition, are attributed to poor sanitation and hygiene. Other studies suggest significantly higher rates of disease than those reported by government records. In East Asia, helminthes are cited to have the prevalence rate of 36% (roundworm), 28% (whip worm) and 26% (hook worm), which would lead to more than fifty million cases. Three million malnourished children may also be a significant underestimate, in a country where 28% (5.4 million) of the under-five children are estimated to be severely or moderately underweight.

The total number of deaths attributed to poor sanitation and hygiene exceeds 50,000, of which 24,000 are accounted for by direct diseases (mainly diarrhea) and 26,000 by

TABLE 32: ESTIMATED NUMBER OF ANNUAL CASES AND DEATHS ATTRIBUTED TO POOR SANITATION AND HYGIENE, 2006[1]

Disease	Morbidity (cases)	Mortality (deaths)
DIRECT DISEASES		
Diarrheal disease	89,417,461	22,880
Helminthes	1,054,048	56
Scabies	28,659,082	583
Trachoma	174,079	-
Hepatitis A	715,330	702
Hepatitis E	23,770	21
Sub-total	120,043,770	24,242
INDIRECT DISEASES RELATED TO MALNUTRITION AMONG CHILDREN UNDER FIVE YEARS		
Malnutrition	3,073,220	na
ALRI	1,066,935	8,049
Malaria	87,818	1,887
Measles	na	3,528
Other	na	11,282
Protein energy malnutrition	na	1,144
Sub-total	4,227,973	25,890
Total	124,271,743	50,132

[1] Economic Impacts of Sanitation in Indonesia. A five-country study conducted in Cambodia, Indonesia, Lao PDR, the Philippines, and Vietnam under the Economics of Sanitation Initiative (ESI) Phase 1, Research Report, WSP-EAP, World Bank Office Jakarta, August 2008.

[22] Estimated using data from the National DHS 2007 which collected diarrheal incidence rates for the under five population (2.5 cases per child per year).

indirect diseases related to malnutrition. These latter deaths include only under-five children and therefore underestimate the total deaths in all age groups. These data however are already five years old, and require updating. Economic development and increasing coverage of basic services are expected to reduce the overall number; however, offsetting this is the increasing population size and the remaining challenges of slum populations.

The potential impact of increased local government engagement has been demonstrated by the government of Payakumbuh City, where sanitation has been mainstreamed in the city development program since 2006. In a speech at the City Sanitation Summit in 2008, the city's mayor stated that the provision and improvement of household toilets, via the CLTS approach, had resulted in a reduction in the city's health subsidy budget from around US$290,000 per year to be less than US$100,000 per year within 2 years[23].

5.5 WATER

Human excreta and wastewater directly disposed of into water bodies, such as rivers and lakes, are major causes of the serious pollution of surface water in Indonesia. For every 1 mg/liter additional BOD concentration in a river from which water supply utilities source water, average water treatment cost increases 25%[24]. Research on surface water quality in Citarum River in West Java by the West Java Environmental Control Body (*Badan Pengendalian Lingkungan Hidup Daerah*/BPLHD) in 2004 showed that the high BOD in this river is due to intakes from domestic (44%-55%), industry (0%-42%), crop agriculture (10%-36%) and livestock agriculture (3% -10%) sources[25].

With human populations – especially around rivers and streams – growing over time, and in the absence of any serious efforts to control this pollution, the situation can only get worse. More than 19% of people dispose of untreated human excreta into water bodies (rivers), producing around 4,400 tons phosphorous per year in these rivers. A 2006 study by West Java BPLHD revealed that domestic wastewater contributed up to 80% of the total surface water pollution in West Java. Thus, the water in all rivers in West Java that pass through urban areas like Bogor, Depok, Bekasi, Bandung and Cirebon are not fit for use without treatment[26].

The most recent data from the Bekasi City BPLHD revealed that almost all rivers in Bekasi are contaminated by E. coli bacteria. E. coli concentrations in the city's two largest rivers (Kali Malang and Kali Bekasi) are between 80,000 MPN/100 ml and 100,000 MPN/100 ml, which far exceeds the maximum threshold of 1,000 MPN/100 ml. As a consequence, the local drinking water company has to spend more on water treatment[27].

The situation is much the same in Jakarta and Surabaya. In 2002, the Environmental Technology Directorate of the Agency for Technology Testing and Application (Badan Pengkajian dan Penerapan Teknologi/BPPT) reported that 70% of the wastewater disposed of in rivers in the Jakarta area was domestic wastewater, and average BOD was more than 90 mg/l. In Surabaya, research by local water supply utility Perum Jasa Tirta reported in 2004 that 87% of the wastewater disposed of in rivers in Surabaya was domestic wastewater, with the remainder coming from industry. The large volume of organic material in domestic wastewater absorbs oxygen in the water and has caused the disappearance of many important river biota: there are now very few wild fish in Surabaya's rivers.

These facts serve to remind all stakeholders of the urgency and importance of improving sanitation. The environmental damage caused by uncontrolled disposal of domestic wastewater into water bodies can no longer be ignored.

[23] The Major of Payakumbuh City speech in the Opening Ceremony of Sanitation Summit, November 5th, 2008
[24] Indonesia Sanitation Sector Development Program (ISSDP), 2007.
[25] http://www.bplhdjabar.go.id/,09 October 2006
[26] http://www.bplhdjabar.go.id/,09 October 2006
[27] http://newspaper.pikiran-rakyat.com, May 12th, 2009

VI. Costs of Improved Sanitation and Hygiene

This chapter presents the cost results in different forms and from different perspectives to aid understanding the nature of costs: in section 6.1, a breakdown of investment, recurrent and program costs; in section 6.2, a breakdown by category of financier (payer); in section 6.3, a breakdown of unit costs for different wealth quintiles; and in section 6.4, a presentation of the marginal costs of moving up different 'rungs' on the sanitation ladder.

6.1 COST SUMMARIES

Table 33 and Table 34 show a summary of sanitation and hygiene costs in rural and urban study sites, respectively. Site-specific costs are provided in Annex I. The hygiene costs in column 2 are distinct from sanitation costs, but it can be added to sanitation costs to estimate the combined costs of hygiene and sanitation interventions. Capital costs refer to putting hardware in place, while program costs reflect software (promotion and awareness raising campaign prior to the facility construction, education and monitoring).

In rural areas, hardware investment cost ranges from US$53 per household for dry pit latrine to US$557 per household for septic tank. The rural community toilet, which in Tangerang site is SANIMAS and serves around 100 households, costs US$ xx per household. The SANIMAS option

TABLE 33: SUMMARY OF AVERAGE COST PER HOUSEHOLD IN RURAL AREAS FOR DIFFERENT SANITATION AND HYGIENE OPTIONS, USING FULL (ECONOMIC) COST (US$, 2009)

Cost Item	Hygiene[1]	Community	Shared	Dry pit	Wet pit	Septic tank
INVESTMENT COSTS: INITIAL ONE-OFF SPENDING						
1. Capital	2	151	130	53	70	557
2. Program	0.1	28	0.0	0.0	0.0	0.0
Sub-total	2	179	130	53	70	557
RECURRENT COSTS: AVERAGE ANNUAL SPENDING						
3. Operation	9.0	0.2	4.0	7.0	7.0	13.0
4. Maintenance	0.0	0.8	4.5	7.4	7.3	12.1
Sub-total	9.0	1.0	9.0	14.0	14.0	25.0
AVERAGE ANNUAL COST CALCULATIONS						
Duration[2]	3	20	10	5	5	20
Cost/household	10	19	28	27	32	82
Cost/capita[2]	2	4	6	5	6	16
OF WHICH:						
% capital	9%	80%	69%	48%	55%	69%
% program	0%	15%	0%	0%	0%	0%
% recurrent	90%	5%	31%	52%	44%	31%
Observations[4]	208	23	98	41	54	224

[1] Mainly soap purchase cost; [2] Refers to length of life of hardware before full replacement ; [3] Based on 5 persons per HH; [4] Number of households (respondents)

is the only one with program costs measured, as it was developed under the government's and NGO's initiative, with US$28 investment cost per household spent, or around 15% of total investment costs.

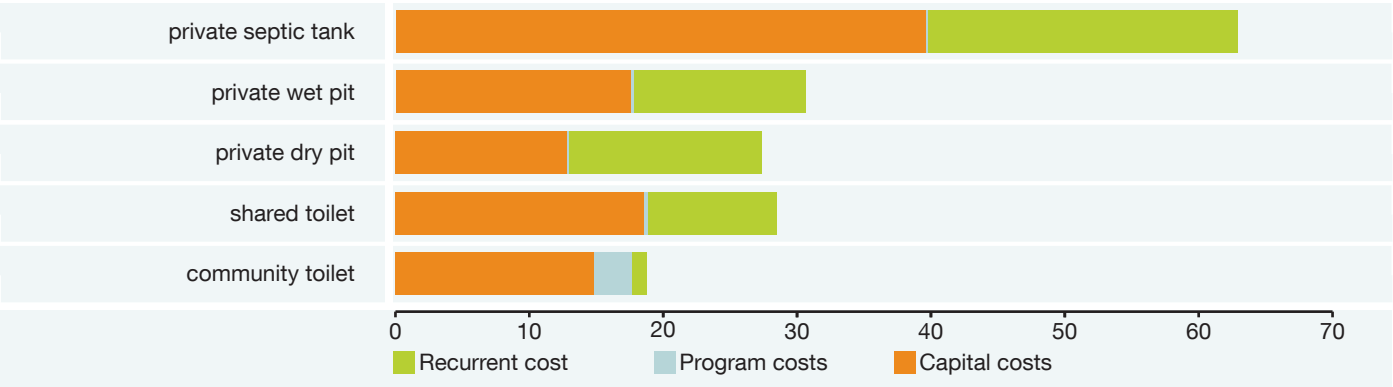
Figure 48 illustrates the main components of annualized costs in rural areas. When converted to annualized life cycle costs, taking into account the expected duration of the investment, annual costs per household vary from US$19 per year for SANIMAS to US$82 for septic tank. Capital costs are the dominant part of the overall costs. However, in the absence of maintenance in the SANIMAS intervention, there is a high risk that the facility will not last for 20 years, or that people will continue to use it even when it is functional (due to poor hygienic conditions of the facility). Hence there needs to be am element of the SANIMAS program that raises awareness on the importance of facility maintenance and institutes a mechanism for proper operations and maintenance to take place.

TABLE 34: SUMMARY OF AVERAGE COST PER HOUSEHOLD IN URBAN AREAS FOR DIFFERENT SANITATION AND HYGIENE OPTIONS, USING FULL (ECONOMIC) COST (US$, 2009)

Cost Item	Hygiene[1]	Community		Shared	Wet pit	Septic tank	Communal sewerage[2]	Sewerage + treatment[3]	
		Optimal	Actual					Optimal	Actual
INVESTMENT COSTS: INITIAL ONE-OFF SPENDING									
1. Capital	2	316	503	104	60	369	479	473	2,198
2. Program	0.1	0	0	13	13	13	0	0.6	3
Sub-total	2	316	503	117	73	382	479	474	2,201
RECURRENT COSTS: AVERAGE ANNUAL SPENDING									
3. Operation	9.0	4	6	3	8	7	13	13	36
4. Maintenance	0.0	3	5	8	13	23	32	39	54
Sub-total	9.0	7	11	11	21	30	45	52	90
AVERAGE ANNUAL COST CALCULATIONS									
Duration[4]	3	20		10	5	20	20	20	20
Cost/household	10	39	62	28	37	70	87	100	317
Cost/capita	2	8	12	6	7	14	17	20	63
OF WHICH:									
% capital	9%	83%	83%	55%	40%	53%	56%	48%	71%
% program	0%	0%	0%	7%	8%	2%	0%	0%	0%
% recurrent	91%	17%	17%	38%	53%	45%	44%	52%	29%
Observations[5]		29		92	116	318	137	46	46

[1] Mainly soap purchase cost; [2] Malang city; [3] Banjarmasin city; [4] Refers to length of life (years) of hardware before full replacement; [5] Number of households (respondents)

FIGURE 48: ANNUAL EQUIVALENT ECONOMIC COSTS PER RURAL HOUSEHOLD FOR MAJOR ITEMS (US$)



For urban sites, wet pit latrine is the lowest investment cost at US$73 per household. Shared latrine is higher at US$117, with private septic tank at US$382. The private sewerage and treatment system at Banjarmasin site and the communal sewerage system in Malang site have the highest investment cost at around US$480 per household. These results reflect the optimal capacity use of the sewerage systems. However, when account is taken of the actual capacity use of the sewerage and treatment system in Banjarmasin site, the cost per household increased to over US$2,000 per household. The community toilets in Banjarmasin increase from US$316 to US$503 per household due to some household members still going to rivers for defecation.

Figure 49 illustrates the main components of annualized costs in urban areas. Similar to the rural areas, the capital costs are the most dominant part of the overall costs. The difference between optimal and actual costs are shown clearly for sewerage network and the community toilets. The contribution of program costs to the annualized costs is small compared to the capital costs and recurrent costs. However, program implementers should be aware of the fact that minimum or even zero budget allocation on program costs for awareness raising and capacity building of the targeted beneficiaries may lead to less effective intervention. Key stakeholders, especially beneficiaries, may not be fully aware of the program, which can be a key determinant of program success (see Chapter 7). For instance, respondents or participants in the focus group discussions in Banjarmasin mentioned that they were not well informed of any initiatives on sanitation development. This led to lack of public willingness to connect their toilets with the sewerage system, thus using less than 15% of the treatment plant's capacity, even after more than 10 years of operation.

6.2 FINANCING SANITATION AND HYGIENE

The contribution of funds for sanitation initiatives depends on which sanitation options are selected and who initiates the intervention. Figure 50 and Figure 51 show the proportional contributions of different parties to total sanitation costs at rural and urban sites, respectively. The figures show that community toilets (SANIMAS) and sewerage systems receive major support from the government (central and/or local government). In some cases of SANIMAS, NGOs contribute financially, also successfully creating community demand or awareness.

For city sewerage systems, the government is responsible for the provision and financing of the entire sewerage networks, while households are only responsible for providing their own toilets and connection from their house to the sewerage network. As well as the connection fee, households also pay a monthly fee which contributes to operations and maintenance. The other sanitation options are on-site systems, whose financing usually fall under the responsibility of households.

FIGURE 49: ANNUAL EQUIVALENT ECONOMIC COSTS PER URBAN HOUSEHOLD FOR MAJOR ITEMS (US$)

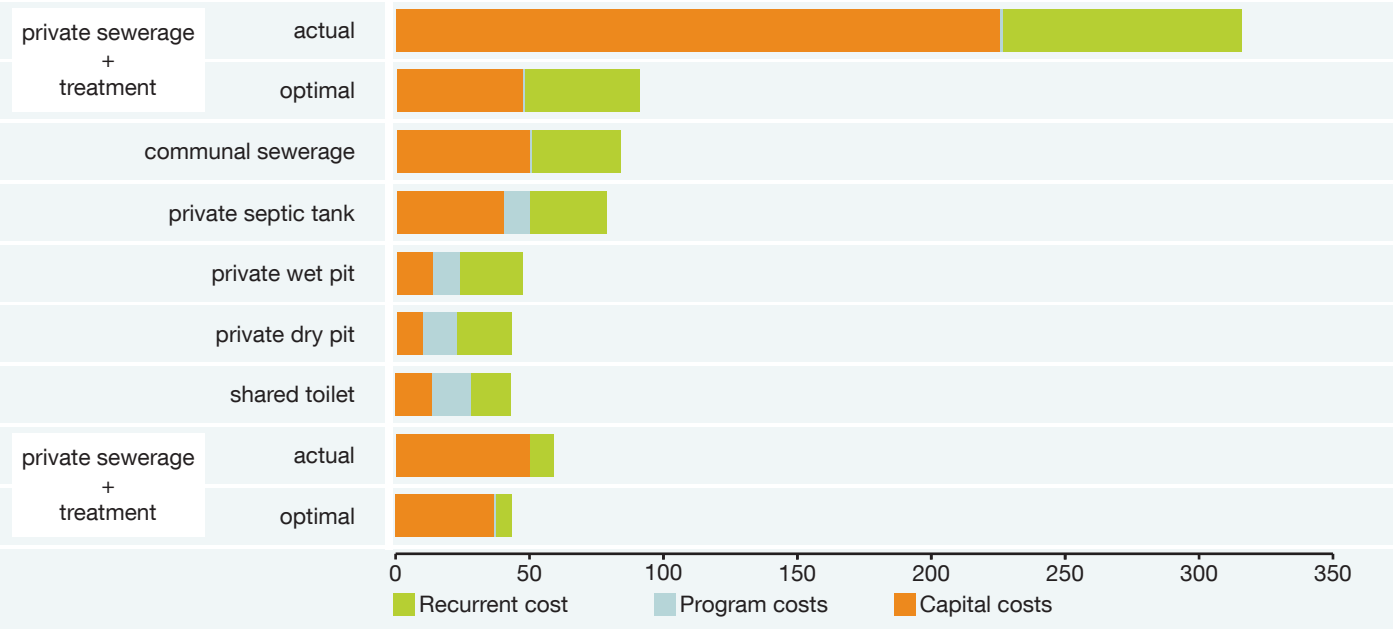


FIGURE 50: PROPORTION OF RURAL SANITATION COSTS FINANCED FROM DIFFERENT SOURCES (%)

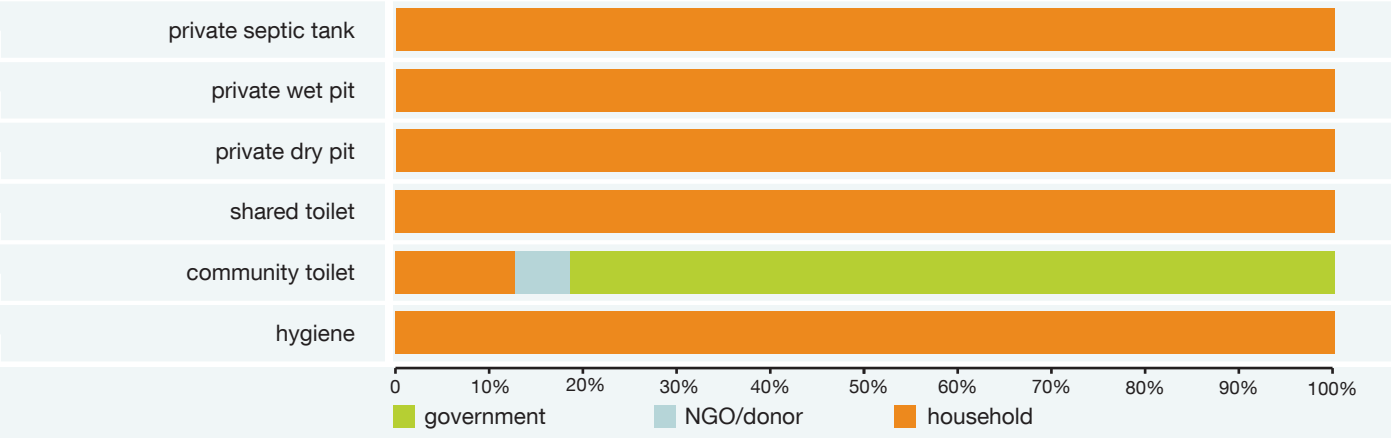


FIGURE 51: PROPORTION OF URBAN SANITATION COSTS FINANCED FROM DIFFERENT SOURCES (%)

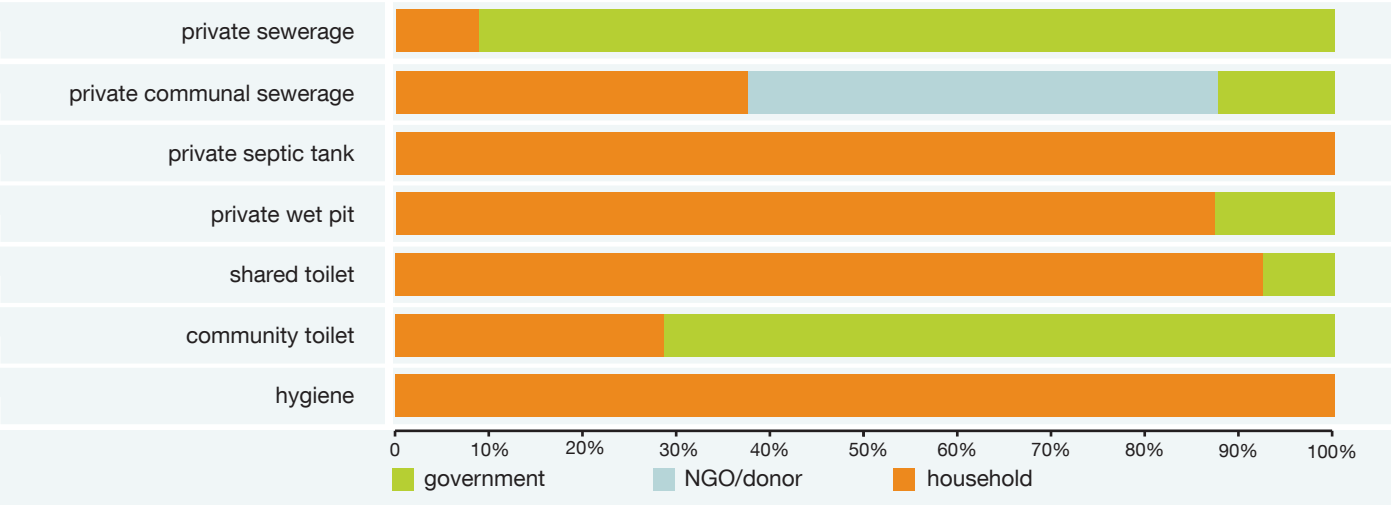
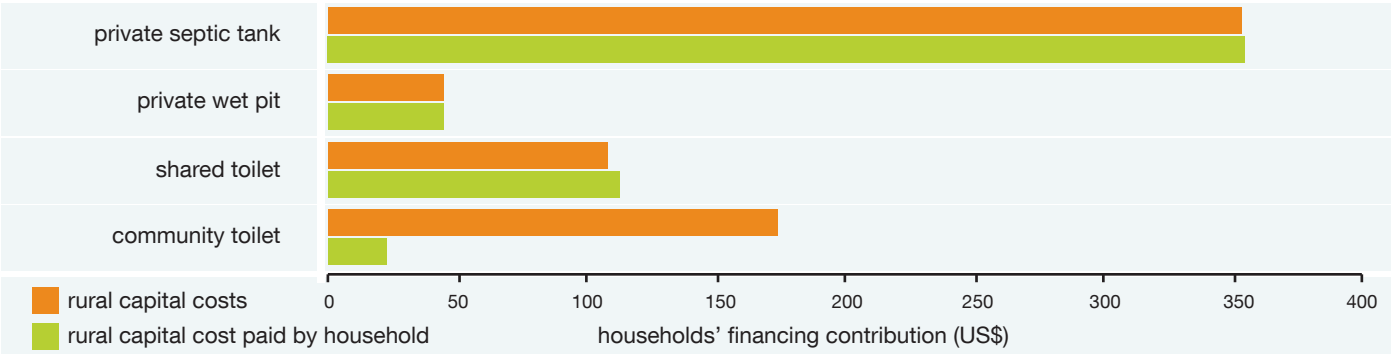


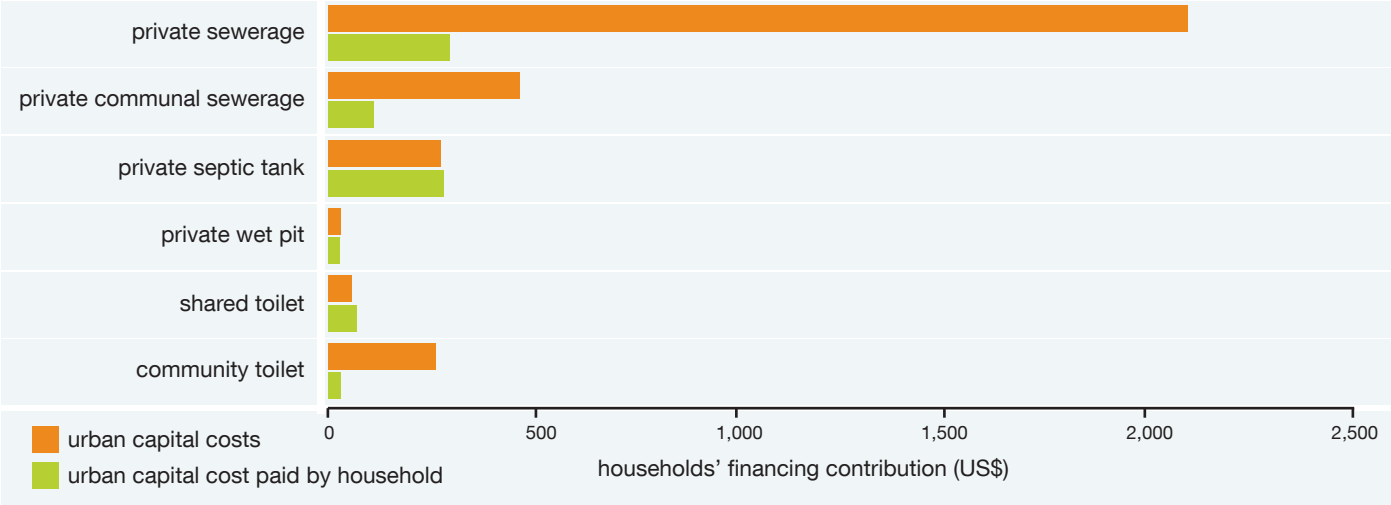
FIGURE 52: CAPITAL COST PAID BY HOUSEHOLDS AT RURAL SITES



The local government of Payakumbuh city contributed through financing of program costs, as part of CLTS implementation. The local government initiated campaigns and community facilitation to raise the awareness of poor households in Payakumbuh to move up their sanitation ladder from open defection to the most affordable sanitation options, which are private dry or wet pit. The latrines, however, were financed by households.

Figure 52 and Figure 53 show the variation between sanitation options of capital cost paid by households at rural sites and urban sites, respectively. The figures reflect that the financing sources for high initial capital of the sanitation options such as community toilets (SANIMAS) and sewerage systems are mainly from the Government. Meanwhile, the ones with low initial capital like private on site toilets (dry pit, wet pit and septic tank) are mainly from households.

FIGURE 53: CAPITAL COST PAID BY HOUSEHOLDS AT URBAN SITES



The figures indicate that the decision to improve a sanitation facility is influenced partly by the initial investment cost, and the recurrent costs. Households with lower cash income tend to be more sensitive to the initial investment costs, and hence they tend to choose sanitation options that need a lower initial outlay of funds. Such an understanding should obviously be considered by program implementers in selecting technological options when they initiate a particular sanitation intervention.

6.3 SANITATION OPTION BY WEALTH QUINTILE

The wealth quintile analysis tabulates the proportion of households receiving each sanitation option by their ownership of assets. Figure 54 shows that richer households are more likely to select septic tanks in rural areas, compared to poorer households. Likewise, poorer households are much more likely to access community or shared toilets compared to rich (top quintile) households.

In urban sites, there is an interesting finding that sewerage connection is not linked to the wealth of a household, but the financing mechanism. In Banjarmasin, all capital costs including the connection fee are fully borne by the local government and the households only pay for construction of toilet room at home. Nevertheless, households' willingness to connect seems still relatively low. This is likely to be due to the absence of dedicated program costs to increase the population's awareness of the system.

6.4 COSTS OF MOVING UP THE LADDER

Costs of moving 'up' the sanitation ladder are presented in Table 35 for rural sites and Table 36 for urban sites. Conceptually, community toilet projects such as SANIMAS are categorized as an improved public toilet, and its position in term of sanitation ladder level is below private wet pit latrine. However, the cost per household reached with SANIMAS community toilets is higher than shared latrine or private wet pit latrine. Therefore, moving 'up' the sanitation ladder from community toilets to private wet pit latrines can lead to a theoretical cost saving. However, households using SANIMAS do so for justifiable reasons such as lack of land availability or the attraction of not spending their own resources on a private toilet. For example, community toilets for rural areas are in Tangerang district. The locations where the present study was conducted are around industrial areas and are densely populated. For some households, it is difficult to provide enough space for family toilets and they tend to use SANIMAS as provided by the government.

A similar situation takes place in the community toilets for urban areas in Banjarmasin. The city has 17 units of community toilets (SANIMAS) at different sites, which serve around 1,200 households. Almost all construction costs were born by the government. The provision of SANIMAS was partly intended to decrease the number of households practicing open defecation at the rivers around the city. Almost all required investment costs were provided by the government. Therefore, cheaper private toilet options such

as pit latrine or septic tank would not necessarily lead the population to construct their own private toilets, as they would more likely be responsible for the financing.

Figure 56 shows the incremental costs of moving up the sanitation ladders from various initial sanitation ladders to the top sanitation ladders at rural sites (septic tank) and at urban sites (urban sewerage systems). The incremental costs at rural sites show a linear trend according to the initial sanitation ladders. Wet pit, the cheapest option, needs higher incremental costs to move up to septic tank than from community and shared toilets. However, the ability of a household to move up the ladder depends on the availability of land within households' own plot to develop a private toilet including septic tank, and the financing incentive and mechanism. For example, the costs of all household connections to the sewerage systems are fully subsidized by the local government and the households pay a monthly fee (sewage treatment charge) and are responsible for building toilets in their home.

FIGURE 54: PROPORTION OF RURAL HOUSEHOLDS SELECTING DIFFERENT SANITATION OPTIONS, BY WEALTH QUINTILE

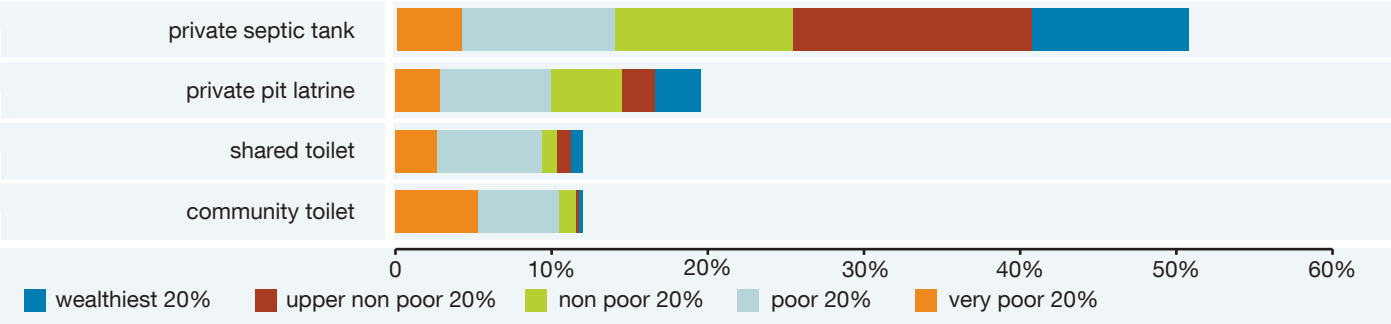


FIGURE 55: PROPORTION OF URBAN HOUSEHOLDS SELECTING DIFFERENT SANITATION OPTIONS, BY ASSET QUINTILE

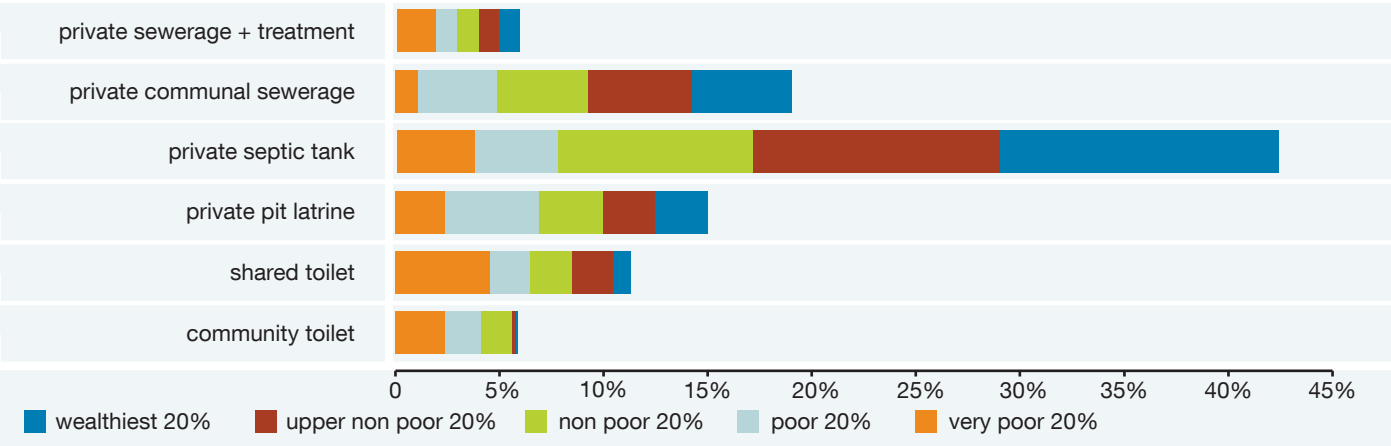


TABLE 35: INCREMENTAL COSTS PER HOUSEHOLD OF MOVING UP THE SANITATION LADDER AT RURAL SITES (US$, 2009)

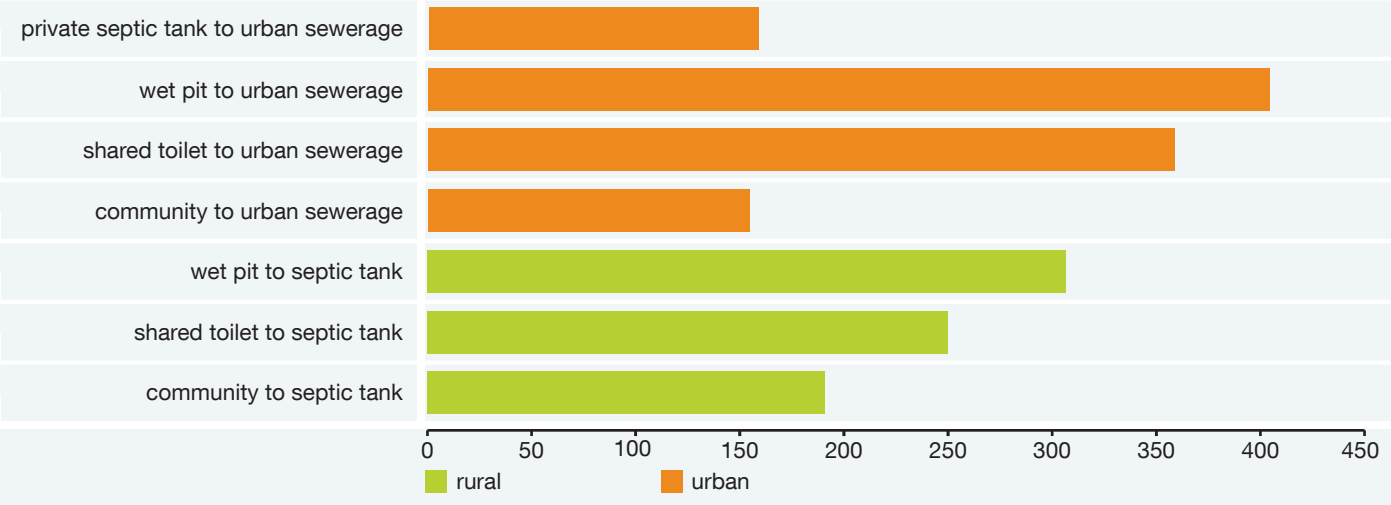
		Target position on sanitation ladder				
		Community	Shared	Dry pit	Wet pit	Septic tank
Initial sanitation ladder	Private wet pit	-	-	-	-	295
	Private dry pit	-	70	-	25	319
	Shared	63	-	-70	-45	249
	Community	-	-65	-133	-108	186

TABLE 36: INCREMENTAL COSTS PER HOUSEHOLD OF MOVING UP THE SANITATION LADDER AT URBAN SITES (US$, 2009)

		Target position on sanitation ladder					
		Community	Shared	Private wet pit	Private septic tank	Communal sewerage	Private sewerage + treatment*
Initial sanitation ladder	Communal sewerage					0	-3
	Private septic tank	-	-	-	-	189	185
	Private wet pit	244	-	-	219	407	404
	Private dry pit	263	58	19	237	426	423
	Shared	205	-	-39	180	368	365
	Community	-	-205	-244	-25	163	160

* Assumed to operate at its optimal capacity

FIGURE 56: INCREMENTAL COSTS PER HOUSEHOLD OF MOVING UP THE SANITATION LADDER (US$)



VII. Sanitation Program Design and Scaling Up

This chapter evaluates selected sanitation programs in terms of their program approaches, their performance in relation to outputs produced, their successes and their failures.

7.1 PROGRAM APPROACHES APPLIED IN FIELD SITES

Table 37 shows the start and finish dates, number of households reached, and coverage of sanitation programs in the ESI field sites.

7.1.1 WSLIC 2 IN LAMONGAN DISTRICT

The sanitation intervention in Lamongan District was Water and Sanitation for Low Income Communities (WSLIC 1 and WSLIC 2), which included clean water, sanitation, training and community empowerment and hygiene components. WSLIC 1 ran from 1993 to 1999, and WSLIC 2 started in 2000. The WSLIC 2 Program in Lamongan was 72% financed by a World Bank loan, while the local government contributed 8% and the community 20% of the program cost (4% in cash and 16% in-kind). Compared with other WSLIC 2 locations, Lamongan district has the largest number of toilets financed by a revolving fund scheme, which is at the core of the program. The program includes construction of household toilets, school toilets, and sewerage system (SPAL).

As well as infrastructure and hardware development, the program also carries out prevention and treatment for environmental-related diseases, including soil, water and stool tests, school deworming, community health counseling, and practical managerial and financial training, as well as training in water treatment and sanitation system operation and maintenance, and health community counseling.

A University of Indonesia study shows that the program has increased the number of private toilet in some villages. Table 37 shows the overall coverage achieved by the project and Table 38 shows the number of toilets built per year from the start of the program to the latest year of data.

TABLE 37: SANITATION COVERAGE INFORMATION PER FIELD SITE

Site	Rural/urban	Households			Project start		Project end	
		Interviewed in ESI survey	Of which reached by program*	%	Year	Coverage (%)	Year	Coverage (%)
1	Lamongan, rural	300	243	81	2001 - 2002	13 villages Revolving fund: 547 HH Self-Financing: 2346 HH	2007	79 villages Revolving fund: 30,323 HH CLTS: 2,040 HH Self-financing: 13,643 HH
2	Tangerang, rural	300	246	82	2007	-	2008	493 HH
3	Banjarmasin, urban	300	210	70	2000	(200 HH)	Ongoing	904 HH (status Feb 2008)
4	Malang, urban	300	252	84	1986	100 HH	1999	737 HH
5	Payakumbuh, urban	300	252	84	2007	48% (4,661 HH)	Ongoing	50.5% (4,871 HH) (status Nov 2009)

TABLE 38: NUMBER OF PRIVATE TOILETS BUILT IN LAMONGAN UNDER WSLIC 2

Year	Units from revolving fund financing scheme	Units from self-financing
2001/2	574	2,346
2003	510	1,570
2004	371	1,011
2005	466	180
2006	1,638	n.a.

n.a - data not available

Although 73% of sanitation facilities were secured through the revolving fund financing scheme, in reality the scheme has been challenging to implement. Participants found it hard to pay the installments, as most of them are very poor. On the other hand, intensive health and hygiene behavior promotion has made the community more sanitation aware and motivated them to build their own private toilets. Table 39 shows the total number of beneficiaries of the sanitation program as of 2008.

TABLE 39: TOTAL NUMBER OF WSLIC 2 BENEFICIARIES IN LAMONGAN, 2008

No	Subdistrict	No of beneficiaries		
		Village (rural)	HH	Population
1	Turi	8	4,488	23,432
2	Pucuk	3	2,162	9,547
3	Brondong	1	1,204	3,248
4	Ngimbang	1	765	3,188
5	Bluluk	2	1,673	6,643
6	Glagah	2	593	3,414
	Total	17	10,885	49,472

Source: Lamongan District Health Office, 2008

7.1.2 COMMUNITY-BASED SANITATION (SANIMAS) IN TANGERANG DISTRICT

Several years ago, Tangerang experienced a diarrhea outbreak that was attributed to poor sanitation. The Tangerang District Health Office noted that around 70% of the local population – most on the north coast in districts such as Kresek, Kronjo, Pakuhaji, and Mauk – do not have proper toilet facilities.

SANIMAS, a community-based sanitation intervention, engages the local community in the planning phase, technology options assessment and construction, and is operated and maintained by the community, with assistance from facilitators[28].

The first SANIMAS in Tangerang was launched in 2008, in Pisangan Periuk, Sepatan District, where almost 80% of households had no private toilets. Financing of the construction of the SANIMAS facility was shared by national government (IDR100 million), regional government (IDR200 million), Bremen Overseas Research and Development Association (BORDA), BEST (IDR50 million), and the community (IDR2 million), for a total of IDR352 million (about US$35,000). The other SANIMAS facilities constructed in Tangerang district are in Sukadiri subdistrict, which serves 326 households; Pagedangan subdistrict, which serves 62 households; and Sepatan subdistrict, which serves 105 households.[29]

In Tangerang, the technology option is MCK++[30]. This technology option uses the brown water flushed from the toilet to produce biogas. The septic tank is connected to an airtight biogas digester plant, which is made from reinforced concrete and installed underground beside the facility. Inside the digester, methane bacteria treat the wastewater and produce methane biogas. The local community uses the biogas for cooking. The gray water from bathing and washing passes through a sand filter before releasing into the drainage system (see Figure 57).

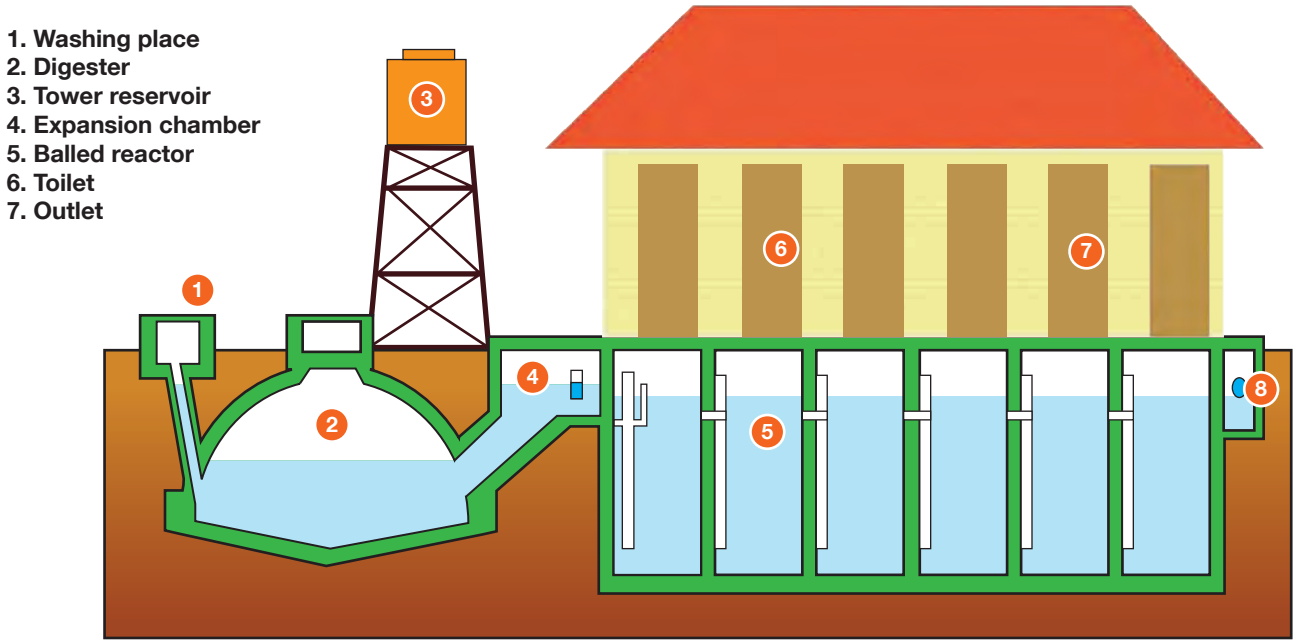
These sanitation facilities have many advantages for the community. For a small fee (IDR1000), users can avoid long queues, have a safe and comfortable place to defecate, and continuous access to clean water for washing and bathing.

7.1.3 BANJARMASIN SEWERAGE SYSTEM

Banjarmasin is one of the few cities in Indonesia to have a sewerage network and wastewater treatment plant. The first sewerage system was built between 1998 and 2000 under the Integrated City Infrastructure Development Program (*Program Pembangunan Prasarana Kota Terpadu*/P3KT)

[28] Directorate of Diseases Control and Enviromental Health, Department of Public Works, WSES Workshop, November 2009
[29] BEST (the facilitator NGO) Tangerang, 2008
[30] MCK++ is a SANIMAS term used to describe a shared toilet facility, plus decentralized wastewater treatment system, plus biodigester.

FIGURE 57: TYPICAL DESIGN OF MCK++ IN TANGERANG DISTRICT[1]



[1] Source: Kreatif Energi Indonesia

of the Kalimantan Urban Development Project (KUDP). Around 77% of the funds came from an IBRD loan, with national government contributing 17% and local government 6% of the total. In 2006, Banjarmasin became a Indonesia Sanitation Development Program (ISSDP) Phase I target location. Set up under this program, the cross-sectoral Banjarmasin City Sanitation Working Group (*Kelompok Kerja/Pokja Sanitasi Kota*) planned a systematic integration of sanitation development. The working group carefully mapped the existing sanitation situation in a City Sanitation White Book, and building on this baseline developed a city sanitation strategy (CSS) that detailed a five-year strategic approach to develop the city's sanitation system, including domestic wastewater, solid waste and drainage. Banjarmasin entered the monitoring and evaluation phase of ISSDP Phase I in 2009. Some sanitation projects in the CSS – notably those aimed at expanding coverage of the sewerage system – received funding commitment from the central government and donors.

Up until 2007, the sewerage system served only population of Lambung Mangkurat, or about 1% of the city's population. In 2010, the sewerage system was extended to Kayu Tangi and Pekapuran Raya. A second extension phase, scheduled to be fully operational by 2015, will bring coverage of the sewerage system up to 75% of the city's population. Non-domestic subscribers, including commerce, industry and government, make up a large proportion (41.5%) of the total (see Table 40).

TABLE 40: COMPOSITION OF PD PAL SUBSCRIBERS

HH Group	% of subscribers	Average monthly payment (US$)
A1	12 %	1
A2	43%	1
A3	3 %	3
A4	0.5 %	17
Commercial, Industry, Government/Institution, etc.	41.5 %	17

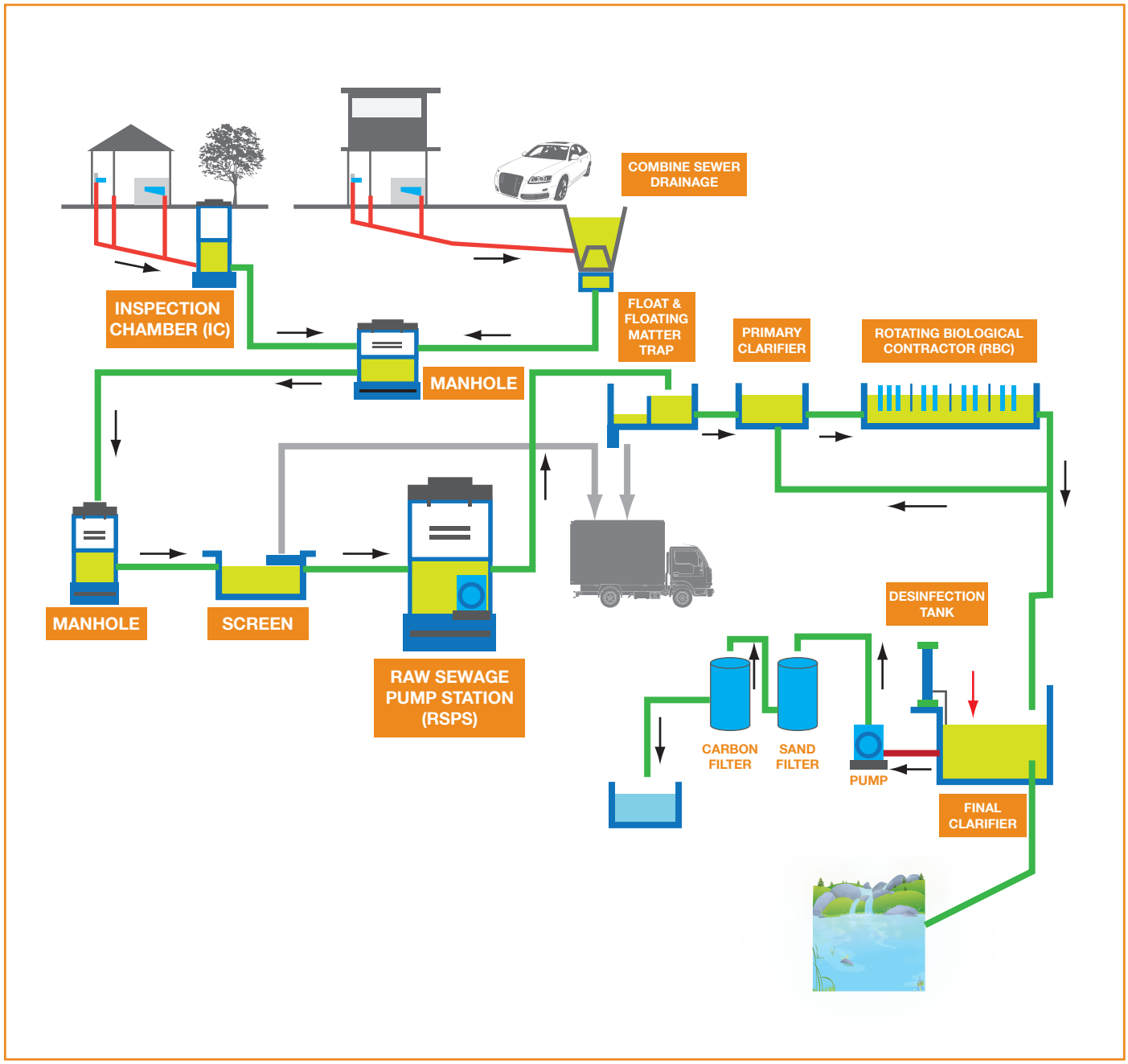
Initially managed by a technical implementation unit of the Banjarmasin city government water utility, the sewerage system is now managed by PD PAL, a new local government wastewater management enterprise. Wastewater entering the sewerage system undergoes primary treatment, and passes through a rotating biological contactor (RBC), settling tank, and sand filter before being discharged into water bodies (Figure 58). Study findings indicate that reduction of COD, BOD, suspended solids, and ammonia is more than 90% efficient (see Table 41).

TABLE 41: REDUCTION OF WASTEWATER PARAMETERS, AND EFFICIENCY OF THE BANJARMASIN WASTEWATER TREATMENT PLANT[1]

No	Parameter	Reduction figures		Treatment efficiency (%)
		Influent	Effluent	
1	COD (Chemical Oxygen Demand	(500 – 700) mg/l	(50 – 70) mg/l	> 90
2	BOD (Biochemical Oxygen Demand)	(250 – 300) mg/l	(20 – 25) mg/l	> 90
3	SS (Suspended Solid)	(250 – 300) mg/l	< 25 mg/l	> 90
4	N¬3 – N (Ammonia)	(15 – 20) mg/l	< 1	> 90

[1] Source : City Sanitation Strategy - Banjarmasin , Pokja Sanitasi Kota Banjarmasin, March 2008

FIGURE 58: SCHEMATIC DIAGRAM OF BANJARMASIN SEWERAGE SYSTEM[1]



[1] Source : City Sanitation Strategy - Banjarmasin, *Pokja Sanitasi Kota Banjarmasin*, March 2008

However, as of December 2010, only 4,277 households were connected to the system, or about 18% of its potential of 24,000 households. PD PAL cites at least three reasons for this low coverage. First, people's lack of awareness of the need for a wastewater treatment system in the city. Second, the limited coverage of the main pipelines due to budget constraints, which means that coverage expansion prioritizes locations that are easiest to reach. Third, difficulties obtaining permission from communities to install underground in their areas.

In fact, PD PAL has been allocating less than 1% of the total sewerage system development budget to sanitation awareness campaigns, hence the reluctance of many households to connect to the sewage system. The focus group discussions conducted in Banjarmasin as part of the ESI study corroborated this: respondents said they had received very little information about the health benefits of good sanitation and how these are linked to the sewerage system. Furthermore, respondents already connected to the sewage system had a number of complaints, including having to deal with backwash of wastewater from the system during floods.

7.1.4 COMMUNITY-BASED SEWER SYSTEM (CBSS) – MALANG CITY

The Community-Based Sewer System (CBSS) in Malang City was pioneered by local volunteer Agus Gunarto in 1985.

This initiative was triggered by a diarrhea outbreak in Malang that resulted in many fatalities among children from poor families. Open defecation was the main cause of this epidemic, as many households used rivers as their toilet as well as for washing, bathing and cooking.

The main sanitation intervention is a communal sewerage system connected to private toilets. The first facility was constructed in Tlogomas, on the outskirts of Malang city. The system was then replicated in five nearby areas with majority poor populations (Watugong, Mergosono, Bareng, Samaan, and Gadang), with support from NGOs, multilateral donors and the city government. Most of the communities in these areas are poor.

Financing for the initial program in Tlogomas was raised in full by the community, without additional support from government or donors. For over a year, funds were collected from the community to pay for the initial construction work, which took about two years to complete. Although the first six households were connected to the CBSS in 1987, it took about ten years for all members of the community to get connected to the system.

The CBSS consists of a network of collecting pipes, laid beneath footpaths or below existing drains, which connect the sewage system to a network of houses. The treatment plant is located at the lowest point in the system, so the flow depends entirely on gravity. Wastewater is filtered through an anaerobic suspended biomass tank, before being released into the local watercourse.

The initial CBSS development raised community awareness and encouraged the villagers not to defecate in the open. After collecting funds and planning technical aspects of the system, the community set about constructing the system using local laborers and masons. The work began with the construction of the treatment plant and progressively worked up the main collection network and connecting to households. Some houses did not have enough spaces for private toilets, thus communal or shared toilet facilities were the logical solution in such densely populated area.

The proportion of funds raised by the community ranged from 10% in Samaan to 100% in Tlogomas. The funds were managed by a special committee set up by the community. Users pay a monthly service charge for the operation and maintenance of the facility. One or two people, usually locals, are hired to maintain the treatment plant. Funding of major repairs and long term maintenance is handled on an ad-hoc basis and requires special collection of funds.

There are approximately 1,105 households in the five villages covered by the CBSS. A study conducted by WSP in 2000 found that 404 households were connected to the CBSS in Malang. Malang municipality was included in ISSDP Phase 2 in 2009 and is a target location for the Urban Sanitation Development Program (USDP) 2010-2014.

7.1.5 COMMUNITY-LED TOTAL SANITATION (CLTS) IN PAYAKUMBUH

In Payakumbuh City, sanitation is a mainstream development priority. In less than three years, sanitation programs such as ISSDP, P2KP and Pamsimas have taken off and had a positive impact on people's health. These include three programs – Clean and Healthy Lifestyle Campaign, Sanitation for Schools, and Community-Led Total Sanitation – that aim to improve people's sanitation awareness.[31]

Launched in 2007, the CLTS program in Payakumbuh aims to trigger the community to build household latrines. Sanitation options range from simple pit latrine to septic tank, but toilet construction is not subsidized. The program covers 16 villages in West Payakumbuh, North Payakumbuh, East Payakumbuh and Latina subdistricts.

Led by the city health office, all local stakeholders are engaged in all aspects of the program, from planning through maintenance of the facilities. The triggering process begins with briefing the community about the program. This is followed by a series of sanitation awareness raising activities, which include participatory mapping of the location, calculation of the volume of feces produced by the community in a year and awareness of the consequences of not disposing of this properly, transect walks to open defecation areas to interview villagers defecate in the open, and explanation of food and drink become contaminated with fecal matter. At focus group discussions, the villagers discuss why they defecate in the open, and are encouraged to feel ashamed of their behavior. They also discuss construction of affordable sanitary toilets and the importance of having a commitment to building them. In the final stage of the triggering process, the community makes a written statement on a large sheet of paper of its collective commitment to stop open defecation and build sanitary toilets, which is displayed in a prominent position as a reminder to everyone. Arrangements are then made for the CLTS team to come back to the village at a later date to check on its progress.[32]

As Table 42 below shows, ownership of private toilets has increased in all CLTS target locations since the inception of the program.

Local government has reported a decrease in the prevalence of diseases, including diarrhea, skin infections, intestinal infection, and pneumonia, since inception of the CLTS program in Payakumbuh, as indicated by the reduced cost of the municipal health insurance scheme over a two-year period.

7.2 COMPARISON OF PROGRAM APPROACHES AND PERFORMANCE

The ESI household survey revealed that, in general, households have the freedom to choose whether to participate in the sanitation initiatives. Figure 59 shows the extent of household choice and participation in decision making. The sanitation programs encourage communities to voluntarily own better sanitation facilities. However, in Lamongan the survey returned a different result: only one respondent received a latrine from a sanitation program, while the rest of the surveyed households said they had paid for construction of the toilet themselves.

TABLE 42: OWNERSHIP OF PRIVATE TOILETS BEFORE AND AFTER INCEPTION OF THE CLTS PROGRAM IN PAYAKUMBUH[1]

No	Subdistrict	No. of Households with Private Toilets (pit latrine or septic tank)		
		Before Triggering (2006)	After Triggering	
			December 2009	December 2010
1	East Payakumbuh	1,187	3,738	4,349
2	South Payakumbuh	814	1,150	1,513
3	Latina	373	703	870
4	West Payakumbuh	454	5,297	6,045
5	North Payakumbuh	1,577	3,909	4,556
	Total	**4,405**	**14,797**	**17,378**

[1] Source : Payakumbuh Municipal Health Office, 2011

[31] www.sanitasi.or.id
[32] Source: Payakumbuh CLTS Implementation Report, 2008

FIGURE 59: PROPORTION OF HOUSEHOLDS WHO SAID THEIR PARTICIPATION IN THE PROGRAM WAS VOLUNTARY

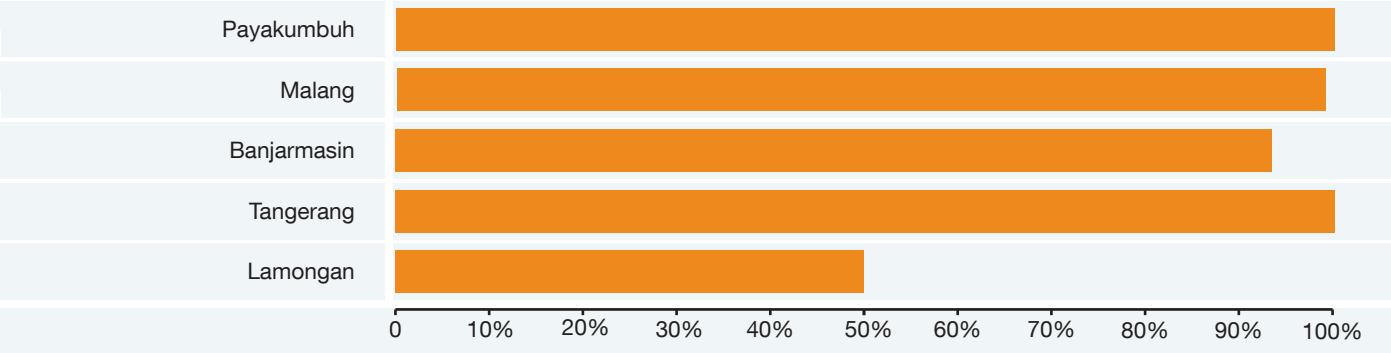
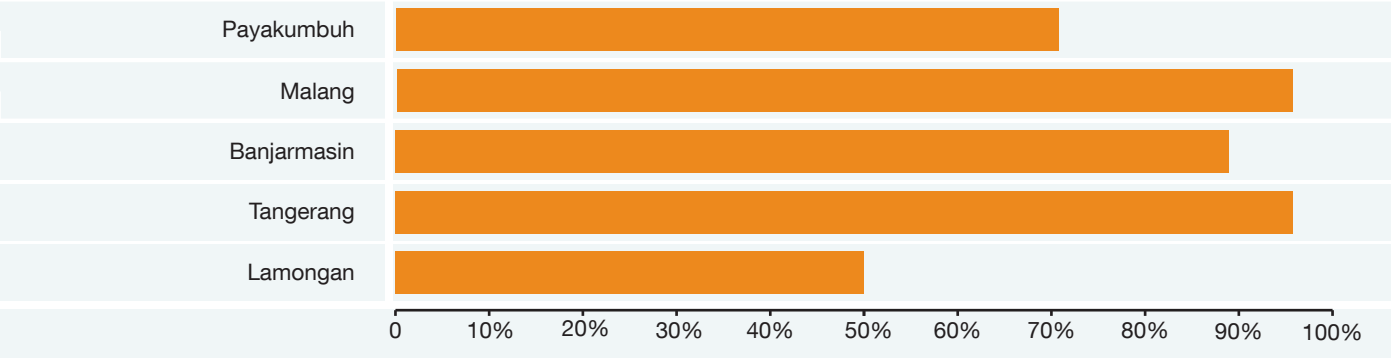


FIGURE 60: PROPORTION OF HOUSEHOLDS OFFERED MORE THAN ONE SANITATION OPTION



More than 70% of the respondents said that they were given more than one sanitation option, allowing them to choose an option that was affordable to them and met their preferences (Figure 60). Offering options is important because it shows to the community that proper sanitation need not be expensive. While communities in Tangerang and Malang were given a full range of options, in Payakumbuh, the options were fewer. The most likely reason for this is that the CLTS program focuses not on subsidizing latrine construction, but on triggering a change in behavior away from open defecation. The CLTS facilitators do not lecture or advise on sanitation habits, and do not provide external solutions, such as toilet designs. Rather, the aim is to trigger the community to make the decision to build their own toilets using simple technology, such as pit latrines.

The average financial contribution of households varied by site and sanitation option selected. On-site systems such as shared toilets, wet pit toilets, and septic tank toilets tend to be funded by households (Figure 61 and Figure 62). The septic tank option is considerably more expensive than the shared option or private pit latrines.

Respondents in Tangerang, Malang and Payakumbuh reported having sufficient water for flushing, no pit flooding and no pit overflow. In Lamongan, about 10% of respondents said that they often or sometimes had pit flooding, and 5% had experienced pit overflow. In Banjarmasin, 1.3% of respondent often had pit flooding and pit overflow (Figure 63).

Table 43 presents selected indicators of the overall effectiveness of the five sanitation interventions, that serve as inputs to the cost-benefit analysis (see Chapter 8).

Key conclusions from these indicators of program effectiveness are:

- The proportion of children using toilets is generally still low.
- Handwashing with soap is not regularly practiced by respondents in Banjarmasin and Tangerang.
- Although Banjarmasin has the lowest figure for open defecation, this is because use of hanging latrines was not categorized as open defecation.

Figure 64 compares selected key indicators of program effectiveness across the study locations.

FIGURE 61: HOUSEHOLD CONTRIBUTION TO TOTAL COST OF TOILET CONSTRUCTION IN RURAL SITES

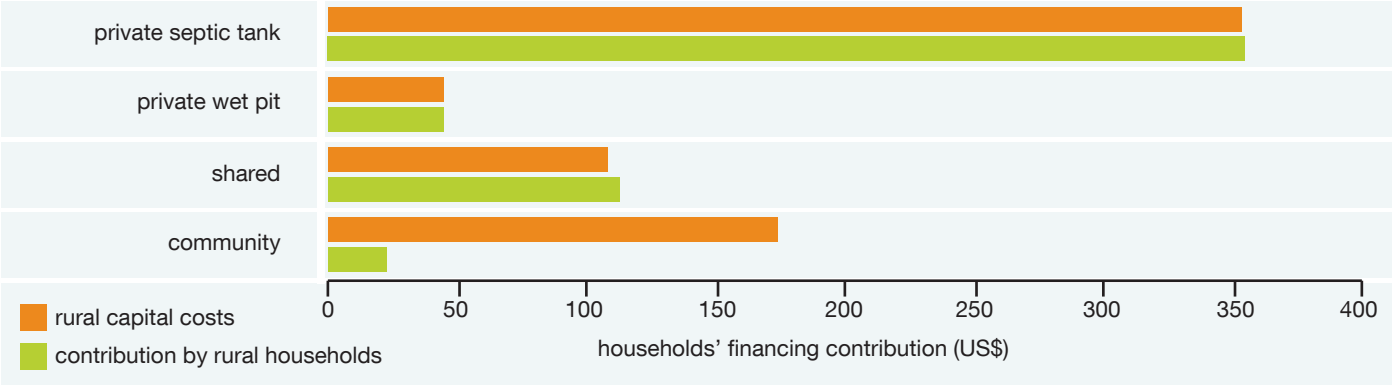


FIGURE 62: HOUSEHOLD CONTRIBUTION TO TOTAL COST OF TOILET CONSTRUCTION IN URBAN SITES

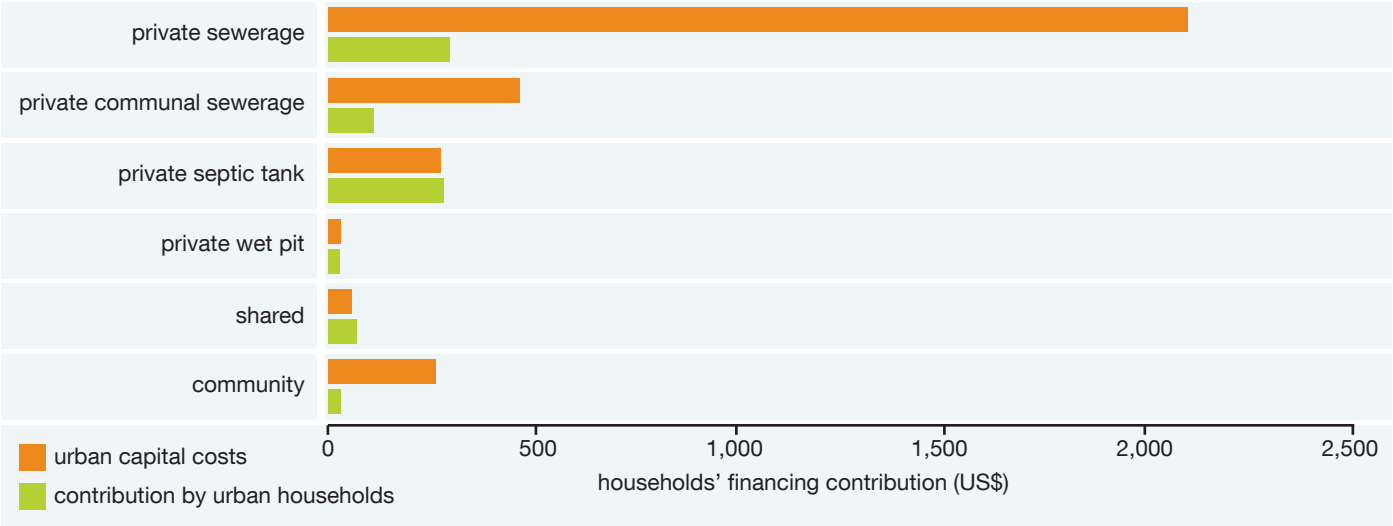


FIGURE 63: FREQUENCY OF SUPPLY OF WATER FOR FLUSHING, AND OF PIT FLOODING AND PIT OVERFLOW

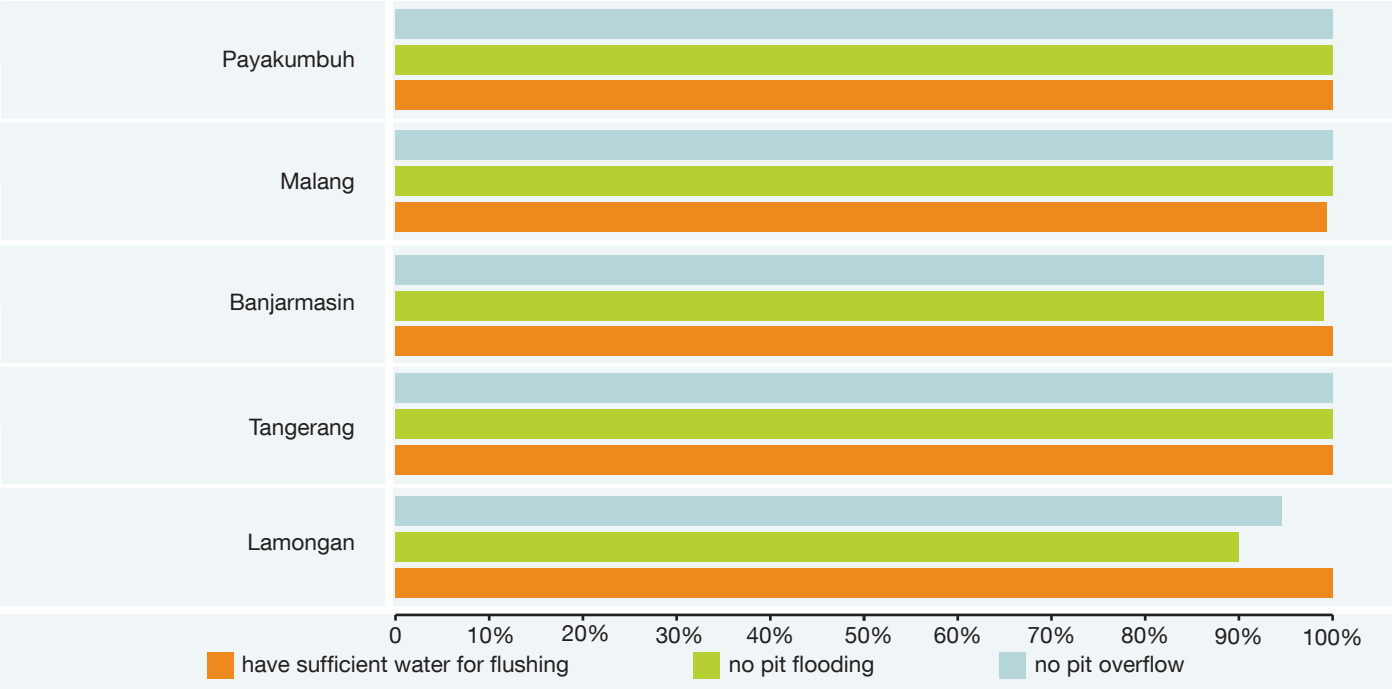
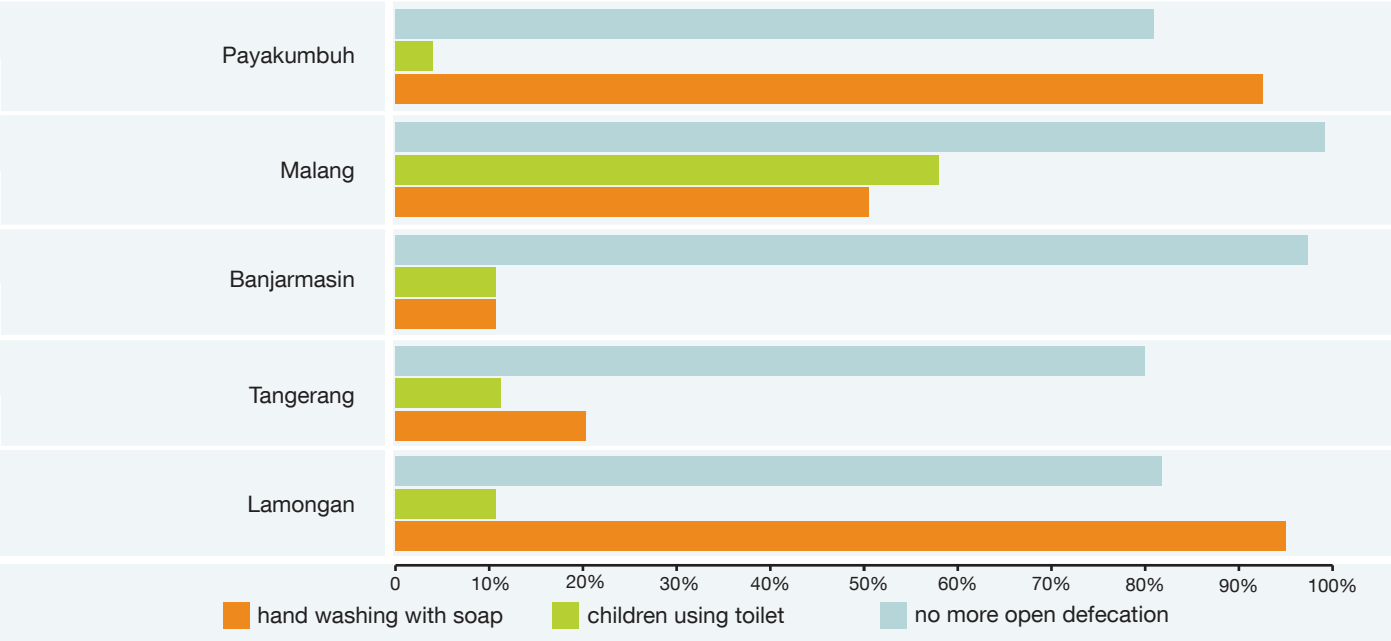


TABLE 43: SELECTED INDICATORS OF OVERALL PROGRAM EFFECTIVENESS

Variable	Rural sites		Urban sites		
	Lamongan	Tangerang	Banjarmasin	Malang	Payakumbuh
Years of program	7	1	Still ongoing	13	Still ongoing
% household members using their improved toilet regularly	81%	82%	70%	84%	84%
HOUSEHOLD CONTRIBUTION TO COST (FINANCIAL & NON-FINANCIAL)					
Community	100%	30%	11%	na	na
Shared	100%	100%	100%	100%	82%
Private dry pit	100%	100%	100%	100%	0%
Private wet pit	100%	100%	100%	100%	71%
Private septic tank	100%	100%	100%	100%	100%
Private sewerage	na	na	9%	na	na
Community sewerage	na	na	na	37%	na
SANITATION PRACTICES AMONG HOUSEHOLDS:					
Using bush or outdoor sites for defecation (sometimes or often)	16%	20%	2%	1%	17%
Using bush or outdoor sites for urination (sometimes or often)	23%	29%	2%	4%	26%
Children using latrine	12%	13%	12%	57%	5%
Children defecating in yard	39%	55%	29%	31%	36%
Washed hands with soap yesterday	96%	21%	12%	50%	94%
Washing hands after defecation (sometimes or often)	87%	4%	7%	32%	84%
WATER SOURCES AND SOAP FOR WASHING HANDS					
Using unprotected wells	21%	4%	31%	20%	16%
Pit latrine/septic tank within 10m of wells	63%	71%	52%	67%	81%
Signs of feces or waste around toilets	8%	9%	19%	5%	9%
Signs of insects in toilets	6%	7%	27%	4%	15%
Running water in or near toilets	68%	74%	38%	36%	37%
Soap available for washing hands	25%	35%	14%	19%	25%

FIGURE 64: COMPARISON OF SELECTED KEY INDICATORS OF PROGRAM EFFECTIVENESS



7.3 BROADER ANALYSIS OF THE PROGRAM APPROACHES

7.3.1 WSLIC 2 (WATER AND SANITATION FOR LOW INCOME COMMUNITIES 2)

Program Information. WSLIC 2 is a community-driven development project in Indonesia under the Ministry of Health, and implemented by Ministry of Health, Ministry of Home Affairs, Ministry of Public Works, and Ministry of National Education. The project objective is to improve the level of health, productivity, and quality of life of low-income communities through behavior change, environment-based health services, clean water supply and safe sanitation. Regarded as an appropriate, accessible, sustainable, and effective participatory program, WSLIC 2 attempted to develop an integrated water supply, sanitation and hygiene improvement action plan in each sub-project community. The initial revolving fund system was later superseded by the CLTS approach.

Program Location. The program ran from 2000 to 2009, and covered 2,461 villages in 36 districts of eight provinces, across Indonesia (South Sumatra, West Sumatra, West Nusa Tenggara, East Java, West Java, Bangka Belitung, South Sulawesi, and West Sulawesi).

Program Intervention. The sanitation component of WSLIC 2 program was SANIMAS. Although the initial revolving fund scheme for construction of household toilets worked well in some areas and communities, their overall impact on low-income beneficiaries and sanitation coverage was limited. People's willingness to repay the loan was very low and led to discontinuity of the sanitation loans. In practice, the loans were often treated as large hardware subsidies, with little effort from the beneficiaries to pay them back.[33]

According to the latest WSLIC 2 progress report, the revolving fund scheme provided 23,560 household loans in 860 communities. This represented 27 loans for household toilets in each community, which is equivalent to an 11% increase in sanitation coverage within the project communities covered to date.[34]

Funding. According to a LP3ES report[35], the sources of fund for WSLIC 2 were: IDA loan (72.5%), AusAID

[33] Robinson, Andy, "Indonesia National Program for Community Water Supply and Sanitation Services, Improving Hygiene & Sanitation Behavior and Services", World Bank, December 2005)
[34] *Kajian Cepat terhadap Program Pengentasan Kemiskinan Pemerintah RI*, LP3ES, Oct 2007
[35] *Kajian Cepat terhadap Program Pengentasan Kemiskinan Pemerintah RI* (Rapid Assessments of the GoI Poverty Alleviation Program), LP3ES, Oct 2007

grant (6.1%), national and regional budgets (11.4%), and community contribution (9.9%). Each program location received a budget allocation of between IDR195 million (US$18,773) and IDR280 million (US$26,957). The community is responsible for operation and maintenance of the facilities, for which users pay a monthly fee.

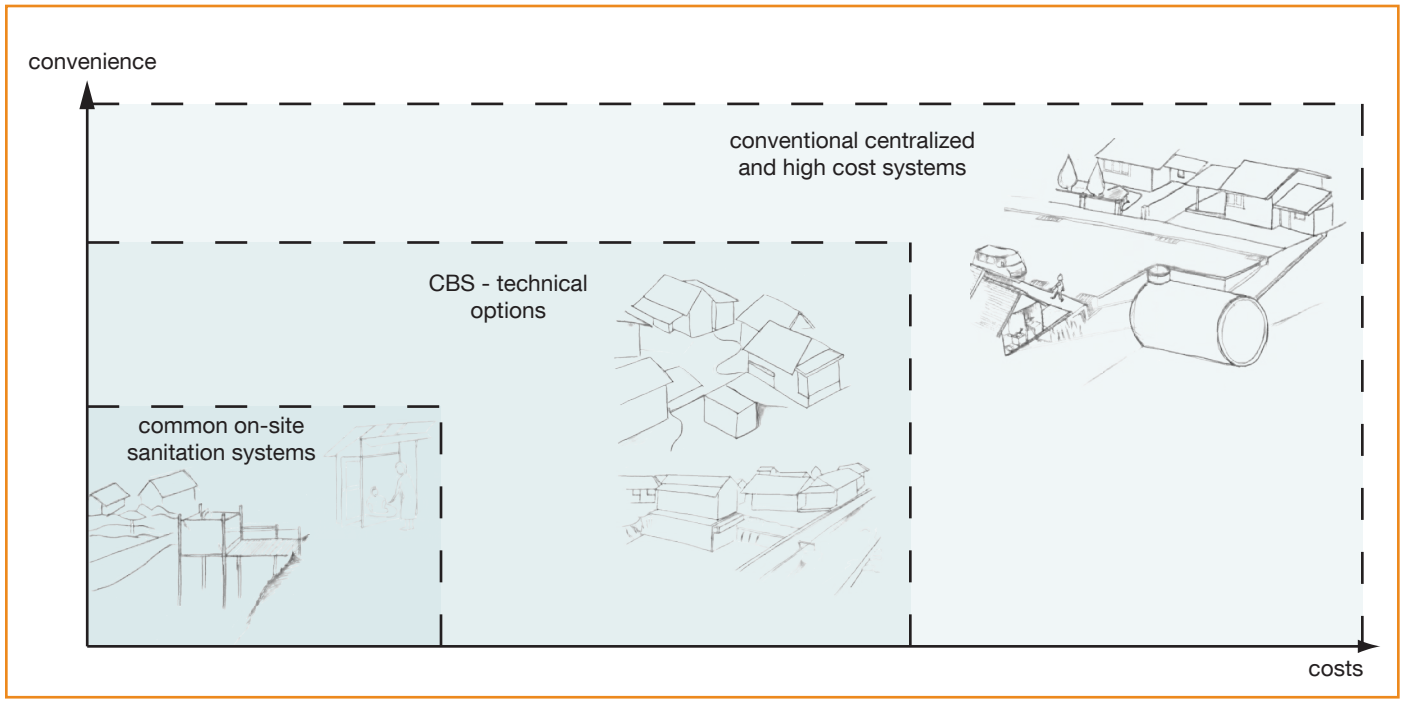
Monitoring and evaluation. A rapid evaluation by LP3ES (Institute for Social and Economic Research, Education, and Information) in October 2007 in six villages found that more than five years since the inception of WSLIC 2, the water supply and sanitation facilities constructed were working properly and still being used by the community. The introduction of the CLTS approach in 2004-2005 had raised people's awareness of health and hygiene behavior, and some had built their own private toilets now that a reliable water supply was available. Diarrhea incidence in project locations had also decreased as people stopped defecating in the open and started handwashing with soap regularly before eating and after defecating.

7.3.2 SANIMAS

Program Information. SANIMAS is a community-based sanitation (CBS) option designed for poor urban communities. It was implemented with the involvement of community and other stakeholders such as local NGOs and government through a process of empowerment. The approach was an alternative option to fill the significant 'gap' between inappropriate sanitation such as open defecation and absorption pit, and the expensive conventional centralized sewerage collection and treatment system. Besides providing facilities and infrastructure, the program also promoted health and hygiene behavior. In SANIMAS, communities found their own informed demand and were given education about sanitation, hygiene, and diseases. The communities were encouraged to organize the operation and maintenance of sanitation infrastructure, and sometimes according to requirements and abilities, sanitation infrastructures were planned, designed and constructed for and together with the community. The approaches were highly demand responsive and relied on active participation as well as contributions from target communities and municipalities.[36] Figure 65 shows how SANIMAS fills the gap in sanitation options.

Local governments act as facilitators, allocate local budget, and carry out monitoring and evaluation. The five principles of SANIMAS are: demand-responsive approach/DRA,

FIGURE 65: SANIMAS FILLS THE GAP[1]



[1] Source: BORDA

[36] Directorate of Diseases Control and Enviromental Health, Department of Public Works, WSES Workshop, November 2009

participation (community involvement), technical options (of facility/infrastructure), self-selection process, and capacity-building.

SANIMAS was a component of the WASPOLA project, a development cooperation between the Indonesian Government and the Australian Government coordinated by WSP. BORDA, a German NGO, working together with Indonesian NGOs, was appointed to implement the SANIMAS project to assist the communities, local governments, and local facilitators in designing, planning, and implementing community-based sanitation (CBS) activities. To ensure the quality of project implementation, BORDA had assistance from several national NGOs.

Program Location. In 2003, SANIMAS was piloted in seven districts/municipalities (Blitar, Pasuruan, Kediri, Mojokerto, Sidoarjo, Pamekasan, and Denpasar). In 2006, SANIMAS was replicated in 345 locations in 157 municipalities in 27 provinces across Indonesia. As of 2010, SANIMAS 1, SANIMAS 2, and SANIMAS 3 had been implemented.

Program Intervention. A range of technology options is available under SANIMAS. MCK Plus is a public toilet block, connected to a decentralized wastewater treatment system, plus a biodigester (see chapter 7.1.2) This sanitation option is suitable for densely populated areas with a high proportion of rented accommodation and a shortage of land on which to build private toilets. The second and third options are shared septic tank connected to up to 20 households and shallow sewer connected to between 50 and 100 households. Both these options are suited to densely populated areas where the beneficiaries have to have enough land to build a private toilet on their own plot.

Monitoring and evaluation. In 2006, WASPOLA conducted outcome monitoring in seven SANIMAS pilot project locations and two control locations in Bali and East Java. The study revealed that in general the facilities were functioning well, that users were satisfied, and that proper and detailed financial records were being kept. The study also showed that more than 75% of people living near SANIMAS facilities had used these toilets for defecating. However, there were some reports of facilities no longer being used after falling into disrepair because user fees had not been collected regularly to pay for their maintenance. Community participation and women's participation in particular were found to be lacking, despite the aim of the program to give users a full voice in decision making.

A WSP study of Community-Based Sewer System (CBBS), the SANIMAS program pioneered in Tlogomas, Malang, found that the most sustainable operating and maintenance systems were in locations, such as Tlogomas and Mergosono, where external contribution was minimal. Despite more than half the population living below the poverty line, people in Mergosono were willing to pay a significant part of the investment cost of the CBSS. Whether the system is totally or partially financed by the community, lower income families contribute a higher percentage of their monthly income than higher income groups. This is particularly a clear example of how low-income households are willing to pay for something they consider to be necessary and appropriate (see Table 44 and Table 45).

Although all five systems have yet to meet effluent standards, individually each has achieved a significant reduction in environmental pollution. The pollution load originating from the community had been halved, although the systems do not meet national technical standards.

TABLE 44: COMMUNITY CONTRIBUTION TO THE COST OF CBSS DEVELOPMENT

Location	Community contribution	Government subsidy	Other source (NGO, private sector)
Tlogomas	100%	-	-
Watugong	51.7%	5.8%	42.3%
Mergosono	86.5%	13.5%	-
Bareng	47.6%	52.4%	-
Samaan	9.8%	90.2%	-

TABLE 45: COMPOSITION OF THE CBSS SUBSCRIBERS BY MONTHLY HOUSEHOLD DISPOSABLE INCOME[1]

Location	Household disposable income (US$)				
	< 30	30 - 45	45 - 60	60 - 70	> 70
Tlogomas	0%	10%	20%	20%	50%
Watugong	0%	36%	27%	18%	18%
Mergosono	29%	29%	15%	21%	7%
Bareng	25%	25%	0%	0%	50%
Samaan	13%	0%	50%	38%	0%
Average	13%	21%	23%	21%	21%

[1] Source: Community-Based Sewer Systems in Malang, Indonesia, Sean Foley, Anton Soedjarwo, Richard Pollard, WSP, 2000.

Building sustainable CBSS will require continuous financial, technical and management support from the government and donors, as well as increased community participation and awareness of hygiene behavior.

7.3.3 SEWERAGE OR CENTRALIZED SYSTEM

Program Information. Regarded as a high cost technology option compared with on-site sanitation systems, only a few cities in Indonesia (Bandung, Banjarmasin, Balikpapan, Cirebon, Jakarta, Medan, Solo, Tangerang, and Yogyakarta) have centralized sewage systems. In recent years, however the government has revised its policy framework for sustainable urban sanitation, in response to growing urbanization and increased pollution of water sources and wastewater in larger cities. The new target is that by 2014, 5% of people living in 16 districts or cities will be served by city-scale sewerage systems.[37]

Funding. Initial construction was funded by grants or loans to local governments from donors such as the World Bank and ADB. Operators have made additional investment in the systems, for installation of new connections, purchase of equipment and other capital outlays. However, financing the cost of expanding the systems falls to local and national governments as borrowing from financial institutions is almost impossible since most of the wastewater management systems (except those in Bandung and Jakarta) are still far from full cost recovery.

Monitoring and evaluation. A 2006 study by the Environmental Services Program (ESP)[38] assessed four main aspects (institutional, management, financial and technical) of nine centralized wastewater systems. Of the nine, five (in Solo, Medan, Balikpapan, Bandung, and Cirebon) are managed by the local government water supply utility, and two (in Jakarta, and recently in Banjarmasin) by a special local government-owned enterprise. The remaining two (in Tangerang and Yogyakarta) are under direct local government management.

The study found that only two of the nine wastewater management systems – in Bandung and Jakarta – have managed to achieve full cost recovery, but even they could improve their financial performance.

Wastewater in eight of the nine sewage systems is treated by aeration pond, aerated lagoon and activated sludge process, or a combination of these. The exception is the wastewater treatment plant in Balikpapan, which uses a rotating biological contactor. Evaluation of system performance found that the average COD and BOD reduction is approximately 50%. The highest COD reductions were recorded in Yogyakarta (89%) and Prapat (85%), and the highest BOD reductions in Banjarmasin (89%), Prapat (85%) and Yogyakarta (88%). The lowest COD and BOD reductions were found in two wastewater treatment plants in Cirebon.

[37] Directorate of Program Development presentation on Ministry of Public Works WSES policy, strategy, and programs, National conference on community based WSES , November 2009

[38] The ESP is a five-year program which was developed by USAID/Indonesia in response to the Presidential Initiative of 2002 to improve sustainable management of water resources. This initiative supports activities in the following three key areas: (i) Access to clean water and sanitation services (ii) Improved watershed management (iii) Increasing the productivity of water

7.3.4 COMMUNITY-LED TOTAL SANITATION (CLTS)

Program Description. Community-Led Total Sanitation (CLTS) was launched in Indonesia in May 2005 through a series of pilot projects funded by the Water and Sanitation Policy Formulation and Action Planning (WASPOLA) project implemented by the Ministry of Health.

Recognizing that merely providing toilets does not guarantee their use, nor result in improved sanitation and hygiene, CLTS focuses on the behavioral change needed to ensure real and sustainable improvements – investing in community mobilization instead of hardware, and shifting the focus from toilet construction for individual household to the development of open defecation free villages. By raising awareness that as long as people continue to defecate in open area (even a minority) everyone is at risk of disease, CLTS triggers the community's desire for change, propels them into action and encourages innovation, mutual support, and appropriate local solutions, thus leading to greater ownership and sustainability.

Following the success of the pilot, CLTS replaced WSLIC 2 (revolving fund scheme) in 2005. The approach subsequently proved successful in locations across Indonesia, and in 2007, the Government of Indonesia in cooperation with the World Bank adopted the CLTS approach for the PAMSIMAS project, implemented in 115 districts across Indonesia. The Asian Development Bank (ADB) has also adopted CLTS in the sanitation program Clean Water Sanitation and Health (CWSH) in 20 districts in Indonesia.[39]

Implementation and scaling up of CLTS in Indonesia has involved governmental and non-governmental institutions at various levels. The Ministry of Health, especially the Directorate General of Disease Control and Environmental Health, is a key institution in CLTS implementation. Other central government bodies and ministries involved in CLTS include the National Development Planning Agency, Ministry of Home Affairs, and Ministry of General Affairs. Ad-hoc institutions at national and local level, and the national WSES working group are also involved.

Location. The CLTS pilot project ran in six districts across Indonesia: Sumbawa (West Nusa Tenggara), Lumajang (East Java), Muara Enim (South Sumatera), Bogor (West Java), Sambas (West Kalimantan), and Muaro Jambi (Jambi). The approach has since been replicated in various locations by both government and non-government agencies.

Between 2008 and 2012, the government plans to trigger 10,000 villages using this approach. As of April 2009, 923 villages had received CLTS triggering and 715 villages had been declared open defecation free. About 325,600 people have gain access to improved sanitation facilities in 21 districts.[40]

Monitoring and evaluation. As part of the IDS research project, 'Going to Scale? The Potential of Community-Led Total Sanitation, between 2006 and 2008, a study was made of nine villages in three districts that applied the CLTS approach. The study found that the success of the CLTS approach was influenced by both internal and external factors. Key internal factors were: sanitation being seen as a village priority, a sense of individual responsibility to contribute to public good, basic awareness of the benefits of using latrines and handwashing with soap, being ashamed about defecating in the open, and women being able to influence their spouses to build a latrine. External factors included strong support from and continuous triggering by community leaders, ongoing external support, availability of water supply and resources for building latrines, including land, cash or in-kind materials, collective community commitment to becoming open defecation free, and government involvement.

Table 45 summarizes the four basic sanitation interventions and approaches discussed in this section.

[39] Entry of the CLTS Approach in Indonesia, Edy/Udin, Percik Magazine Dec. 2008
[40] Learning At Scale TSSM Project, Indonesia Country Update June 2009, Field Note, WSP

TABLE 46: COMMUNITY CONTRIBUTION TO THE COST OF CBSS DEVELOPMENT

No	Project/ intervention	Site Location, urban/ rural	Provinces covered/ population	HH receiving intervention	Implementer	Funder	Funding Mechanism	Annual Value	Period of Project (year to year)	Change in coverage over project period	Data sources, reports used
1	WSLIC 2: 1. SANIMAS - Private toilets - Public toilet 2. Institutional Sanitation (school toilets, village office toilets, community health center toilets, etc.) 3. Simplified sewerage (SPAL)	Rural	South Sumatera, West Sumatera, West Nusa Tenggara, East Java, West Java, Bangka Belitung, South Sulawesi, West Sulawesi	2,409 villages (2009) Target : 2000 villages / 37 districts Achievement : 2,298 villages / 37 districts	– Ministry of Health – Ministry of Home Affairs – Ministry of Public Works – Ministry of National Education	– WB (loan) – AusAID (grant) – National and local government – community contribution	– IDA credit : 72.5% – Grant (AusAID) 6.1% – National and local government 11.4% – community 9.9%	US$ 106,700,000.- (total budget)	2000 - 2009		– Rapid Evaluation Study of poverty alleviation program WSLIC 2 and PAMSIMAS, LP3ES, October 2007 – Study of WSLIC 2 by Indonesia University 2001 – 2006 – Indonesia National Program for Community Water Supply and Sanitation Services, Improving Hygiene and Sanitation Behavior Services, Andy Robinson, Dec 2005 – www.wslic2.go.id – MoH presentation at WSES national workshop, Nov 2009
2	SANIMAS: – MCK plus latrines – Shared septic tank – Simplified sewerage / shallow sewer	Urban/ Rural	South Sumatera, West Sumatera, West Nusa Tenggara East Java, West Java, Bangka Belitung, South Sulawesi, West Sulawesi	345 locations (2008) 21,000 low income rural communities	Ministry of Public Works, local government	National government, local government APBD, BORDA, community contribution	– National government : material IDR 100 million – Local government : construction IDR 200 million, community empowerment IDR 50 million – BORDA : community empowerment IDR 50 million – Community (in-kind & in-cash) : 2-4%		2001 - 2004 (pilot project - WB and BORDA Indonesia) 2005 to date (Replication of program on national scale with different funding schemes)		– Sanimas Outcome Monitoring Study Final Report, Waspola, April 2006 – SANIMAS presentation at the 2nd Philippine National Summit, July 2009 – Pro-poor Water and Wastewater Management in Small Towns – Case Study, UN Economic and Social Commission for Asia and the Pacific, year ….. – www.pu.go.id – www.indonesia.go.id – www.kimpraswil.go.id
	– CBSS (Community Based Sewer System) / SANIMAS Malang Construction of communal septic tank	Malang City, subdistrict Tlogomas, Watugong, Mergosono, Bareng, Samaan					Community contribution ranged from 100% in Tlogomas to 10% in Samaan	IDR 1,991,506,462 (budget year 1999)			Community-Based Sewer Systems in Malang, Indonesia, Sean Foley, Anton Soedjarwo, Richard Pollard, WSP (2000)
3	Sewerage system: – construction of sewerage system and WWTP	Urban	West Java, South Kalimantan, East Kalimantan, Jakarta, North Sumatera, Central Java, Banten, Yogyakarta	- 2.33% - 1.65% - coverage of city scale centralized system	PD PAL, local water supply utilities, local health offices	WB (IBRD loan), national government and local government		Start of program (construction) in the first half of the twentieth century (built by the Dutch). End of program is incalculable since program coverage is still way below the expected level			– Comparative Study of Centralized Wastewater Treatment Plants in Indonesia, ESP USAID, September 2006 – Banjarmasin Sanitation Whitebook, Program Development Technical Team, August 2007
4	CLTS: Triggering to stop open defecation	Urban/ rural	West Sumatera, South Sumatera, Jambi, West Java, Banten, East Java, West Kalimantan, West Nusa Tenggara,	138,733 households (under WSLIC 2) 10,000 villages (2008 – 2012) - Per April 2009: 932 villages have received CLTS triggering and 715 villages declared ODF	– Ministry of Health (Directorate General of Disease Control and Environmental Health) – National Planning Agency – Ministry of Home Affairs – Ministry of General Affairs – National WSES Working Group	World Bank Government	No subsidy for the basic sanitation infrastructure. Funding is needed for training and visits (for triggering, mentoring, monitoring, etc.)		2005 -		– Community Based Total Sanitation Strategy, Ministry of Health (2008) – CLTS Payakumbuh reports – Payakumbuh Sanitation Whitebook, Payukumbuh Sanitation Working Group and Municipal Government, 2007 – Institutional Dimensions of Scaling Up of CLTS in Indonesia, Edy Priyono, 2008 – CLTS, Learning from Community in Indonesia, Owin Jamasy & Nina Shatifan, May 2008 – Community Led Total Sanitation (CLTS) in Indonesia, Bowo Leksono, Percik Magazine Dec. 2008 – Learning At Scale TSSM Project, Indonesia Country Update June 2009, Field Note, WSP

7.4 ANALYSIS OF PROGRAM APPROACHES

7.4.1 PERFORMANCE OF PROGRAM APPROACHES

Overall, the sanitation programs that were analyzed in this study have made an important contribution to sanitation improvement in Indonesia. Nevertheless, the program implementation has several shortcomings. WSLIC 2 succeeded in improving water supply access, but the revolving sanitation fund, which was the mainstay of WSLIC 2 sanitation program, did not fully succeed, and was unable to reach the poorest communities. Other issues of the WSLIC 2 program were: lack of awareness of low cost sanitation options, social gap between community leaders and poor households, lack of clear hygiene improvement strategy and community facilitators' lack of knowledge and experience of health and hygiene behavior. Therefore, only a part of these participatory processes were translated into concrete actions.

The SANIMAS program has built public toilets, shared septic tanks, and simplified sewerage systems that are still being used and work well. However, a few shortcomings were noted, such as the lack of community access to information and training, and participation of users in the SANIMAS development process. Under-specification of materials was also an issue. The CBSS program in Malang using the SANIMAS approach is a good example of a community initiative identifying and implementing sanitation solutions. CBSS was initiated, funded, organized, built, and operated by the community, and then replicated with support from local governments, NGOs, external support agencies, and the private sector. The program achieved widespread awareness and broad improvements in personal hygiene practice among the communities.

Sewerage systems exist in less than ten cities in Indonesia, and these networks are estimated to reach only 2.33% of the total population (National Census, 2007), which is one of the lowest coverage levels in Asia. The systems cover a small part of these cities, mainly city centers and commercial areas. Performance of these sewerage systems varies from city to city. Only two (in Jakarta and Bandung) have achieved full cost recovery. Users are generally reluctant to pay service fees unless sewerage charges are collected through water bills. Hence, most rely on government subsidies to meet operating and maintenance costs. System expansion is largely dependent on government support. Treatment plants are generally idle due to insufficient flow, broken pumps or both.

By focusing on triggering behavior change, CLTS has resulted in reduced open defecation. In villages where every household uses its own toilet or a shared toilet with other households, diarrhea incidence and outbreaks of vomiting have declined. Environmental benefits include ditches and water drainage free from human feces. People are more concerned about safety and are aware that defecation in rivers may harm other people. Unlike WSLIC 2 program, CLTS was successful in reaching the poorest households, but was relatively difficult and expensive to scale up and hence likely to be less cost effective in reaching large and diverse populations. To deliver a more efficient program, a solution needs to combine both 'sanitation marketing' and 'total sanitation' elements into the sanitation and hygiene promotion component (TSSM/SToPs). Another downside of the CLTS program is lack of effort from project facilitators to encourage the community to resolve technical problems, such as constructing toilets in dense settlements and swampy areas after a triggering process. Project facilitators who have poor understanding of the behavior change concept tend to see a triggering process as a one-off event rather than analyzing and responding to local contexts. With local project units focusing on meeting their water supply targets, CLTS claimed to have served its purpose once some toilets had been built.[41] Community members not engaging in the CLTS process was not due to lack of potential, but rather because facilitators or informal leaders have not been able to trigger villagers into action. Among the constraining factors were poor leadership, divided community, dependency on external assistance, resistance from influential authority figures and lack of water supply. Yet, there was not any clear operational strategy to shift from open defecation to total sanitation. After a heavy-duty CLTS program, communities were not willing to move on to improved hygiene behaviors that are equally important for health impact.

Despite the challenges left by various sanitation-related programs, access to safe sanitation in intervention areas has

[41] The CLTS Story in Indonesia, Empowering Communities, Transforming Institutions, Furthering Decentralization, Nilanjana Mukherjee & Nina Shatifan, October 2008).

increased in the past few years (increased use of pour flush latrine from 64% in 2004 to 69% in 2007). People have a growing awareness of hygienic and healthy behavior. Support from the government in the areas of management, finance and technical issues, as well as community awareness and high level of community involvement has greatly contributed to the success of these sanitation-related programs.

Performance monitoring and evaluation is crucial to program sustainability and effectiveness. Government data on sanitation indicators need to be more accurate than at present. A study by EHRA found that in 2006, 69.3% of the Indonesian population had access to 'proper' sanitation (e.g. toilet with a septic tank and or pit latrine). This figure exceeds the MDG target for sanitation coverage, although the quality of the infrastructure was not considered.[42]

7.4.2 INFORMATION, EDUCATION, AND COMMUNICATION (IEC): DEMAND-DRIVEN APPROACH VERSUS PROJECT-DRIVEN APPROACH

In response to historical experience of water supply and sanitation projects, after five years of preparation, in 2003 the Government of Indonesia introduced a national policy on Development of Community-based Water Supply and Environmental Sanitation. Past experience indicated existing water supply and sanitation facilities were not functioning properly mainly due to lack of active community involvement during the planning, construction, operation, and maintenance processes. A limited range of sanitation options had led communities to select options that neither met their demands nor were compatible with local conditions, including culture, managerial capacity, and geographic conditions. As a result of this low level of community involvement, the water supply and sanitation facilities were not properly maintained, which is the main cause of the poor sustainability and ineffective use of these facilities. As a result, these facilities and services had not provided long lasting benefits to users. Many studies found that programs that fully engaged the community and adopted a demand-driven approach have better sustainable infrastructure management, compared with programs that adopt a project-driven or supply-driven approach, in which planners and engineers assess people's needs at a specific project site to determine the type of service provided, generally not taking into account the expressed needs and conditions of the sanitation facilities users.

A sustainable sanitation program requires not only hardware, but also software intervention, including information, education and communication (IEC) campaigns. IEC media may take the form of educational and communication tools such as documentary film shows, radio shows, posters, banners, distribution of booklets leaflets, open-air drama, or targeted folk music. The main focus of IEC material development is creating local demand for sanitation.

Of the four program approaches analyzed, CLTS had the strongest IEC component. Through mass, focused use of IEC media, CLTS zeroes in on software rather than hardware development. The triggering processes in CLTS program, such as fecal calculation, defecation mapping, contamination flow, and focus group discussions are all part of the IEC campaign. A strong IEC component was also found in the sanitation marketing process, which was combined with CLTS to achieve total sanitation. The IEC campaigns included promoting options to masons, village contests and events, product demonstrations, and hygiene promotion and support, through IEC media such as leaflets, posters, videos, district radio, infomercials, local television programs, and village billboards.

The SANIMAS and WSLIC 2 programs also made use of IEC media in the hygiene promotion campaigns, training and focus group discussions, to encourage people to adopt health and hygiene behaviors and empower them to make community action plans for the proposed sanitation facility.

Examples of programs with a strong demand-driven approach are CLTS and CBSS in Malang, especially in Tlogomas subdistrict. These two programs received no government subsidies to build sanitation facilities. The cost of construction was met by the community, as an impact of their awareness of the importance of having sanitary toilets.

[42] EHRA study of six cities in Indonesia (Surakarta, Denpasar, Banjarmasin, Blitar, Jambi, Payakumbuh) found that of the total number of household toilets with a septic tank on average only about 25% have been emptied since they were installed. Of those that have been emptied, only 17% had been emptied in the previous five years.

Other programs adopting a demand-driven approach are SANIMAS and WSLIC 2. These programs were very demand responsive and relied on active participation as well as contribution from target communities and municipalities. The communities were given choices and assisted to select the most appropriate technology for their sanitation facilities. But unlike CLTS and CBSS Malang in Tlogomas subdistrict, SANIMAS and WSLIC 2 received financial support from the government to build toilets. Compared with community-funded programs, sanitation programs in Indonesia that provide financial subsidies for toilet construction do not leverage demand for sanitation in general as well, and are not as successful at engaging the private sector in creating market mechanisms that could offer a range of options for poor people, thereby leveraging health improvement.[43]

The WSLIC 2 revolving fund scheme had drawbacks too, while the CBSS program in Malang (SANIMAS), which had the lowest level of financial subsidy, was more effective initiative than any of the programs that relied on financial subsidies.

The major drawbacks of the demand-driven, or community-based approach are the often poor quality engineering design due to lack of qualified technical advice, and the prolonged timeline for completion of the project.

7.4.3 CHOICE OF SANITATION TECHNOLOGY OPTIONS

The choice of sanitation technology options for a particular sanitation program is influenced by social, technical, economic, and environmental acceptability. Social acceptability is related to the culture or religious beliefs of a target community. For instance, a study by WSP in East Java found that cleansing with water after defecating is common practice in most communities. People who do not have their own toilets or who practice open defecation reported that one of the benefits of defecating in rivers is the availability of water for cleansing after defecating. Thus, latrine options need to consider water availability even if cleansing occurs in places other than latrines.[44]

Technical acceptability relates to site conditions, space availability, availability of local building materials and technical capacity. For example, septic tanks are not an appropriate option for swampy areas such as the slum areas of Banjarmasin. Better options would be a centralized sewage system or shared septic tank. In hilly areas such as Bandung, development of off-site systems would be technically problematic, and the investment, operation, and maintenance costs would be very high. The logical choice of sanitation technology would be septic tanks, or an off-site system divided into clusters, each with its own wastewater treatment plant.

Economically acceptable means the capital costs of the facility are within available budget, and the community can afford regular payments to cover operation and maintenance expenses, hence improving the sustainability of the sanitation facility. The CBSS in Tlogomas, Malang is a good example of an economically acceptable technology. Here the community was willing to contribute to the capital cost, and make regular payments to cover the OM costs, amounting on average to less than 1% of their monthly household expenditure. In addition, there is an explicit undertaking by the community that they will also be responsible for any additional repair cost when required. Another example is the construction of communal toilets in a densely populated area in Jatiuwung, Tangerang district. Here as well as in-kind contributions, the community also made a 2–4% cash contribution to the construction of communal toilets, and are willing to pay a service fee that they find economically acceptable.

Environmentally acceptable means that water usage reflects water availability and the system takes into account the quality of groundwater and its surrounding ecosystem. In a slum and densely populated area where there is little space between houses, building a private toilet with septic tank is not environmentally acceptable as it could result in contamination of groundwater. Here the better option is to build public toilets or a centralized wastewater treatment plant on suitable plots, such as in Denpasar under the SANIMAS program.

[43] Percik Magazine, December 2008
[44] Opportunities to Improve Sanitation: Situation Assessment of Sanitation in Rural East Java, Indonesia. Jaime Frias. Water and Sanitation Program. 2008.

Sanitation options offered by unsubsidized programs such as CLTS in low-income communities are very simple, inexpensive constructions with a short life span. In East Java these are roofless superstructures with a wooden frame and walls made from plastic, gunny sacks or bamboo mats. The slab is bamboo and clay-lined with a wooden lid, and the pit is unlined.[45]

Sanitation facilities with a longer life span, such as city-scale sewerage/centralized systems and septic tanks, are generally more expensive. Although well-constructed and maintained septic tanks have a lifespan of 20 years or more, and about 65% of urban households in Indonesia are connected to septic tanks, there is the threat of groundwater contamination in densely populated areas.

7.4.4 PROGRAM REPLICATION

Generally, sanitation programs covered by this study are replicable under certain circumstances. It requires tremendous efforts and financial support, which committing parties should be aware of. The CBSS program in Malang is a viable option for small towns in Indonesia. The system may not be replicable down to the last detail, but it can and should be used as a model and adapted to fit local conditions. Currently, the CBSS program has been replicated in other subdistricts in Malang including Watugong, Mergosono, Samaan, Bareng, and Gadang. Further program replication would require support from local government and other third parties, including NGOs, external support agencies, and the private sector.

The replication of WSLIC 2 is WSLIC 3 or PAMSIMAS. However, unlike WSLIC 2, PAMSIMAS also serves urban areas, and its replication is subsidized by national and local government, and the Ministry of Public Works acts as the executing agency of PAMSIMAS. The target is to reach 5,000 villages or neighborhoods between 2007 and 2012, and the target for additional replication by local government and communities is to reach about 1,000 villages or neighborhoods.

CLTS replication requires the involvement of various government and non-government institutions, including the Ministry of Health, NGOs, community health centers, village midwives, village authorities, volunteers and informal leaders. Under the current decentralized system of government, sanitation is a local government's responsibility. Therefore, it is district government that decides which approach to adopt, although national government can encourage local governments to adopt a particular option and to scale up.

CLTS replication must be initiated by intensive sharing of information within the government bureaucracy, to provide a clear picture of the basics of CLTS and how this approach can be used to improve health conditions, particularly environmental health. An important principle in CLTS scaling up is ensuring that the system is able to run without any sophisticated inputs (Narendranath 2007). Hence, the use of existing human resources and organizations is recommended, such as the community health center with sanitarians and village midwives as frontline facilitators in the villages. The biggest challenge is the availability of village midwives and their willingness to live in the assigned village, because only by staying for quite some time in a village can these midwives become good facilitators.[46]

Sewerage systems that require large investment are being expanded with support from multilateral and bilateral aid agencies. In order to deal with the massive public investment, the modular system concept was proposed in the mid 1990s. This concept involves dividing urban areas by population density and other physical factors, then developing independent sanitation solutions for these areas. These modules can then be linked through trunk sewers as economies of scale develop. For the next five years, the government will focus more on optimizing the development of existing sewerage systems, by constructing additional networks and household connections.[47]

[45] TSSM Project : Indonesia Country Update June 2009 (Learning at Scale)
[46] Institutional Dimensions of Scaling Up of CLTS in Indonesia, Edy Priyono, 2008
[47] Indonesia, Overview of Sanitation and Sewerage Experience and Policy Option, Sukarma & Pollard, 2001, www.indonesia.go.id.

7.4.5 ISSUES THAT DETERMINE CHOICES OF INTERVENTION AND PROGRAM DESIGN

Cost and efficiency. The cost-effectiveness of hygiene promotion or interventions such as handwashing campaigns is closely related to the availability of water and sanitation facilities. Most Indonesians use water for anal cleansing after defecation, thus out-of-reach water is taken as a major barrier to use toilets, washing hands, and general hygiene. The hygiene interventions would be less cost-effective if water and sanitation facilities are either inadequate or not available.

For toilet construction, the use of local materials, such as bamboo, mud, or palm fronds, and familiar building techniques will significantly reduce costs. Moreover, CLTS does not provide financial support for toilet construction or any required external design. The important issue is for households to make their own decision to stop open defecation and build the easiest and most affordable toilets as low-cost facilities that can easily be improved and upgraded later.

Although community driven, WSLIC 2 did not really succeed in delivering access to improved sanitation among poor households. Lack of awareness about low-cost sanitation options is one of the most likely causes. Toilets constructed under government sanitation programs tend to promote solid walled and roofed toilet enclosures, with a pour-flush toilet pan and offset, and solid-lined pit with some form of vent pipe. For poor communities this type of toilet is not affordable without some form of subsidy. Low-cost toilet construction should be considered if more effective sanitation programs for the poor is a goal. By using local materials, familiar building techniques, and local labor, the costs will be significantly reduced, and will be more useful for the targeted community.

The SANIMAS example shows that facilities using more sophisticated technology are very costly, are used by only a few people, and fees will place a significant burden on poor families. SANIMAS design and construction must also take into account local conditions, including water availability, local culture and characteristics, and the financial capacity of the local community.

Energy use. Sanitation facilities in low income areas should incorporate energy-saving technology to reduce operation costs. In Tlogomas, the CBBS is constructed in such a way that wastewater flows directly to a treatment plant located at the lowest point of the system, and then discharged into a river or local water course. The flow of wastewater depends entirely on gravity, hence using less energy than a pump operated system.

In Jatake village in Jatiuwung subdistrict, the SANIMAS public toilets produce biogas that the locals use for cooking and lighting, thereby reduced the need for regular energy. However, the proper operation and maintenance of the biogas system is essential to its sustainability.

Water use. Lack of water is a major constraint even when people are aware of the benefits of using toilets and are ready to build them. People with limited access to clean water tend to restrict the amount of water they use for cooking and drinking. They would not want to waste water on flushing toilets or washing clothes. Even pour-flush options, which require a minimum volume of water, would be difficult to maintain in areas with limited water supply.

In East Nusa Tenggara (NTT) where drought is an annual occurrence, only 26.6% of the population uses goose neck water-sealed toilets; the rest defecate in the open, increasing the prevalence of diarrhea. Pit latrines require less water than 'regular' toilets, but the waste often decomposes slowly and the smell is unbearable. The Indonesian Institute of Science is developing new technology to deal with sanitation problems in arid area. The Biotoilet is a dry toilet that uses sawdust to accelerate waste decomposition. Within five months, the waste is decomposed, forming compost. This technology has been piloted in three areas in Bandung (the LIPI Center of Applied Physics Research, Daarut Tauhid Islamic Boarding School, and Kiara Condong ward).[48] Although the pilot has been successful, the challenge lies in its social and cultural acceptability.

Polluting discharge. Improper discharge of wastewater leads to waterborne diseases such diarrhea. In urban slums, households often discharge toilet waste directly into rivers

[48] www.targetmdgs.org

because they do not have the space to build a septic tank. Kusuma Bangsa in Pemecutan Kaja ward, Denpasar has had a high incidence of diarrhea and other water-borne diseases due to lack of proper sanitation facilities and frequent floods, which have contaminated shallow wells and bored wells. Before the SANIMAS program began, about 80% of the rented rooms and houses in which the majority of the local population live had small bathrooms and toilets without proper septic tanks. Wastewater from the toilets was discharged into a nearby stream. During the rainy season, water from this waste and rubbish filled stream swamped most houses in the area. The SANIMAS solution was to construct a simple sewage system, which includes a wastewater treatment plant that treats around 60m^3 of black and grey water per day. Inexpensive and easy to operate and maintain, this DEWATS technology reduces the pollution load by up to 90%[49].

Other issues. Sanitation choices do not necessary correlate to wealth: many households living below the poverty line defecate in improved latrines and one-third of the richest (40% of the population) defecate in rivers (National Census, 2004). Studies in East Java found that other needs often take priority over latrines. Preferences have little to do with a family's ability to pay and more with a household's choice of expenditure. Underlying these preferences are poor awareness of potential benefits of latrines, poor awareness of latrine designs, models, and sanitation options, lack of understanding of health risks of defecating in rivers, and social acceptance of open defecation. However, people are willing to pay for improved sanitation that offers practical and social benefits (which are perceived to be more important than health and environmental benefits), such as accessibility, increased property value, time savings, secured proximity, privacy, and comfort (not feeling rushed). Water availability for anal cleansing is another consideration in choice of sanitation option.[50]

In contrast, in Tlogomas, Malang, it was the unhealthy living conditions leading to the death of several people following a diarrhea outbreak in 1985 that triggered people to stop defecating in the open and start using improved sanitation. Hence, it can be concluded that increased awareness can trigger investment in sanitation for health and environmental benefits.

Formative research on hygiene and health conducted by Environmental Services Program (ESP) in September 2006 in several urban, rural and peri-urban areas found that the perceived ideal toilet should have a goose neck water seal, with a bucket full of water beside the toilet and water dipper within reach. The toilet should look clean and not smell, have good drainage and be of a comfortable size. This 'ideal' toilet was found mostly in urban areas. In rural communities, the main factor preventing people from building toilets was lack of funds, although some of them were reported to have high incomes.

People are willing to invest in improved sanitation for several reasons, including: the desire to have facilities that they perceive as part of modern life, to safeguard their privacy, enhance their self image and the assurance of being able to defecate anytime, even when it is raining or at night when it is uncomfortable and unsafe to defecate in the open.

[49] DEWATS Treatment System Indonesia, BORDA

[50] Opportunities to Improve Sanitation: Situation Assessment of Sanitation in Rural East Java, Indonesia. Jaime Frias. Water and Sanitation Program. 2008.

VIII. Efficiency of Improved Sanitation

This chapter synthesizes the information presented in Chapters 4 to 7 to present sanitation option efficiency under both ideal and actual program conditions. Alongside the quantitative cost-benefit and cost-effectiveness ratios, non-quantified impacts are also presented. The chapter consists of three sections:

- Efficiency of sanitation interventions, compared with no option (section 8.1).
- Efficiency of moving from improved sanitation options to other options 'higher' up the sanitation ladder (section 8.2).
- Contextualization of the results in a national context and use of the results to scale up sanitation (section 8.3).
- Overall cost-benefit assessment, taking into account all the elements (section 8.4).

8.1 EFFICIENCY OF SANITATION AND HYGIENE IMPROVEMENTS COMPARED TO NO FACILITY

8.1.1 QUANTITATIVE ANALYSIS

Economic analysis combines evidence on the cost and benefits of sanitation improvements already presented in earlier chapters, giving a number of alternative measurements of efficiency. As previously mentioned, each study site has atypical characteristics and therefore combining the results would be inappropriate; hence a separate presentation of economic analysis is made for each site. However, the results can be perceived as indicative figures of the economic performance of sanitation improvement.

The following paragraphs will describe the ideas of where the benefit values come from which covers all economic costs incurred once a household with no toilet builds a toilet option with respect to its sanitation ladder alternative. The analysis starts from rural sites and then to urban site situations. Cultural and environmental situation background may influence economic value generation either among different sites or between urban and rural situations.

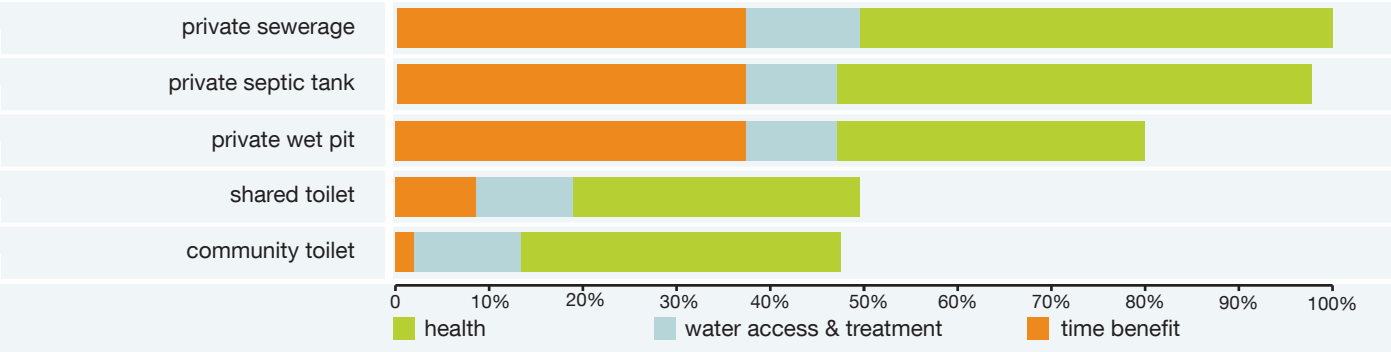
The benefit value drivers

As a prelude to the quantitative analysis, the following paragraphs describe the benefit value driver components. The benefit value drivers are:

- Being healthy and avoiding all related costs due to sickness such as disease treatment, transportation costs for having treatment and unproductive time.
- Time benefits from having a private toilet (less travel and no queuing time).
- Reduced water treatment and water access costs due to better environmental sanitation.

Figure 66 shows an example set of benefit value drivers using the case of urban study sites in Banjarmasin. The full benefit is represented as 100% which is obtained by choosing sanitation options that have the full economic benefit, such as private toilet with septic tank or sewerage and wastewater treatment. The notion of the full economic benefit means that it consists of all benefit value components i.e. "health benefit", "time benefit" and "water treatment and water access". The other options on the sanitation ladders are rewarded proportionally according to their total nominal benefit value as a fraction of the full benefit value. For example, private toilet connected to sewerage systems at its optimal capacity can deliver total present value of benefits of US$1,166 (the full benefit, 100%) over a 20-year period, while private wet pit toilet can deliver total benefit US$391 or 80% of the full benefit over the same period with an additional reinvestment at Year 11, as it has 10 years expected life.

FIGURE 66: EXAMPLE OF THE BENEFIT VALUE DRIVERS' CONTRIBUTION IN BANJARMASIN



The figures also show that the main benefits come from being healthy and avoiding spending due to sickness (paying for the doctor, medicines and transports to get to health facilities). The second largest benefit is the value of access time savings. Households receiving private toilets enjoy the greatest time savings as they do not need to travel or queue for their toilet needs. For those who use shared or community toilets, the time savings contribution is relatively smaller as they still need time to queue for their toilet needs.

The last benefit comes from water access and water treatment. The estimated values reflect potential gain for households in term of annual cost reduction for drinking water treatment before and after improved sanitation. This value is assumed, based on the fact that some households will decide not to boil their drinking water anymore and/or choose a cheaper treatment method. Water source access costs may also be reduced due to closer sources of water supply becoming cleaner and more usable for meeting domestic needs.

Benefit-cost analysis at rural sites

Table 47 and Table 48 show BCR figures for rural sites at Lamongan District and Tangerang District respectively. They present results under both optimal and actual program conditions. The notion of optimal efficiency refers to a condition of full achievement of all key performance indicators of sanitation programs. Meanwhile, actual efficiency refers to the existing achievement of sanitation programs which by definition are less than 100% of the optimal efficiency.

The differentiations of benefit values between 'optimal' and 'actual' come from the following assumptions:

- Benefit-cost figures vary depending on whether a system is operating at intended capacity ('optimal') or current capacity ('actual').
- Optimal cost figures come from engineering standards for particular sanitation ladders, while actual cost figures come from field survey data. In some cases the actual costs are less than the optimal costs due to under-specification of sanitation. For instance, one can use substitute materials to get cheaper materials option but sacrificing their quality and life time. Such lower costs give more chance for poor households to afford private sanitation provision. However, the under specification sanitation leads to shorter life time and needs more recurrent investment. Hence in terms of annual cost equivalent, it may not be cheaper to invest in below standard specifications.
- Ideal benefit figures are also related to program effectiveness. They are measured by sanitation utilization rates. A fully utilized sanitation option is in an ideal situation where household members always use their toilet every time they need it. While actual benefit figures come from underutilized sanitation where household members, for any reasons, do not always use their toilet when they need it. In this case, the actual benefit values used to be less than the ideal benefit values.

The study results for Lamongan District reveal all performance parameters are beyond their minimum feasible values:

- Benefit-cost ratio: both its optimal and actual benefit values of every ladder exceed its cost figures. The top sanitation ladder option in Lamongan District is private toilet with onsite septic tank. The BCR value reveals that for every US$1 input of investment costs generates US$3 under optimal program conditions and US$2 under actual conditions. The BCR figures for other sanitation options are more favorable as the input of investment costs are much cheaper while generated economic benefits (at household level) are almost similar.
- Internal rate of return: All sanitation options have IRR of greater than 100%, which means that each year the investment value is more than repaid. Only private septic tank under actual conditions has IRR below 100%, at 79%.
- Payback period: For shared and private pit toilets it takes less than 1 year for a household to recover its initial investment costs. For private septic tank, the optimal payback period is 2 years and 3 months, while the actual is 2 years and 10 months
- Net present value (NPV): All NPV values are positive. It means the investments on any sanitation ladder deliver positive net economic gains.

The results for Tangerang district are similar to Lamongan. All benefit-cost figures show sanitation options to be economically attractive, and for some cases the performance is higher than for Lamongan.

Figure 67 shows how benefit figures of all sanitation ladder options at rural sites cover their investment costs. As detailed in Figure 48 (Chapter 6), septic tanks are shown to be the highest sanitation ladder option for rural sites in terms of annualized cost, and hence have the least favorable benefit-cost ratios in both Lamongan and Tangerang districts.

The study also estimates the effect of basic hygiene interventions in addition to the sanitation intervention. The basic hygiene practice is hand washing with soap (HWWS). In the rural areas, such an additional intervention delivers additional values of health benefit. Adding hygiene practices to sanitation interventions increases program efficiency and decreases the cost per DALY averted. It means the additional generated benefit values can cover required input costs (costs for soaps and other related hygiene expenses). It also implies that hygiene practice is an important factor to decrease health risks. Figure 68 shows the higher Net

TABLE 47: RURAL AREA (LAMONGAN DISTRICT) EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARED WITH "NO TOILET"

Efficiency measure	Scenario	Shared toilet	Private wet pit	Private septic tank
COST-BENEFIT MEASURES				
Benefits per US$ input (US$)	Optimal	6.7	6.1	3.3
	Actual	5.4	5.1	2.7
Internal rate of return (%)	Optimal	>100%	>100%	>100%
	Actual	>100%	>100%	79%
Pay-back period	Optimal	8 months	5 months	2 years 3 months
	Actual	10 months	6 months	2 years 10 months
Net present value (US$)	Optimal	1,498	1,757	2,081
	Actual	1,174	1,394	1,379
COST-EFFECTIVENESS MEASURES				
Cost per DALY averted (US$)	Optimal	423	548	945
	Actual	522	485	1,378
Cost per case averted (US$)	Optimal	3	4	7
	Actual	4	5	10
Cost per death averted (US$)	Optimal	38,513	49,905	86,234
	Actual	47,489	61,535	125,819

The field sites: 1) Geger, 2) Keben, 3) Badurame and 4) Turi.

TABLE 48: RURAL AREA (TANGERANG DISTRICT) EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARED WITH "NO TOILET"

Efficiency measure	Scenario	Community toilet	Shared toilet	Private wet pit	Private septic tank
COST-BENEFIT MEASURES					
Benefits per US$ input (US$)	Optimal	3.0	4.7	7.8	4.3
	Actual	2.5	3.9	6.0	3.7
Internal rate of return (%)	Optimal	44%	>100%	>100%	100%
	Actual	64%	>100%	>100%	79%
Pay-back period	Optimal	3 years 3 months	1 year 1 month	5 months	2 years
	Actual	4 years	1 year 4 months	5.5 months	2 years 3 months
Net present value (US$)	Optimal	908	1,266	2,064	2,371
	Actual	662	945	1,525	1,769
COST-EFFECTIVENESS MEASURES					
Cost per DALY averted (US$)	Optimal	1,628	1,148	1,024	1,562
	Actual	1,988	1,401	1,034	1,725
Cost per case averted (US$)	Optimal	9	7	5	8
	Actual	10	8	7	9
Cost per death averted (US$)	Optimal	63,868	50,789	40,157	61,608
	Actual	77,983	62,013	49,031	68,061

The field sites: 1) Sarakan, 2) Kayu Agung, 3) Sukasari, and 4) Tanjakan Villages

Present Values (NPVs) of benefit (optimal as well as actual) as the result of adding hygiene practices to the sanitation interventions.

The cost-effectiveness ratios indicate what a household has to pay to get "one additional unit of health benefit". Figure 69 shows the cost per case averted at both rural sites. The figures imply that in order to prevent a case of disease, a household using a septic tank needs to pay more than a household using any other sanitation ladder options. However, the figures omit other benefits such as time saving and intangible benefits.

Benefit-cost analysis at urban sites

Table 49, Table 50 and Table 51 show that, for urban sites, the optimal and actual performance of sanitation interventions are similar to those in rural areas: all economic performance parameters are above their minimum economically viable values. The results for Banjarmasin are described below:

- Benefit-cost ratio (BCR): the optimal economic benefits value of every sanitation option exceeds the costs. The most expensive sanitation ladder option is the sewerage system in Banjarmasin whose investment costs at optimal capacity are US$473 per household connection. Its BCR value is 1.1, which means if the systems operate at their optimal capacity, they could deliver economically viable results. However, in 2009 the system was operating at 14% capacity, thus giving significantly higher investment costs per household connection (US$2,201). Such a high investment cost obviously makes it hard to achieve economic viability. With its low capacity utilization, every US$1 input of investment generates US$0.25 output of economic benefit. The BCR figures for the other sanitation options are much higher as the investment costs are much lower while generated economic benefits are similar.
- Internal rate of return: the IRRs for shared, private pit latrine and toilet with septic tank are favorable, at rates of between 30% and well over 100%. For community toilets the IRR is 15% at optimal functioning, reduced to 5% at actual rates of capacity utilization. For off-site treatment, IRR is 12% at optimal functioning, reduced to a negative figure at actual rates of capacity utilization.

FIGURE 67: COMPARISON OF RURAL BCR VALUES OF DIFFERENT SANITATION LADDER AND AT DIFFERENT SITES

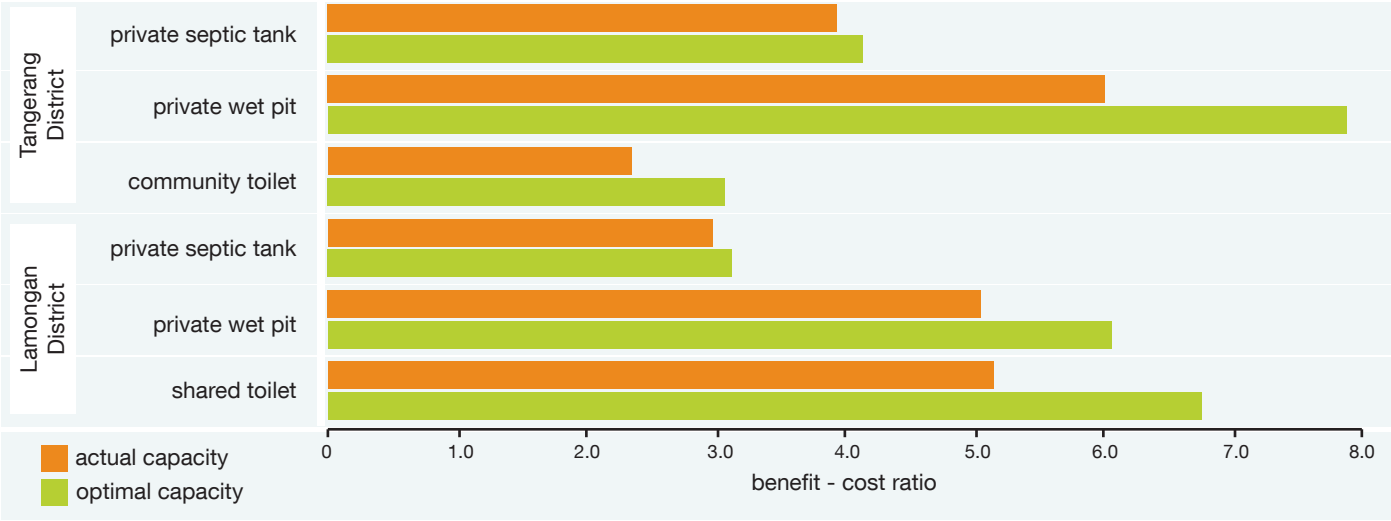


FIGURE 68: COMPARISON OF NET PRESENT VALUE OF SANITATION ONLY AND OF SANITATION + HYGIENE PRACTICES FOR TOILET WITH SEPTIC TANK AT RURAL SITES

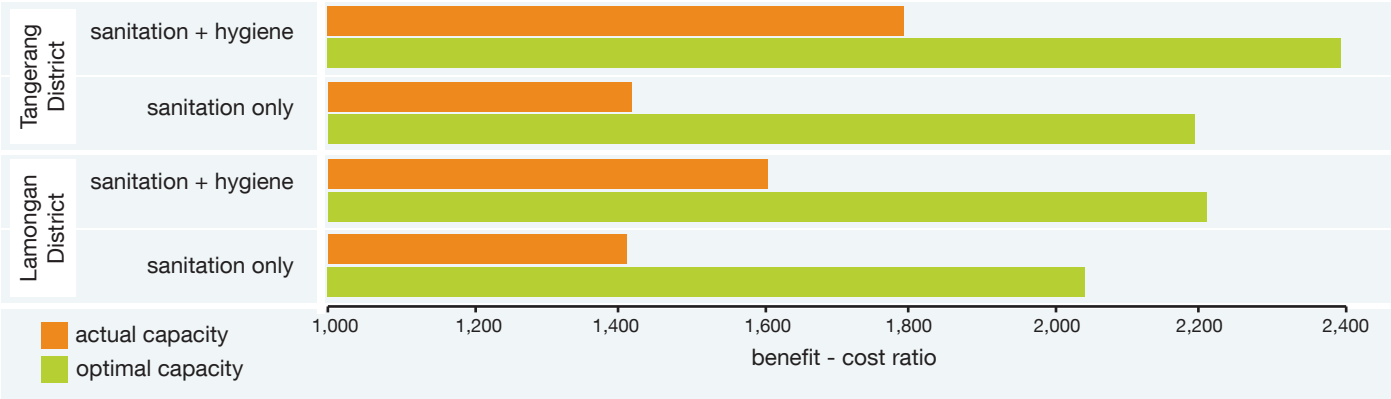
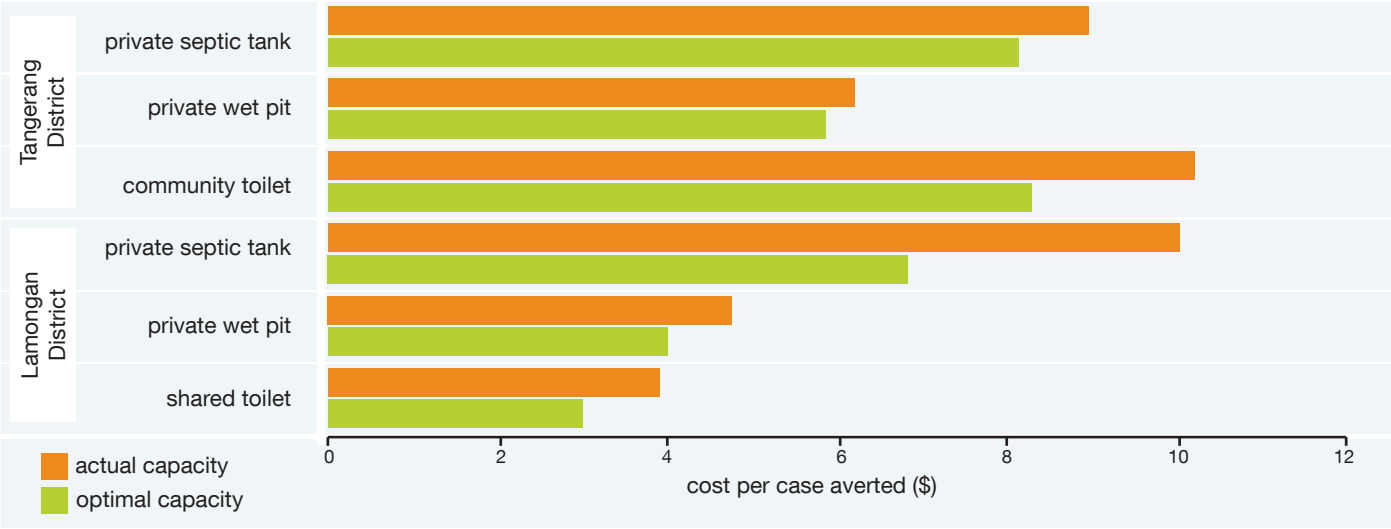


FIGURE 69: COST PER CASE AVERTED ($) AT RURAL SITES



- Payback period: shared, private pit latrine and toilet with septic tank all have payback periods of less than 3 years at optimal rate of toilet use by households, and less than 7 years for actual use. At optimal capacity utilization, the maximum payback period is around 8 years for off-site treatment, which is well below the expected length of life of 20 years.
- Net present value (NPV): All NPV values at optimal capacity are positive, which means that investment in toilets with any sanitation ladder options are economically viable.The differentiations of benefit values between 'optimal' and 'actual' are based on the same assumptions as the ones for rural analysis. In case of Banjarmasin sewerage systems, the BCR figure at its actual capacity (by January 2010) is 0.2 (less than 1), Payback Period more than 20 years and NPV = -2,395. A similar case also happens to the community toilets (SANIMAS) which operates at about 70% of their capacity and the BCR value is 0.9. Some of the targeted beneficiaries sometime still go to rivers for their toilet related activity purposes (defecation, washing, bathing etc.).

Figure 70 shows benefit-cost ratio figures of selected sanitation options at urban sites are greater than their investment costs (BCR>1). Refer to Figure 49 in chapter 6, private toilet connected to sewerage systems and community toilets, which need higher annual equivalent investment costs per household than other sanitation ladder options.

The cost effectiveness figures for urban sites show almost similar values for all sanitation ladder options. The urban sites figures imply that in order to prevent a case of disease risk, at optimal capacity utilization, a household with private toilet connected to communal sewerage pays more than using any other sanitation ladder options. In the case of sewerage systems in Banjarmasin, its actual cost per case/episode averted is extremely high compared to the other sanitation ladder options.

TABLE 49: URBAN (BANJARMASIN) EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARED WITH "NO TOILET"

Efficiency measure	Scenario	Community toilet	Shared toilet	Private wet pit	Private septic tank	Private off-site treatment
COST-BENEFIT MEASURES						
Benefits per US$ input (US$)	Optimal	1.4	2.3	2.8	1.8	1.1
	Actual	0.9	1.4	1.9	1.2	0.25
Internal rate of return (%)	Optimal	15%	97%	>100%	88%	12%
	Actual	5%	30%	>100%	41%	Negative
Pay-back period	Optimal	8 years 11 months	2 years	9 months	2 years 2 months	8 years 2 months
	Actual	16 years 10 months	4 years	1 year 3 months	7 years	>20 years
Net present value (US$)	Optimal	159	333	617	772	139
	Actual	-56	107	291	382	-2,395
COST-EFFECTIVENESS MEASURES						
Cost per DALY averted (US$)	Optimal	1,502	993		1,299	978
	Actual	2,142	1,416		1,198	1,395
Cost per case averted (US$)	Optimal	9	6		8	6
	Actual	13	9		11	8
Cost per death averted (US$)	Optimal	47,948	31,696		41,462	31,419
	Actual	68,399	45,215		59,146	44,820

The field sites: 1) Pekapuran Laut, 2) Kelayan Luar

TABLE 50: URBAN (MALANG) EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARED WITH "NO TOILET"

Efficiency measure	Scenario	Shared toilet	Private wet pit	Private septic tank	Private off-site treatment
COST-BENEFIT MEASURES					
Benefits per US$ input (US$)	Optimal	2.8	4.3	2.5	2.3
	Actual	2.3	3.6	2.1	1.9
Internal rate of return (%)	Optimal	>100%	>100%	100%	55%
	Actual	>100%	>100%	65%	43%
Pay-back period	Optimal	1 year 8 months	7 months	2 years	3 years
	Actual	2 years 2 months	8 months	2 years 6 months	3 years 7 months
Net present value (US$)	Optimal	503	1,302	1,226	1,328
	Actual	369	1,007	872	977
COST-EFFECTIVENESS MEASURES					
Cost per DALY averted (US$)	Optimal	1,200	1,661	2,253	1,944
	Actual	1,433	1,486	2,692	2,133
Cost per case averted (US$)	Optimal	9	12	16	38
	Actual	10	14	19	46
Cost per death averted (US$)	Optimal	34,484	47,741	65,224	157,589
	Actual	41,200	57,039	77,926	188,278

The field sites: 1) Kedung Kandang, 2) Lowowaru, 3) Mergosono, 4) Tlogomas, 5) Arjowinangun and 6) Dinoyo

TABLE 51: URBAN (PAYAKUMBUH) EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARED WITH "NO TOILET"

Efficiency measure	Scenario	Shared toilet	Private wet pit	Private septic tank
COST-BENEFIT MEASURES				
Benefits per US$ input (US$)	Optimal	1.8	2.3	1.4
	Actual	1.5	1.7	1.8
Internal rate of return (%)	Optimal	50%	>100%	16%
	Actual	68%	>100%	30%
Pay-back period	Optimal	2 years 11 months	1 year 3 months	6 years 9 months
	Actual	3 years 8 months	1 year 11 months	6 years 6 months
Net present value (US$)	Optimal	273	530	336
	Actual	144	266	243
COST-EFFECTIVENESS MEASURES				
Cost per DALY averted (US$)	Optimal	1,674	1,995	2,714
	Actual	1,988	1,649	2,435
Cost per case averted (US$)	Optimal	8	10	13
	Actual	10	12	12
Cost per death averted (US$)	Optimal	38,847	46,293	63,518
	Actual	46,137	54,980	56,990

The field sites: 1) Talawi, 2) Kotopanjang, 3) Payolinyam and 4) Kubu Gadang

Cost-effectiveness figures are mainly influenced by:

- Total investment costs of a household to develop a toilet.
- Generated benefit in terms of avoided or reduced health risks due to toilet ownership. Greater reduced risks lead to lower cost per health gain achieved.

Figure 71 shows the comparison of cost per case/episode averted at urban sites. Community toilets, shared toilets and septic tank toilets deliver relatively low cost per case averted compared to private toilet connected to communal sewerage. In the case of Payakumbuh, as mentioned in the previous chapter, the sanitation investment costs are very low. The CLTS approach in Payakumbuh has creates significant awareness to the importance of possessing a private toilet. In addition, the local culture of West Sumatera with its cohesiveness and collectivist spirit also contributed to the way people built their toilets. Many households built their toilets with minimum input costs. They used sand and (sometimes) cement received from their neighbors. They collectively purchased a molding tool so that they can make the toilet part by themselves from cement-sand mixtures. The owners were involved in the construction processes together with masons. Such situations reduced cash capital spending significantly. However, the total capital costs for toilet investment per household may be greater than the current figure as the value of time of the household devoted to the toilet construction has not been included.

FIGURE 70: COMPARISON OF URBAN BCR VALUES OF DIFFERENT SANITATION LADDER OPTIONS AND AT DIFFERENT SITES

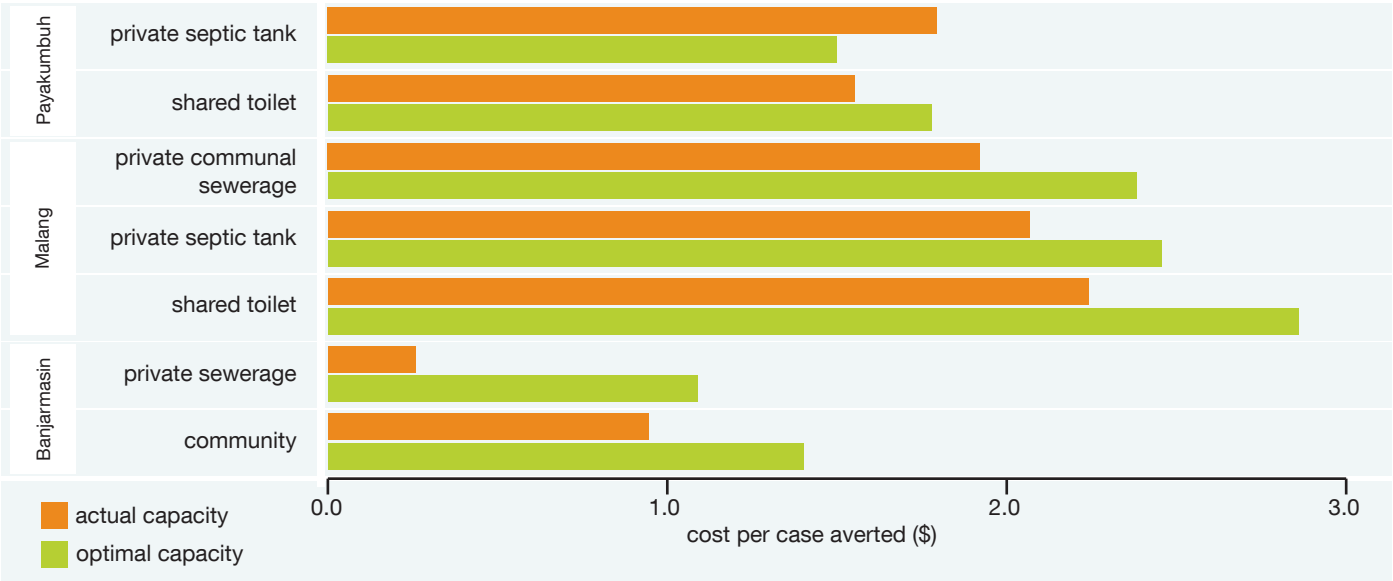
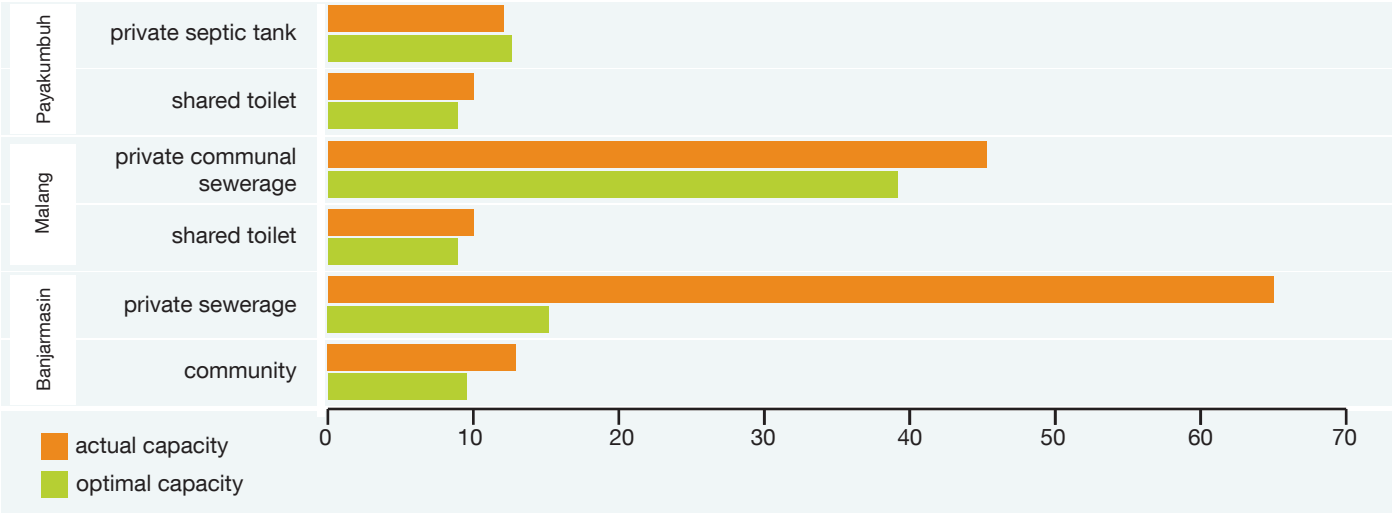


FIGURE 71: COMPARISON OF URBAN COST PER CASE AVERTED (US$)



The situation is very similar in Malang city, where people built their communal sewerage systems collectively. People contributed by direct involvement in the construction as well as providing some of the required materials. Although not as low as in Payakumbuh, the capital costs for toilet investment per household were much reduced. In contrast, the highly capital-intensive sewerage system in Banjarmasin, coupled with its low actual capacity utilization, leads to very high cost per case averted of more than US$60, compared with other options and sites, where it is <US$15. To improve this situation and increase the number of household connections, greater community awareness of the importance of sanitation is needed.

8.1.2 QUALITATIVE ANALYSIS

The benefits of household sanitation reach far beyond the above quantified benefits. There are also several intangible benefits or non-monetized benefits which are not easily expressed in quantitative units, such as comfort and better environment. The above benefit value measurements (CBA and CEA) take into account only the reduced risks and time associated with ceasing to practice open defecation. Traditionally, CBA and CEA give zero weight to intangibles and variables not included in analysis. For instance, according to the cost per case/episode averted figures, ones would conclude that community and shared toilets, which are typically outside houses, are the best options. In fact, there are many other sanitation activities that can be done in improved toilet facilities and bathrooms that have a positive value, especially for women, such as bathing, female hygiene, washing, and cleaning home appliances.

Chapter 4.4 described the concerns that households with no private toilets have, particularly for women. Women are generally most concerned about safety, for themselves and for their children. Men, on the other hand, are more concerned about practicality. Both men and women rate reduced access time and cleanliness as important factors in getting a toilet. Among other non-monetized benefits are comfort, privacy, and less time spent queuing. In addition, improved toilets enhance the owner's perceived social status. Almost all respondents agreed that improved sanitation leads to a cleaner environment, which is very important.

However, there are also factors that make people with improved toilets continue to use toilet options defined as 'unimproved', such as hanging toilets on a river or on a fish pond. For instance, some people in Payakumbuh prefer to defecate in hanging toilets on a pond to feed their fish, as well as preferring the open air and absence of bad smell that tends to accumulate in toilets that are not properly cleaned. Another interesting finding from the Banjarmasin site is the preference of households for open defecation in rivers in front of or behind their houses. People living on the riverbanks use the rivers as a kind of one-stop shop for carrying out daily activities, including defecation.

As well as the above household and community level benefits, there are also larger scale benefits of improved sanitation – the knock-on effects on tourism, business and the sanitation supply market. According to the tourism and business surveys, there are clear knock-on effects:

- Tourism: the sanitary condition of public places affects how tourists enjoy their stay in Indonesia. While sites most frequented by tourists (e.g. beaches, hotels) tend to have good sanitation facilities, the general sanitary conditions in Indonesia was rated as 48% satisfactory by the respondents. This is a challenge for the Government of Indonesia, especially the components of government that are responsible making tourism businesses more aware of sanitary conditions.
- Business: Improved sanitation will enhance the quality of life and increase the productivity of businesses through cleaner natural resources (such as water supply) and increased employee productivity.

The sanitation supply market will also gain significant benefit from increasing people's awareness of and demand for sanitation-related goods and services. As mentioned previously, the total potential sanitation market size (by 2014) is about 16.67 million new toilets worth US$17.3 billion. This figure consists of new toilet investment costs of US$16.8 billion and cumulative maintenance costs from 2008 to 2014 of US$500 million. Therefore, increased investment by households and government leads to huge business opportunities for mason services, and sanitation materials and products.

8.2 EFFICIENCY OF ALTERNATIVES FROM MOVING UP THE SANITATION LADDER

The previous section analyzed the economic performance of household sanitation options compared with 'no toilet' as the baseline. This section evaluates the incremental economic performance of moving up the sanitation ladder. This analysis is important because there are many households with basic sanitation that may consider upgrading their existing sanitation option. For example, households that use shared toilets or community toilets may wish to move up to private pit, private septic tank or private sewerage (communal or larger scale). The analysis is most relevant for households whose current sanitation option has yet to come to the end of its useful life. If, on the other hand, a household's sanitation option/system has broken down and requires capital investment in maintenance or replacement, then the comparison with 'no toilet' as the baseline is more relevant, as the household could return to open defecation or move to an option lower down the ladder, such as hanging toilet or public toilet.

Benefit-cost analysis of moving up ladders in rural sites

Table 52 and Table 53 show the economic performance of moving up the sanitation ladders in the rural districts of Lamongan and Tangerang, respectively. At both study sites, the highest option on the sanitation ladder is septic tank and the initial points on the sanitation ladder, for comparison, are shared latrine and private wet latrine. Benefit value drivers of moving from shared latrine to private septic tank come from water access and treatment, time saving and increased health benefit; and of moving from private wet latrine to private septic tank, from improved water access and treatment and increased health benefit as it is assumed that improved wastewater management reduces health risks in the broader sense. Moving up the ladder could be economically justified if the incremental benefits exceed the marginal costs incurred. Overall, each step of moving up the ladder has favorable economic performance, with benefit-cost ratios exceeding 2, except pit latrine to septic tank in Tangerang which has a cost-benefit ratio of 1.5.

Moving up the sanitation ladder is an option for households that wish to improve the quality of the environment as well as gain the benefits quantified above such as health, water and time benefits (Figure 72). This option should be promoted particularly in dense and highly populated areas like the study sites in Tangerang. In some particular contexts, such as locations with heavy surface water pollution and where land is scarce, the option of moving up from unimproved shared options to communal sewerage is highly attractive. In this case, non-quantified benefits of improved wastewater management play an important role in the decision. Therefore, local governments should promote and initiate raising community awareness and facilitate implementation of sanitation options.

Benefit-cost analysis of moving up ladders in urban sites

Similar analyses were conducted of moving up the sanitation ladder at urban sites. The results show that some options are not economically viable due to marginal costs outweighing incremental benefits. For instance, in Banjarmasin the cost of moving from wet pit latrine to septic tank toilet is US$160 per household, while the incremental economic benefit is US$106. Also, the marginal cost outweighs the incremental benefits of moving up the ladder from shared toilet to private septic tank or to private communal toilet in Malang, and from private wet pit latrine to private septic tank in Payakumbuh. However, note again that the quantified benefit values do not include the full environmental benefits.

The ultimate sanitation solution, especially for urban areas, is urban sewerage systems or at least communal sewerage or on-site treatment systems. As population density tends to increase over time, land prices rise and land availability diminishes. Therefore, on plot (but outside the house) systems such as dry pit, wet pit and septic tank will no longer be viable due to land scarcity.

This study does not take into account the land cost for urban on-site systems. If land scarcity (that leads to extremely high land prices) were taken into account in the calculations, movement up the ladder from on-site isolation to communal sewerage or even to larger-scale centralized sewerage will probably become more economically viable. This assumes that the land where the water treatment plant is located outside downtown or in less populated areas, where land prices are correspondingly lower.

TABLE 52: RURAL AREA (LAMONGAN DISTRICT) EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARING DIFFERENT POINTS ON THE SANITATION LADDER

Efficiency measure	Scenario	Moving from shared latrine to:	Moving from private wet latrine to:
		Improved private Septic tank	Improved private Septic tank
COST-BENEFIT MEASURES			
Benefits per US$ input (US$)	Optimal	3	2
	Actual	2	2
Internal rate of return (%)	Optimal	92%	36%
	Actual	62%	21%
Pay-back period	Optimal	2 years 1 month	3 years 9 months
	Actual	2 years 8 months	5 years 8 months
Net present value (US$)	Optimal	812	404
	Actual	601	195
COST-EFFECTIVENESS MEASURES			
Cost per DALY averted (US$)	Optimal	1,249	1,374
	Actual	1,540	1,694
Cost per case averted (US$)	Optimal	9	10
	Actual	11	12
Cost per death averted (US$)	Optimal	114,542	125,990
	Actual	141,235	155,352

TABLE 53: RURAL AREA (TANGERANG DISTRICT) EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARING DIFFERENT POINTS ON THE SANITATION LADDER

Efficiency measure	Scenario	Moving from community latrine to:	Moving from shared latrine to:	Moving from private wet latrine to:
			Improved private Septic tank	
COST-BENEFIT MEASURES				
Benefits per US$ input (US$)	Optimal	4	4	1.5
	Actual	3	3	1.2
Internal rate of return (%)	Optimal	86%	69%	17%
	Actual	58%	50%	15%
Pay-back period	Optimal	2 years 2 months	2 years 5 months	6 years 7 months
	Actual	2 years 9 months	3 years	9 years 3 months
Net present value (US$)	Optimal	1,176	1,070	223
	Actual	783	719	180
COST-EFFECTIVENESS MEASURES				
Cost per DALY averted (US$)	Optimal	2,780	2,553	3,007
	Actual	3,395	3,118	3,671
Cost per case averted (US$)	Optimal	15	13	16
	Actual	3,395	16	19
Cost per death averted (US$)	Optimal	110,800	101,757	119,829
	Actual	110,800	124,245	146,311

FIGURE 72: ECONOMIC PERFORMANCE OF MOVING UP THE RURAL SANITATION LADDER

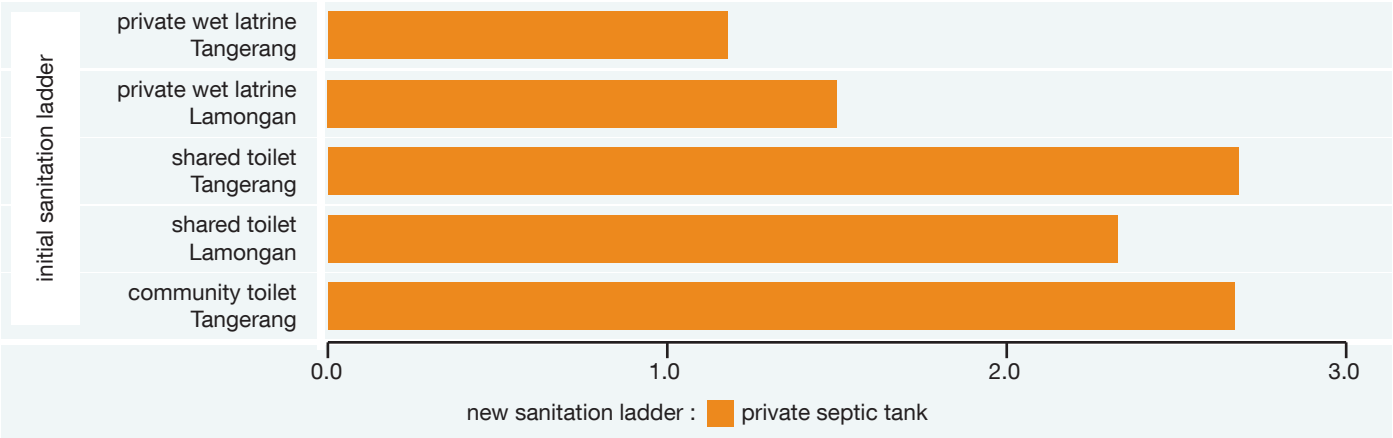


TABLE 54: URBAN AREA (BANJARMASIN) EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARING DIFFERENT POINTS ON THE SANITATION LADDER

Efficiency measure	Scenario	Moving from shared/community latrine to:		Moving from private wet pit latrine to:
		Private septic tank	Private sewerage	Private septic tank
COST-BENEFIT MEASURES				
Benefits per US$ input (US$)	Optimal	2	1.7	0.9
	Actual	1.2	0.7	0.5
Internal rate of return (%)	Optimal	48%	31%	2%
	Actual	17%	-3%	-4%
Pay-back period	Optimal	3 years 1 month	4 years 2 months	16 years
	Actual	6 years 8 months	>20 years	>20 years
Net present value (US$)	Optimal	324	255	(54)
	Actual	72	(102)	(104)
COST-EFFECTIVENESS MEASURES				
Cost per DALY averted (US$)	Optimal	2,529	2,862	2,807
	Actual	3,607	34,900	4,004
Cost per case averted (US$)	Optimal	15	17	17
	Actual	22	212	24
Cost per death averted (US$)	Optimal	82,204	93,033	91,250
	Actual	117,266	1,134,549	130,171

Note: Figures in parentheses are negative values

Banjarmasin is a special case. Land scarcity is more of an issue here than at any of the other study sites. As mentioned in the previous chapter, many poor households live along riverbanks and use the rivers as their toilets as well as for washing, bathing and children playgrounds. Larger rivers are also used for public transportation. The provision of improved toilets such as SANIMAS or shared toilets connected to the sewerage system would certainly give these poor households access to technically adequate and economically viable sanitation.

For Malang City, moving up from shared latrine to communal sewerage would be economically unfavorable. Again, the total investment cost per household of private toilet connected to communal sewerage far outweighs the cost of shared latrines. The situation would probably be different if land were as scarce as it is in Banjarmasin.

Figure 73 shows the summary of BCR values of moving up sanitation ladders in the three urban study sites. A BCR values of less than 1 indicates that the generated economic

TABLE 55: URBAN AREA (MALANG) EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARING DIFFERENT POINTS ON THE SANITATION LADDER

Efficiency measure	Scenario	Moving from shared latrine to:		Moving from private wet pit latrine to:
		Private septic tank	Communal sewerage	Private septic tank
COST-BENEFIT MEASURES				
Benefits per US$ input (US$)	Optimal	3	0.8	0.7
	Actual	2	0.7	0.6
Internal rate of return (%)	Optimal	90%	3%	0%
	Actual	62%	0%	-2%
Pay-back period	Optimal	2 years 1 month	15 years 3 months	>20 years
	Actual	2 years 7 months	>20 years	>20 years
Net present value (US$)	Optimal	855	(70)	(179)
	Actual	625	(154)	(263)
COST-EFFECTIVENESS MEASURES				
Cost per DALY averted (US$)	Optimal	3,373	3,642	4,521
	Actual	4,030	4,351	5,401
Cost per case averted (US$)	Optimal	24	26	32
	Actual	29	31	38
Cost per death averted (US$)	Optimal	98,870	106,744	132,514
	Actual	118,124	127,532	158,321

Note: Figures in parentheses are negative values

TABLE 56: URBAN AREA (PAYAKUMBUH) EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARING DIFFERENT POINTS ON THE SANITATION LADDER

Efficiency measure	Scenario	Moving from shared latrine to:	Moving from private wet latrine to:
		Private septic tank	Private septic tank
COST-BENEFIT MEASURES			
Benefits per US$ input (US$)	Optimal	1.5	0.6
	Actual	1.0	0.5
Internal rate of return (%)	Optimal	20%	-2%
	Actual	9%	-9%
Pay-back period	Optimal	5 years 9 months	>20 years
	Actual	9 years 11 months	>20 years
Net present value (US$)	Optimal	198	(155)
	Actual	11	(217)
COST-EFFECTIVENESS MEASURES			
Cost per DALY averted (US$)	Optimal	3,572	4,061
	Actual	4,242	4,823
Cost per case averted (US$)	Optimal	18	20
	Actual	21	24
Cost per death averted (US$)	Optimal	84,816	96,433
	Actual	100,732	114,529

Note: Figures in parentheses are negative values

benefit would be less than the incremental cost of moving up the sanitation ladder. However, this does not mean that households should not move up the sanitation ladder, especially given the challenges associated with building some types of sanitation option, and the intangible benefits not quantified in the benefit-cost calculations. The results indicate how important it is that stakeholders, especially local governments, take measures to decrease the investment costs of sanitation options and promote more affordable ones.

At the same time, greater attention needs to be given to raising people's awareness of the importance of having technically sound and comfortable toilets. The aim is to establish awareness among households to voluntarily engage and actively participate in sanitation improvement programs. This in turn will shift the financing burden, from government bearing the whole cost to households contributing to the cost of sanitation.

8.3 SCALING UP RESULTS FOR NATIONAL POLICY MAKING

It has been pointed out in the previous section that the study results do not represent nationwide sanitation situations. Such results should be perceived as indicative outcomes for further exercises to promote evidence-based decision-making in sanitation development. However, the ultimate use of this study is not only the improvement of sanitation decisions in the field sites of the study, but in assessing national policies in the light of the field level results. How different are the selected sites in terms of the underlying characteristics, and how replicable are the sanitation interventions in the rest of the country? These issues are dealt with in turn.

In order to give a brief framework of thinking, Table 57 presents an assessment of some underlying characteristics include economic, social, demographic, cultural, geophysical with respect to the following aspects:

FIGURE 73: ECONOMIC PERFORMANCE OF MOVING UP THE URBAN SANITATION LADDER BENEFIT-COST RATIOS

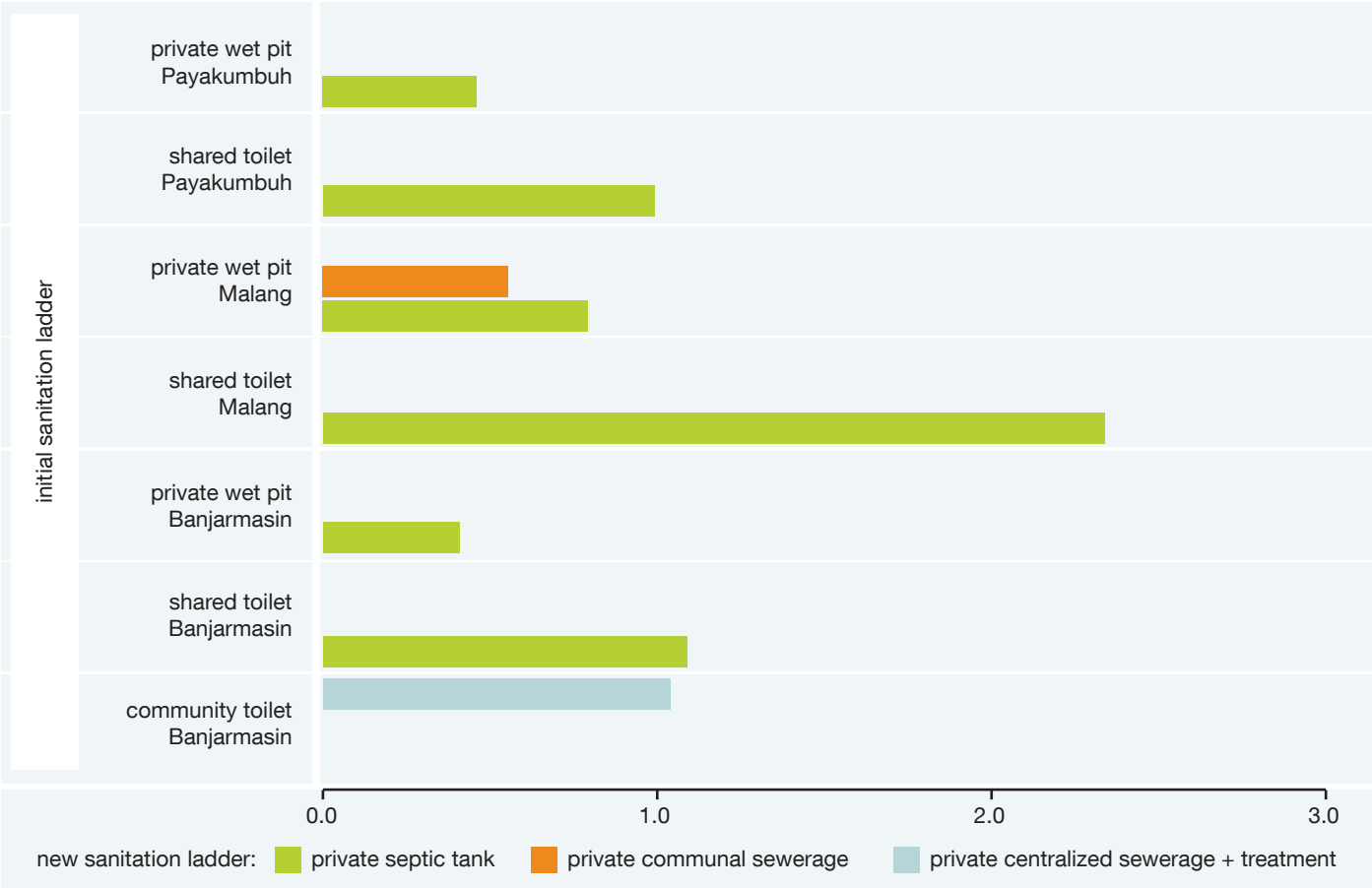


TABLE 57: TYPICAL NATIONWIDE SANITATION SUBGROUPS VERSUS FIELD SITE CHARACTERISTICS

Sites	Population size represented	Climate	Social group	Demographics	Economy	Sanitation coverage
Typical locations						
1. Coastal - lowland (rural)	Moderate to high	– Temp: 22 – 26 °C – Precipitation low to moderate*	Main occupation: - Farming - Fisheries	– Pop density: moderate to high	– Gross Regional Product (GRP): moderate	Moderate
2. Coastal - Lowland (urban)	High	– Temp : 22 – 26°C – Precipitation: moderate	Main occupation: - industry - trading	– Pop density: high	– GRP: high	High
3. Upland - hilly (urban)	Moderate to high	– Temp : 22 – 26°C – -Precipitation: high	Main occupation: - Trading - industry	– Pop density: moderate to high	– GRP: high	High
Field sites						
1. Lamongan (rural) / Coastal lowland rural	1,439,886 (2008)	– Temperature: 20 – 30°C – Precipitation: 2,670 mm/year	Ethnic: Javanese Main occupation: - Farming - Fisheries	– Pop Density: 794 people/ km^2 (2008) – No. of HH : 338,534 HH – Av. farm size: 4 persons/ HH – Av. children < 5: 1 person /HH	– GRP : IDR 5,336,440 per capita/year – Ability / willingness to pay for sanitation option: 0 – 500,000 IDR	46%
2. Tangerang (rural) / coastal lowland rural	3,585,256 (2008)	– Temperature: 23 – 33°C – Precipitation: 1.475 mm/year	Ethnic: Sundanese Main occupation: -Industrial labor	– Pop Density: 3,229 people/km^2 (2008) – No. of HH: 828,645 HH – Av. farm size : 4 persons/ HH – Av. children < 5: 1 person /HH	– GRP : IDR 8,190,000 per capita/year – Ability / willingness to pay for sanitation option: 0 – 500,000 IDR	58%
3. Banjarmasin (city) / Coastal lowland urban	602,725 (2006)	– Temperature: 25 – 38°C – Precipitation: 2.682 mm/year – Flooding occurred during high tide	Ethnic: Banjar Main occupation: - small trading - services	– Pop Density: 8,371 people/km^2 (2006) – No. of HH: 154,527 HH (2006) – Av. Farm size : 4 persons/HH – Av. children < 5: 1 person /HH	– GRP : IDR 8,043,860 per capita/year – Ability / willingness to pay for sanitation option: 0 – 500,000 IDR	44%
4. Malang (city) / upland hilly urban	816,444 (2007)	– Temperature: 23 – 24°C – Precipitation: 1.833 mm/year	Ethnic: Javanese - Madura Main occupation: - small trading - industry - services	– Pop Density: 7,418 people/km^2 (2007) – No. of HH: 250,085 HH – Av. Farm Size: 4 persons/HH – Av. children <5: 1 person /HH	– GRP : IDR 25,161,600 per capita/year – Ability / willingness to pay for sanitation option: 0 – 500,000 IDR	70%
5. Payakumbuh (city) / upland hilly urban	104,969 (2007)	– Temperature: 26°C – Precipitation: 2250 mm/year – Humidity: 45–50%	Ethnic: Minang Main occupation: - small trading - small farmer	– Pop Density: 1,305 people/km^2 (2007) – Number of HH: 24,725 HH – Av. Farm size : 4 persons/HH – Av. children <5: 1 person /HH	– GRP : IDR 12,900,000 per capita/year – Ability / willingness to pay for sanitation option: 0 – 500,000 IDR	49%

Notes: *) Definition by The Meteorology, Climatology and Geophysics Agency (BMKG) Indonesia: Low to moderate precipitation (rainfall): 20 - 50 mm per day, moderate to high precipitation 50-100 mm per day, above high precipitation: above 100 mm per day (http://id.wikipedia.org/wiki/)

- physical location – coastal, lowland/plain, upland, mountainous, etc,
- climatic features such as rainfall, water scarcity, and flooding,
- social groups, ethnicity and related cultural factors affecting acceptance of sanitation options,
- demographics – family size, number of children under five, etc.,
- economic level of living, and ability or willingness to pay for sanitation options; and
- sanitation coverage.

One of the criteria for selection of ESI study sites was to be representative of other parts of Indonesia in terms of geophysical, climatic, demographic and socio-economic characteristics. The sanitation options applied in the field sites of this study are basically common to most national contexts. For example, on-site septic tank and wet pit latrine are the most common sanitation options in any district or city in Indonesia. Urban sewerage and communal sewerage systems, meanwhile, are sanitation options that need further evaluation before they are promoted widely in Indonesia.

A national sanitation program, particularly a scaling up strategy, needs to take into account the appropriateness of sanitation option alternatives. In the past, massive top down delivery mechanisms have been used in programs of centralized government, with limited community participation, leading to low effectiveness and sustainability of the programs. Meanwhile, purely bottom up approaches – waiting for households to make their own choices with little outside intervention – are time consuming and have limited effectiveness. Therefore, there should be a menu of technologies and delivery approaches from which selections can be made and implemented in the most appropriate way for a particular field site. For example, for poor communities still practicing open defecation in Payakumbuh, the CLTS approach has been proven the most effective at the initial stage of sanitation development. At a later stage, the local government shifts the focus to delivering the so-called "One Thousand Toilet Movement" to accelerate toilet ownership among households. This is expected to encourage all households to stop open defecation as soon as possible.

In recent years, the Government of Indonesia, in collaboration with the World Bank's WSP and the Netherlands Government, has delivered the Indonesia Sanitation Sector Development Program (ISSDP). The program involved six cities in the first phase and eight cities in the second phase. The program adopted a new approach for sanitation development which combined top down and bottom up approaches. The top down element is providing facilitation to city governments to develop comprehensive city scale sanitation strategies (CSS), and the bottom up element is encouraging local initiatives by involving all local stakeholders (local government bodies, local parliament, local communities, local private sectors and local communication media) in assessing their own sanitation situation and developing a five-year strategy to improve their city scale sanitation. The approach also uses the existing sanitation condition as the baseline for further development. The ISSDP approach is considered successful and has been adopted as the approach for a nationwide program of sanitation development. A set of comprehensive methods has been developed that enables local governments to design and implement their sanitation development. Banjarmasin, Malang and Payakumbuh – three of the ESI Phase 2 field sites – are among the cities participating in the ISSDP.

In a previous chapter, it was reported that there is an imbalance in the distribution of responsibility in terms of sanitation financing. Households, many of which are poor, bear most of the cost of almost all on site sanitation options. Offsite urban sewerage systems, meanwhile, are largely financed by governments. To establish more of a balance in the distribution of the responsibility for financing among the stakeholders for all sanitation ladder options, requires adequate and appropriate campaigns to raise people's sanitation awareness and advocacy campaigns to get support from stakeholders. Well-planned and well-executed awareness and advocacy campaigns should address challenges in the sector such as financing and government stewardship capacity.

8.4 OVERALL COST-BENEFIT ASSESSMENT

The ESI Phase 1 reported that in 2006 Indonesia lost an estimated IDR56 trillion (US$6.3 billion) annually due to poor sanitation and hygiene. This is equivalent to approximately 2.3% of gross domestic product (GDP). In other words, the country would be able to benefit significantly if sanitation and hygiene were improved.

The ESI Phase 2 Study extends the previous study results by generating robust evidence on the costs and benefits of sanitation improvements in different programmatic and geographic contexts in Indonesia. The benefit analyses focus on household level at study sites as well as national level. The benefit of sanitation improvement at household level involves three main potential benefit value drivers i.e. health costs, time saving, and water access and treatment costs; all of which are presented quantitatively as well as qualitatively (Chapter 4).

Benefit analysis at national level covers the knock-on effects of sanitation improvement on tourism, business and the sanitation supply market, drawing on primary data as well as robust secondary data to make conclusions on the likely economic impacts of sanitation improvements (Chapter 5). Such an analysis enriches the comprehensiveness of the study and provides an increased awareness that sanitation sector may have a broader effect on other economic sectors.

The main output of the ESI Phase 2 study is a set of CBA results covering sanitation as well as hygiene improvement in selected rural and urban areas. It presents a thorough economic benefit analysis of sanitation improvement for all available sanitation ladder options at the study sites. Quantifiable benefits of having improved sanitation options were monetized and evaluated using several economic performance indicators. The analysis included two main types of intervention: (1) from no sanitation option (open defecation) or unimproved option (e.g. hanging toilet) to having any type of improved toilet, whether communal, shared or private; and (2) moving up the sanitation ladder from basic improved to more advanced improved toilets (Chapter 8). Hence, program implementers are provided with robust and detailed figures on which sanitation interventions may be economically viable in any given setting. Such quantitative information may also be used to support an advocacy campaign to get support from stakeholders.

Sanitation improvement options vary from basic level to advanced level options. Each of them delivers specific economic benefits but each also entails a cost. Therefore, this study provides detailed information on sanitation investment costs, which cover physical (capital) and nonphysical (program) costs, as well as operation and maintenance costs for each sanitation option. The figures are also presented on an annual basis in order to have fair and clear comparisons among the available sanitation ladder options at each study site, given that different options have a different expected life span (Chapter 6). Households of different socio-economic levels – from poor to wealthy – can therefore choose which point on the sanitation ladder is appropriate for them, based on their preferences and ability to pay.

In addition to the benefit analysis of sanitation improvement at household level and national level, the study presents a program approach analysis (PPA), which informs program implementers of the importance of implementing programs efficiently (Chapter 7). The PAA involved a structured assessment of selected sanitation programs, presenting results on program effectiveness and the appropriateness of a particular intervention approach with respect to specific geographical characteristics and cultural and socio-economic contexts.

IX. Discussion

9.1 STUDY MESSAGES AND INTERPRETATION

9.1.1 MAIN MESSAGES

The study results at rural sites reveal that all sanitation interventions are economically feasible. The actual benefit-cost ratio or BCR values range from 2.0 (private septic tank in Lamongan district) to 6.0 (community and private pour-flush toilets in Tangerang district). As payback periods are short, the internal rates of return are very high, exceeding 100% in many cases. Therefore, all investments at any level on the sanitation ladder, both at optimal and actual utilization, are economically feasible at rural sites.

At urban sites, all sanitation ladder options are economically feasible at their optimal utilization. The BCR values range from 1.1 for private toilet connected to the sewerage system in Banjarmasin to 4.0 for private wet pit in Malang city. Nevertheless, there are two sanitation ladder options – SANIMAS and private toilet connected to the sewerage system in Banjarmasin – which are not economically feasible at their actual capacity utilization, both with BCR of 0.2. Their actual levels of capacity utilization are 70% and 14%, respectively. These figures are a reminder to program implementers that sanitation interventions require careful planning and implementation.

Given that some people already have some form of sanitation, the decision they face is whether to move further up the sanitation ladder. At rural sites, further investments in sanitation are economically justified, with the following BCR figures:

- Lamongan district: the lowest actual BCR is 2.0 with an annual rate of return of 21% for moving up from private wet latrine to improved private septic tank.
- Tangerang district: the lowest actual BCR is 1.2 with an annual rate of return of 15% for moving up from private wet latrine to improved private septic tank.

At all urban sites, moving up the sanitation ladder from shared latrine to improved private septic tank is economically feasible at both optimal and actual capacity utilization. Other improvement options for moving up the sanitation ladder are not economically feasible, having a BCR of less than 1.

As well as the above quantitative benefits, there are also non-monetized benefits that should be taken into account to justify any sanitation investment. People may consider paying any price to acquire intangible benefits such as:

- The comfort of having a better environment as the result of possessing an improved private toilet.
- More privacy for doing other activities in a toilet room, especially for stay-at-home mothers, such as bathing, female hygiene, washing or cleaning home appliances.
- Economic gains from environmental improvements such as not contaminating groundwater used for drinking water, or improved quality of the neighborhood (e.g. closed rather than open drains transporting sewage).
- Connecting to off-site systems such as communal or urban sewerage systems due to limited space to build a septic tank.
- Larger scale economic benefits from having good sanitation, such as knock-on effects on tourism and business as well as the sanitation supply market.

The benefit value drivers in the quantitative analysis include the costs related to sickness, such as physician's fee, medicines and transport to health facilities, as well as saving time from not traveling to site of open defecation or queuing at public toilets. Marginal benefits have been valued related to

averted pollution of local water sources and reduced travel or treatment costs; however, the actual economic benefits are likely to be significantly greater than those valued in this study. Among the valued benefits, the health benefits will most likely lead to financial savings for households as well as health care providers. Therefore, decreased risks to health as a consequence of having better sanitation would lead to reduced household spending on health-seeking efforts, thus safeguarding cash resources for other uses.

For sanitation financing purposes, benefits can be classified into private and community benefits. Private benefits include direct health benefits (averted transmission between members within the same household), access time savings and intangible benefits of an improved and closer toilet. The community benefits include environmental benefits that are enjoyed by the community as a result of the joint effort of households to improve their sanitation facility as well as community-wide reductions of communicable disease (often termed 'health externalities'). Due to lack of empirical evidence on the distinction between private and community health benefits, disaggregated results were not presented in this study. However, there are clear and established public health arguments for public investment in sanitation to capture the health benefits, of which there are many precedents in countries of the developed world. Furthermore, investment in infrastructure is not enough: public funds also need to be utilized for raising community awareness and motivating households to take action.

Linking the benefits above with gender and their distributional assessment also requires understanding the different benefits for women, men, children and the elderly. In the previous chapter, it was mentioned that husbands are the decision makers when it comes to building and upgrading a sanitation facility, especially for higher cost facilities or facilities that involve disruption such as housing improvements. Therefore, husbands need to become one of the target groups for sensitization on the economic benefits of sanitation investment, to persuade them to invest. However, as housewives, children and the elderly tend to spend more time at home than the husbands, they would be the main beneficiaries of family toilet provision and would gain greater intangible benefits.

9.1.2 ROBUSTNESS OF RESULTS

To undertake the variety of economic calculations in the study, a range of assumptions had to be made as the basis for the analysis. The main assumptions of the quantitative analysis are as follows:

- The health risks posed by those who live in the study sites are assumed to be caused, among other things, by the level of sanitation. Open defecation practice is the most disease-prone option. Private toilet with septic tank and septage management, or toilets connected to sewerage systems with wastewater treatment, have the lowest health risks.
- Time savings from having better sanitation will have economic benefits, whether the time savings are used for wage earning, for non-income productive benefit, or for leisure time. A conservative value of time was used: 30% of the average wage for adults, and half of this value for children.
- Having better sanitation will lead to improved environment quality, which will avert pollution of local water sources and reduce water treatment costs.

The above assumptions may even be conservative under the following conditions:

1. When averted costs from avoided disease cases are greater than their assumed values.
2. Where there exists ample opportunities to earn additional income from the time saved and people are eager to spend their productive time in a productive manner.
3. People's behavior related to water treatment is heavily influenced by water source quality.

On the other hand, the assumptions are considered to be optimistic under the following conditions:

1. Sanitation is not the only factor that affects people's health risk. There may be other factors causing these same diseases, such as the way parents take care of their under-five children, food safety and the hygiene behavior of adults.
2. Not everybody perceives that being higher up the sanitation ladder is preferable, nor does it leads to regular toilet utilization. In sites such as Payakumbuh, some people who have private toilets still regu-

larly defecate in hanging toilets on ponds. Therefore there are some uncertainties in calculating benefits. In order to explore the impact of breakdown in this assumption, the efficiency calculations are presented under different scenarios: optimal versus actual capacity utilization.

3. In a country with relatively high unemployment like Indonesia, there are not many opportunities to profit from the saved time although people are eager to spend the time productively. The opportunities would be far fewer if people were reluctant to spend the time saved productively.
4. People are not aware that having better sanitation makes water treatment simpler and thus potentially reduces its cost.

In order to understand the sensitivity of the results to changes in these assumptions, a sensitivity analysis was conducted on three variables: the value of time, the value of premature death, and the diarrheal disease rate. The selected case study for the sensitivity analysis was the Banjarmasin urban site, presenting values for the sewerage system and the community toilet options. Banjarmasin was selected as the BCR of these sanitation options was the least favorable out of all the sites – hence one can observe whether less pessimistic assumptions would lead to a BCR of greater than unity. The assumptions used for the sensitivity analysis were as follows:

- Value of time: increase to 100% of the average wage for adults, and 50% for children.
- Value of time: using GDP per capita instead of the average wage.
- Value of premature death: substitute the alternative value of statistical life (VOSL) for the human capital approach. This involved adjusting a VOSL from developed countries of US$2 million to Indonesia, based on the difference in income levels.
- Diarrheal disease rate: a rate of twice the baseline estimate is used.

TABLE 58: SENSITIVITY ANALYSIS RESULTS FOR BANJARMASIN SEWERAGE SYSTEM

Efficiency measure	Scenario	Private toilet with off-site treatment at its actual capacity utilization					
			Sensitivity analysis version				
		Baseline analysis value	Increased value of time	Value of time = GDP per capita	Increased value of premature death	Increased baseline diarrheal disease rate	All parameters changed
COST-BENEFIT MEASURES							
Benefits per US$1 input (US$)	Optimal	1.1	2.5	1.7	1.6	1.4	6
	Actual	0.2	0.6	0.4	0.4	0.30	1.3
Internal rate of return (%)	Optimal	12%	70%	32%	28%	20%	>100%
	Actual	<0%	<0%	<0%	<0%	<0%	15%
Pay-back period	Optimal	8 years 2 months	2 years 5 months	4 years 1 month	4 years 6 months	5 years 11 months	11 months
	Actual	>20 years	>20 years	>20 years	>20 years	>20 years	7 years 1 month
Net present value ($)	Optimal	139	227	751	647	380	4,910
	Actual	(2,395)	(89)	(1,950)	(2,024)	(2,219)	1,081
COST-EFFECTIVENESS MEASURES							
Cost per DALY averted (US$)	Optimal	2,548	2,548	2,548	2,548	2,211	2,211
	Actual	10,818	10,818	10,818	10,818	9,389	9,389
Cost per case averted (US$)	Optimal	15	15	15	15	11	11
	Actual	66	66	66	66	47	47
Cost per death averted (US$)	Optimal	81,874	81,874	81,874	81,874	81,874	81,874
	Actual	347,621	347,621	347,621	347,621	347,621	347,621

TABLE 59: SENSITIVITY ANALYSIS RESULTS FOR BANJARMASIN COMMUNITY TOILETS

Efficiency measure	Optimistic scenario	Community toilet with treatment					
			Sensitivity analysis version				
		Baseline analysis value	Increased value of time	Value of time = GDP per capita	Increased value of premature death	Increased baseline diarrheal disease rate	All parameters changed
COST-BENEFIT MEASURES							
Benefits per US$1 input (US$)	Ideal	1.7	2	2	3	2	6
	Actual	1.1	1	2	2	1	4
Internal rate of return (%)	Ideal	21%	32%	34%	38%	31%	173%
	Actual	9%	17%	17%	20%	0	73%
Pay-back period	Optimal	5 years 8 months	4 years 1 month	4 years	3 years 8 months	4 years 3 months	1 year 7 months
	Actual	4 years 1 month	3 years 5 months	3 years 3 months	2 years 11 months	3 years 6 months	1 year 3 months
Net present value ($)	Ideal	272	500	529	599	475	1,805
	Actual	24	184	205	253	166	1,101
COST-EFFECTIVENESS MEASURES							
Cost per DALY averted (US$)	Ideal	1,502	1,502	1,502	1,502	1,302	1,302
	Actual	2,142	2,142	2,142	2,142	1,858	1,858
Cost per case averted (US$)	Ideal	9	9	9	9	7	7
	Actual	13	13	13	13	9	9
Cost per death averted (US$)	Ideal	47,948	47,948	47,948	47,948	47,948	47,948
	Actual	68,399	68,399	68,399	68,399	68,399	68,399

Table 58 and Table 59 show the results for the sewerage system and the community toilets, respectively. According to the sensitivity analysis, the most influencing variable is value of time by changing the average wage of adults to 100% and of children to 50%. However, the change in any single parameter alone does not make the system economically feasible (i.e. BCR > 1) at the actual capacity utilization of centralized system of 14%. The system becomes economically feasible only when all four parameters are changed at the same time. In the case of community toilets, changing the average wage of adults to 100% and of children to 50% produces an economically feasible result.

The results point to the finding that, in order to have efficient and economically feasible sanitation interventions – particularly for sewerage system and community toilets (SANIMAS) – the most important factors are increasing the utilization of the facilities towards the optimal level and increasing the capacity utilization of the treatment facility. The adjustment of assumptions also point to the uncertainty surrounding the benefits obtainable from improved sanitation, and hence their economic feasibility. The choice of conservative input values in the baseline assessment and the omission of several benefits from the quantitative analysis, suggests that the benefit-cost ratios will be higher – possibly significantly higher – than those reported in the baseline assessment.

9.1.3 GENERALIZABILITY OF RESULTS

It has been mentioned that the results of this study do not represent the country-wide sanitation situation. In terms of sanitation coverage, none of the five study sites, each with their own specific characteristics, would be representative of the general rural or urban sanitation situation in such a large country as Indonesia. There will be too many different 'typical' settings, each with their own unique characteristics and each delivering different economic benefits as the result of sanitation intervention. Therefore, the economic analysis results presented here for each site only truly represent the sanitation intervention benefits at that particular site.

However, areas with low improved sanitation coverage, with typical characteristics such as open defecation practices and unprotected ground water sources, are expected to have similar health status and water variables. Likewise, areas with a similar demographics, such as population density, age composition of family members and average wage, will have similar benefits once their sanitation facilities are improved. The fact that the major health benefits are attributed to the population aged five years and under, any settings with significantly lower fertility patterns (and hence fewer young children per household) are likely to have lower benefit-cost ratios. On the other hand, households with more adults will have greater access time savings. Larger households will generally have more favorable economic performance, as the costs are spread amongst more people.

The same observation applies for the tourism and business surveys. A sample of 254 holidaymakers and business visitors and ten companies interviewed cannot possibly represent the more than 6 million tourists visiting Indonesia each year[51] as well as the large numbers of companies located in Indonesia. There will be many different personal opinions about which are the most influential aspects of sanitation. However, in general, the impact of poor sanitation on the enjoyment of stay for tourists and the performance of employee in a business will have similar results. Therefore, the results of this study can provide indicative figures for the benefits of sanitation improvement as a whole.

9.2 UTILIZATION OF RESULTS IN DECISION MAKING

9.2.1 POTENTIAL USES OF RESULTS

Although conducted in only five sites, this study provides hard evidence on the costs and benefits of improved sanitation. These 'indicative results' provide strong advocacy materials to convince stakeholders to increase their spending on sanitation, and to focus greater attention on more efficient program implementation and further scaling up of improved sanitation facilities. Traditionally advocacy material is produced without specific targets and fed into the public domain. The results of this study, on the other hand, provide more specific information for different target groups and different sanitation stakeholders.

For instance, when presenting BCR figures, the household should be a greater focus of advocacy efforts, as is the case with community-led approaches such as CLTS and sanitation marketing approaches such as TSSM. The messages on the economic return of investing in improved sanitation will help convince households to pay more for sanitation to a level of effective demand that will lead to an investment decision.

At national and city/district level, the economic returns together with information from the program approach analysis, the costs of improved sanitation and their sources of financing will support the policy aspects of sanitation development, particularly for the PPSP, which is currently ongoing in Indonesia. For selection of interventions and appropriate technology through a better understanding of costs (investment, recurrent, annual equivalent) and economic returns (annual, short-term, long-term), this study provides in-depth yet practical case studies. The models of analysis have been developed in such way to cover the following issues:

- Enabling the inclusion of **efficiency criteria** in the selection of sanitation options when governments (at central and local level) and/or donors prepare sanitation strategic planning or specific sanitation projects and programs,
- Bringing greater focus on **appropriate technology** through increased understanding of the marginal costs and benefits of moving up the sanitation ladder in different contexts. The policy makers may develop 'stepping stone scenarios' when they prepare community-based sanitation program approaches, which also consider the process of raising awareness on better sanitation in the community.

In order to accelerate progress and meet the government target as well as MDG target on sanitation coverage, the PPSP has calculated that meeting both targets would require a total spend of US$5,356 million within the next five years. At the time of the launch of the program, the government committed to contributing about 30% of the total cost requirement and will seek to mobilize other sources of funding. This study also provides evidence-based

[51] Ministry of Culture and Tourism, 2009.

advocacy to convince all stakeholders that contributing to the total cost of the PPSP is economically feasible and will deliver valuable outcomes for the national economy. Therefore, it can be used to leverage grants to incentivize private investments in sanitation.

In the sanitation program preparation phase, the cost-benefit model in this study can contribute to the design of feasible financing options by identifying program beneficiaries as well as cost incidence of the sanitation program. The program planners can design 'matching' sanitation options and implementation approaches against the beneficiaries' ability to pay and their level of awareness. In the end, it will contribute to optimize program effectiveness.

The sensitivity analysis reveals that the determinants of efficiency are, on the benefit side, health variables, time savings and program performance. On the cost side, they are low investment costs per household reached, low operation and maintenance costs, and efficient program delivery. It is important that such information is well understood by program implementers. A good understanding of the determinants of program efficiency will also help program implementers boost the benefits of sanitation programs.

9.2.2 TRANSLATING EVIDENCE TO ACTIONS

The Sanitation Technical Team (TTPS), which is responsible for formulating policies as well as planning and implementing national sanitation sector development, will be the party that will find the detailed study results most useful. Table 60 presents the TTPS team members as well as other parties/ stakeholders whose areas of responsibility may lead them to use the results of the study.

9.2.3 INTEGRATING ECONOMIC CONSIDERATIONS INTO DECISION MAKING PROCESSES

The development of sanitation in Indonesia has become a national issue. The Government of Indonesia has placed the sanitation developments among the national priorities, declared at the 2nd National Sanitation Conference, December 2009. The Sanitation Technical Team has initiated a national "giant step" of sanitation development through the Acceleration of Settlement Sanitation Development Program (PPSP) 2010-2014. One of the targets is for Indonesia to be free of open defecation by the end of 2014, or earlier.

The first stage out of the six successive and comprehensive PPSP stages[52] is advocacy, which involves awareness-raising in order to create demand for sanitation among national, provincial and city/district governments as well as among end users (communities). Such advocacy requires robust and convincing data and information to convince the campaign targets of importance of sanitation improvement at household level. Therefore:

1. Decision makers at central, provincial and local levels can each utilize the study results as evidence of the economic importance of sanitation, thus leading to demand creation for sanitation.
2. The third stage of the PPSP – City Sanitation Strategy – can use the CBA model to enrich its Environmental Health Risks Assessment (EHRA) study. The outcomes of such a study demonstrate not only indicative health risks of particular areas, but also potential quantitative benefits that might be acquired should the sanitation condition in the areas be improved.
3. During the fourth stage of the PPSP – compilation of detailed technical proposals presenting sanitation programs or project profiles – the study results which can be utilized are the costs of improved sanitation and hygiene, the cost-benefit performance of sanitation investment, and the comparison of program performance, with the aim of securing financing commitments from stakeholders. Each stakeholder is offered the opportunity to take part in the proposed sanitation programs, hence, there ought to be a balance of responsibilities and an optimal blend of contribution among them according to their position and capacity. Local governments can make use of the program approach analysis to help them decide which of the implemented approaches is most appropriate to their local context.

[52] The Organization and Management of the USDP Project, 2010: The six PPSP stages are (1) advocacy, (2) institutional preparation, (3) City Sanitation Strategy, (4) detailed technical proposals, (5) implementation, and (6) monitoring and evaluation.

4. The sixth stage of the PPSP – monitoring and evaluation – can learn from the frameworks used in this study, such as the CBA and PAA models, which are tools to periodically measure performance of sanitation programs during and after implementation. Sanitation financiers and implementers will be able to assess to what extent the implemented sanitation programs have achieved their goals and targets, and the division of the total benefits amongst the different beneficiaries and stakeholders. Therefore, all contributing parties will have a fair assessment of and possess a sense of ownership in the sanitation programs. Hence, in the long run such assessments are expected to increase program sustainability.

TABLE 60: POSSIBLE USE OF STUDY RESULTS BY TTPS TEAM MEMBERS AND STAKEHOLDERS

No.	Party/Agency	Use of Study Results	Functional Activities
1	BAPPENAS	• CBA results • Program costs	Coordinating all national level government agencies in strategic planning and annual budgeting for sanitation sector.
2	Ministry of Public Works (MPW)	• CBA results • Program costs	• National level strategic planning, annual budgeting, technology option development and selection. • Design and implementation of appropriate sanitation options.
3	Ministry of Health (MoH)	• CEA results • Program approach analysis • Intangible benefits	• Coordinating with BAPPENAS and MPW: conducting health component of interventions at national level. • Program approach option development. • Design and implementation of appropriate sanitation approach. • Fostering program effectiveness to its optimal level.
4	Ministry of Home Affair (MoHA)	• Program approach analysis • Program costs	Facilitating all sanitation program implementation including capacity building at provincial and city/district level.
5	Ministry of Finance (MoF)	• CBA results • Program costs • Potential impacts of improved sanitation on tourism, businesses, foreign investment, and sanitation markets	• National level annual budgeting for sanitation sector. • Setting budget allocation for sanitation sector.
6	Decentralized governments	• CBA results • Program costs • Program approach analysis • Intangible benefits • Potential impacts of improved sanitation on tourism, businesses, foreign investment, and sanitation markets	• Strategic planning, annual budgeting, program approach selection at local level. • Implementation of appropriate technology option and sanitation approach. • Achieving optimal program effectiveness. • Sanitation supply assessment at local level. • Developing local potential to provide sanitation supply.
7	Sanitation Donor Group and NGOs	• CBA results • Program costs • Program approach analysis	• Setting budget allocation to support sanitation development.
8	Media	• CBA & CEA results • Program approach analysis • Potential impacts of improved sanitation on tourism, businesses, foreign investment, and sanitation markets • Intangible benefits	• Sensitization and advocacy to all stakeholders • Promoting and campaigning issues such as: - sanitation is no longer private issue, but it is a public shared issue, - there are knock on effects of improved sanitation on tourism, businesses and foreign investment, and sanitation markets
9	Households	• CBA results • Intangible benefits	• Messaging of cost-benefits through sanitation marketing to develop sanitation demand and improve willingness to pay for sanitation provision • Peer social marketing to increase awareness on gender sensitivity that women, children and elderly are the main beneficiary of family toilet provision

One of the challenges in program cost assessment is the difficulty of matching the hardware costs of an intervention with the software costs of the same intervention, given that different sector ministries manage different components of the same sanitation programs. For example, it is difficult to match particular sanitation program costs in the Ministry of Health (software component) with the corresponding programs implemented by the Ministry of Public Works (hardware component) as they were not designed as integrated sanitation programs. Consequently, it is difficult to calculate the total sanitation intervention costs, covering all related software and hardware costs of the sanitation programs. Therefore there is a need to synchronize and synergize all sanitation-related initiatives carried out separately by the various sector ministries.

5. In order to have comprehensive cost figures for any particular sanitation program, it is recommended that all participating parties record and keep information about related program costs and develop calculations for overall program cost. For this purpose, the costs calculation model in this study can be applied, with some adjustments according to program specific contexts.
6. Sanitation programs implemented by different ministries should be coordinated to ensure effective funds disbursement and program implementation. Inter-departmental cooperation in the WSLIC program (Water and Sanitation for Low Income Communities) and ISSDP are very good examples of this. WSLIC 3 (also known as PAMSIMAS), which was funded by the Ministry of Public Works, utilized the CLTS approach developed by the Ministry of Health. ISSDP, which implemented an institutional approach, fostered the creation of the TTPS in 2007. The purpose of the TTPS is to synchronize and coordinate sanitation developments throughout their planning, implementation, monitoring and evaluation processes. Since then, any sanitation related initiatives from sector departments are incorporated into an integrated sanitation development program, which is now called PPSP. ISSDP facilitated 14 cities to develop their city sanitation strategies (CSS). PPSP started in 2010 and will be facilitating 330 cities/districts to develop and implement their CSS during the next five years. With such ambitious targets, and involving many parties and various stakeholders with different levels of awareness, building and maintaining a balanced awareness and understanding and involvement among the stakeholders will be a major challenge for the program.
7. Communication tools should be developed which are easy to understand, are interesting and motivating and hence lead to accelerated awareness and commitments to support sanitation development. The communication tools should include the monetary value of sanitation benefits or CBA figures. It is recommended that the TTPS facilitate local governments (PPSP participants) to conduct these activities in order to monetize the value of sanitation benefits.
8. The CBA figures in this study can be used to trigger initial awareness. The TTPS can then use the CBA model to calculate sanitation cost-benefit performance figures that can be used to develop the CSS in selected cities/districts. Simplified methods and tools are required in order to do this. Once the selected cities/districts have calculated their sanitation cost-benefit figures, they can then help other participating cities/districts to do the same. In doing so, there will be also a period of shared learning among the sector ministries and local governments to assess the economic benefits of sanitation development. The PAA study showed that sanitation program effectiveness is highly influenced by strong campaign, promotion and education for the community. For instance, FGD results in Banjarmasin revealed that some community members did not understand the need for a sewerage system, which has deterred them from connecting to the sewerage system. There may be other influencing factors for the households' willingness to connect, however, such as the government's failure to allocate sufficient funds for program promotion, instead spending the large portion of funds on construction of sanitation

facilities. On the other hand, the CLTS program in Payakumbuh allocated a large portion of funds on community campaign and education as part of the effort to put an end to open defecation, while the cost of sanitation facilities construction were borne by the community. The CLTS program has successfully reduced open defecation in the area.

9. It is very important for governments to allocate sufficient funds for software development to raise people's awareness of sanitation, and not just provide funds for hardware development. Financing the maintenance of the sanitation intervention should also be taken into account in order to ensure its sustainability.
10. Program performance indicators revealed that handwashing with soap after defecation is not common practice in local communities. As mentioned above, community campaigns and education initiatives are very important, especially those targeting health and hygiene behavior. Handwashing with soap as a component of health and hygiene behavior should always be part of a sanitation program. Paying more attention to promoting handwashing with soap will enhance the effectiveness of sanitation programs and enable full capture of the health benefits.

Distribution of the responsibility for financing construction of sanitation facilities is often not balanced. In general, poor people using on-site systems bear the cost of their construction, while urban households with toilets connected to a sewerage system rely on government to build their sanitation facilities. Lack of awareness among urban communities of the importance of improved sanitation at household level is one of the reason behind the imbalance in the distribution of financing responsibilities. An appropriate and easy-to-understand awareness campaign program for stakeholders, especially program beneficiaries, may help to redress the balance.

On the national level, the study also highlights the links between sanitation and productive sectors that are key contributors to sustainable economic growth, such as tourism, business and the sanitation supply market. These findings should be used to sensitize and convince other government departments, such as those responsible for tourism, industry and private sector development, to invest more in sanitation.

9.2.4 SUMMARY RECOMMENDATIONS

This study finds that all sanitation interventions have benefits that exceed costs, when compared with "no sanitation facility." The high net benefits from low-cost sanitation options, such as pit latrines, suggest these technologies should be centerpiece to increasing access for rural households. However, in densely populated areas, pit latrines have limited feasibility, and to improve quality of life in increasingly populous cities, decision makers need to take into account the economic benefits of improved conveyance and treatment options. If funding is available, populations prefer options that transport waste off site. Appropriate treatment and/or isolation of waste is key to the future sustainable development of Indonesia. Based on the findings of this study, three key recommendations for decision makers are proposed:

1. **Intensify efforts to improve access for the entire Indonesian population to improved basic sanitation.** Indonesia approved a sound community-based sanitation strategy in 2008 that needs to be implemented, and enough evidence is available to show that establishing a viable sanitation market – where demand by all income levels meets affordable and good quality supply – is feasible. For policy makers and local governments, this requires special attention to ensure demand is triggered, health benefits are captured, and coverage is sustained (i.e., avoiding a return to open defecation). Sanitation providers, from wholesalers to community-based masons, need to improve on affordable, upgradable latrine structures and design to ensure widespread uptake. Information on sanitation options and models for households everywhere in Indonesia is another key element for rapidly accelerating and sustaining coverage.
2. **Go beyond basic sanitation provision, where the population demands it and the funding is available.** In densely populated urban areas, only basic sanitation provision is no longer feasible due to the higher expectations of populations, space constraints

and risks of groundwater pollution. Decision makers should therefore be aware of the full range of conveyance and treatment options, and their related costs and benefits, in order to avoid investing in expensive technologies that are difficult and costly to sustain. In municipalities where funding is sufficient to permit more sustained and quality services, these will better capture the full environmental and health benefits and respond to the population's wish for a clean, livable environment.

3. **Promote evidence-based sanitation decision-making.** Variations in economic performance of options suggest that careful consideration of site conditions and local demand and preferences is needed to select the most appropriate sanitation option and delivery approach. Decisions should take into account not only the measurable economic costs and benefits, but also other key factors for a decision, including intangible impacts and socio-cultural issues that influence demand and behavior change, availability of suppliers and private financing, and actual household willingness and ability to pay for services.

Bibliography

Buku Pedoman. SANIMAS. Directorate General of Human Settlement, Ministry of Public Works. 2006.

City Sanitation Strategy - Banjarmasin, Pokja Sanitasi Kota Banjarmasin, March 2008.

Community Led Total Sanitation Implementation Report at Payakumbuh. 2008.

Community Led Total Sanitation in Indonesia, Bowo Leksono, Percik Magazine Dec. 2008

Comparative Study on Centralized Wastewater Treatment Plants in Indonesia. ESP USAID. September 2006.

Direktorat Bina Program presentation on policy, strategy, and program of Ministry of Public Works, AMPL. National conference on community based AMPL. November 2009.

Final Report on Quick Review of Poverty Alleviation Program, Government of Indonesia: Program WSLIC-2 and PAMSIMAS, LP3ES. October 2007.

Formative Research Report and Hygiene and Health. ESP USAID & WSP-EAP. September 2006.

Indonesia: Overview of Sanitation and Sewerage Experience and Policy Option. Sukarma & Pollard. 2001.

Indonesia National Program for Community Water Supply and Sanitation Services, Improving Hygiene and Sanitation Behavior Services. Andy Robinson. December 2005.

Institutional Dimensions of Scaling Up of CLTS in Indonesia. Edy Priyono. 2008.

ISSDP Advocacy Materials, Sanitation Development Technical Team (TTPS) of the National Planning Agency (BAPPENAS). 2007.

Jamasy, Owin and Shatifan, Nina. .CLTS – *Learning from Communities in Indonesia*. May 2008.

Kajian Cepat terhadap Program Pengentasan Kemiskinan Pemerintah RI, LP3ES. October 2007.

Mukherjee, Nilanjana and Shatifan, Nina. *The CLTS Story in Indonesia, Empowering communities, transforming institutions, furthering decentralization*. October 2008.

National Policy Development of Community-Based Water Supply and Environmental Sanitation, National Planning Agency. 2003.

Percik Magazine no October 2003, July 2005, April 2007, March 2008, December 2008.

Permasalahan dan Strategi Pembangunan Lingkungan Berkelanjutan Studi Kasus: Cekungan Bandung, Setiawan Wangsaatmaja, Arwin Sabar, dan Maria Angela Novi Prasetiati, Badan Pengendalian Lingkungan Hidup Propinsi Jawa Barat, Departemen Teknik Lingkungan Institut Teknologi Bandung.

Presentation SANIMAS by Dept PU at Loknas AMPL, Jakarta 2-4 November 2009.

Priyono, Edy. *Institutional Dimensions of Scaling up of CLTS in Indonesia*. AKADEMIKA-Center for Public Policy Analysis, Bekasi, Indonesia. December 2008.

Pro Poor Water and Wastewater Management in Small Towns, Sanitation by the Community in Denpasar Indonesia. April 2007.

Riset Kesehatan Dasar (RISKESDAS) 2007, Laporan Nasional 2007, Badan Penelitian dan Pengembangan Kesehatan Departemen Kesehatan, Republik Indonesia. Desember 2008.

Rivany, Ronnie. Indonesian – *Diagnosis Related Group (INA-DRG)*. Department of Health Policy and Analysis, SPHUI. 2008.

Roadmap to Sanitation Development 2010-2014, the Sanitation Development Technical Team (TTPS). Revised Version. 2010.

Robinson, Andy. I*ndonesia National Program for Community Water Supply and Sanitation Services, Improving Hygiene & Sanitation Behavior and Services*. World Bank. 2005.

Sanimas Outcome Monitoring Study. Final Report. WASPOLA. April 2006.

Sanitation White Book Banjarmasin. August 2007.

Sanitation White Book Payakumbuh. 2007.

Sistim Pengolahan Air Limbah Rumah Tangga - Sebuah Sukses Stori Di Desa Tlogo Mas Malang - Direktorat Perkotaan Dan Perdesaan Wilayah Barat Ditjen Tata Perkotaan Dan Tata Perdesaan Departemen Permukiman Dan Prasarana Wilayah, Jakarta. March 2004.

Status Mutu Air Sungai, Studi Kasus Sungai Citarum, Pusat Litbang SDA, Balai Lingkungan Keairan. 2004.

Strategi Nasional Sanitasi Total Berbasis Masyarakat, Depkes RI, Jakarta. 2008.

The Enter of CLTS Approach to Indonesia, Edy/Udin, Percik Magazine. December 2008.

TSSM Project: Indonesia Country Update. June 2009.

University of Indonesia. Study on WSLIC 2 from 2001 – 2006.

Water and Sanitation Program. *Case Study Of the people, by the people, for the people: Community-Based Sewer Systems in Malang, Indonesia*. Foley, Sean; Soedjarwo, Anton; Pollard, Richard. Field note. March 2000.

Water and Sanitation Program. Indonesia, *Overview of Sanitation and Sewerage Experience and Policy Options*. Sukarma, Risyana and Pollard, Richard. 2001.

Water and Sanitation Program. *Economic Impacts of Sanitation in Indonesia A five-country study conducted in Cambodia, Indonesia, Lao PDR, the Philippines, and Vietnam under the Economics of Sanitation Initiative (ESI) Research Report*. August 2008.

Water and Sanitation Program. *Enabling Environment Assessment for Scaling Up Sanitation Programs: East Java, Indonesia*. Robinson, Andy. January 2008.

Water and Sanitation Program. *Opportunities to Improve Sanitation: Situation Assessment of Sanitation in Rural East Java, Indonesia*. Frias, James. April 2008.

Water and Sanitation Program. *Opportunities to Improve Sanitation: Situation Assessment of Sanitation in Rural East Java, Indonesia*. Frias, Jaime. 2008.

Water and Sanitation Program. *Learning At Scale TSSM Project. Indonesia Country Update*. Field Note. June 2009.

Water and Sanitation Program. *Total Sanitation and Sanitation Marketing Project: Indonesia Country Update June 2009*. Field note. August 2009.

Water and Sanitation Program. *Urban Sanitation in Indonesia: Planning for Progress*. Field Note. April 2009.

Annex Tables

ANNEX A. STUDY METHODS
TABLE A 1. SUB-NATIONAL SANITATION COVERAGE RATES, LATEST YEAR (2007)

No.	Province	Private Toilet	Shared Toilet	Community Toilet	No Toilet
1	Riau	79.8	8.5	1.7	9.9
2	Kepulauan Riau	77.8	14.4	1.8	6.0
3	Kalimantan Timur	76.4	9.5	5.2	8.9
4	DKI Jakarta	72.6	20.1	6.7	0.7
5	Sumatra Utara	71.8	6.8	4.0	17.4
6	Sumatra Selatan	65.8	11.1	4.0	19.1
7	DI Yogyakarta	65.4	25.8	0.7	8.2
8	Sulawesi Utara	64.1	16.2	3.4	16.4
9	Lampung	64.1	11.1	1.8	23.0
10	Jambi	63.3	9.6	4.0	23.1
11	Jawa Barat	61.8	12.7	8.7	16.9
12	Nusa Tenggara Timur	60.8	12.1	1.6	25.5
13	Bangka Belitung	60.7	5.0	2.0	32.3
14	Bali	59.5	20.0	0.3	20.2
15	Bengkulu	59.5	9.9	2.4	28.2
16	Kalimantan Selatan	59.3	13.3	9.0	18.4
17	Jawa Tengah	58.7	12.4	3.5	25.4
18	Sulawesi Selatan	58.4	12.6	1.6	27.4
19	Kalimantan Barat	57.9	6.6	3.3	32.2
20	Sulawesi Tenggara	57.7	8.2	2.8	31.2
21	Jawa Timur	57.1	15.3	1.8	25.8
22	Banten	53.3	12.0	2.0	32.8
23	NAD	51.2	8.2	8.4	32.2
24	Kalimantan Tengah	51.1	14.5	8.4	26.1
25	Sumatera Barat	49.1	12.5	7.1	31.2
26	Papua	47.9	11.6	4.2	36.3
27	Maluku	46.5	7.1	7.6	38.9
28	Sulawesi Tengah	45.4	8.1	3.7	42.8
29	Papua Barat	43.3	16.1	13.1	27.5
30	Sulawesi Barat	42.0	7.0	3.1	47.9
31	Maluku Utara	36.8	18.5	7.7	36.9
32	Nusa Tenggara Barat	35.6	13.0	2.3	49.1
33	Gorontalo	31.0	19.2	7.5	42.2
	Indonesia	58.9	12.1	4.2	24.8

Source : Susenas 2007

TABLE A 2. SELECTION OF FIELD SITES FOR THE ECONOMIC STUDY

Program name	Location(s) covered	Implementing agents	
Selected field sites			**Reason for inclusion**
Lamongan District (East Java Province) / WSLIC 2 Project	Sub-district : Turi Villages : Turi, Badurame, Geger, Keben	Ministry of Health	Kabupaten Lamongan has the largest number of households coverage among other location of WSLIC 2 project in Indonesia
Tangerang District (Banten Province) / SANIMAS	Sub-district : Sepatan Villages : Sarakan, Kayu Agung Sub-district : Rajeg Villages : Sukasari, Tanjakan	Ministry of Public Works	SANIMAS project has been implemented in various areas in Indonesia. It is better if the chosen site is located not far away from Jakarta to minimize the survey budget and manage / allocate the spare budget for other locations.
Banjarmasin City (South Kalimantan Province) / Sewerage System	Sub-district : Central Banjarmasin Villages : Pekapuran Laut, Kelayan Luar	Local Government	• The sewerage system in Banjarmasin is one of the few sewerage systems in Indonesia that has a good performance and management • Banjarmasin could be one of the 5 (five) sites locations for the ESI 2 study that is more or less represent typical sanitation conditions on Kalimantan Island. • Some data on the sanitation conditions in Banjarmasin are available already and access to related agencies or officials are easier, regarding the ongoing ISSDP project
Malang City (East Java Province) / CBSS (Sanimas)	Sub-district: Kedung kandang, Lowokwaru Villages : Mergosono, Tlogomas, Aryowinangun, Dinoyo	Local Government Ministry of Public Works	Malang City has a SANIMAS program that is initiated, funded, and managed by the community, and proven successful. The program has been replicated at other locations in the surrounding areas.
Payakumbuh City (West Sumatera Province) / CLTS	Sub-district: North Payakumbuh Villages : Talawi, Kotopanjang, Panyolinyam, Kubu Gadang	Ministry of Health Directorate General of Disease Control and Environmental Health National Planning Agency Ministry of Home Affairs Ministry of General Affairs National Pokja AMPL (National Working Groups)	• Availability of primary data as well as secondary data regarding the pre-intervention conditions such as environmental health survey report and the CLTS Proceeding/ Report • Availability of commitment for a full support from the local government (the Mayor and the Sanitation Working Group) which is indicated by a strong intention and providing required and available relevant data • There is a preliminary indication that having a more attention and commitment from the Local Government for sanitation improvement lead to a significant decrease of health subsidy budget during the last 3 consecutive years • A strong intention from BAPPENAS/ Sanitation Technical Team to include Payakumbuh in the ESI – 2 Study • Kodya Payakumbuh could be one of the 5 (five) site locations for the ESI 2 study that is more or less represent the sanitation condition at Sumatera Island.

TABLE A 2. SELECTION OF FIELD SITES FOR THE ECONOMIC STUDY (CONTINUED)

Program name	Location(s) covered	Implementing agents	
Selected field sites			**Reason for inclusion**
WSLIC 2 : • Sumenep District (East Java Province) • Sampang District (East Java Province) • Mojokerto District (East Java Province)			Although all of the location mentioned have a large number of revolving fund, but the number is still far below Kab. Lamongan. Another thing is the locations mentioned here are all located in East Java province, the same as Kab. Lamongan
SANIMAS : • Denpasar City (Bali Province) • Surakarta City (Central Java Province)			Denpasar and Surakarta City located further from Jakarta compared to Tangerang which could influence the project budget
Sewerage System : • Surakarta City (Central Java Province)			The Surakarta Sewerage System doesn't perform well enough compared to the one in Banjarmasin.
CLTS : • Bogor District (West Java Province) • Muara Enim District (South Sumatera) • Cirebon District (West Java) • Ciamis District (West Java)			• The study meant to represent the condition of Indonesia. Since location from Sumatera Island hasn't been represented, so Kab Bogor, Kab. Cirebon, and Kab. Ciamis (located at Java Island) should be excluded • Kab. Muara Enim could be choosen as study location for CLTS program but Payakumbuh is much more prepared in availability of data, support from local government, and is the chosen location of SanTT

TABLE A 3. ASSESSMENT OF ADVANTAGES AND LIMITATIONS OF DIFFERENT DESIGN OPTIONS

No.	Design	Advantages	Limitations
DESIGNS INVOLVING FIELD DATA COLLECTION			
1	Economic study designed entirely for research purposes, including matching and randomization of comparison groups	• Addresses the specific questions of the research • Highly scientific design	• Expensive and long time period • May not capture health impact • Limited generalisability
2	Economic research attached to other research studies (e.g. randomized clinical trial)	• Captures health impact with degree of precision • Can conduct additional research on other impacts • Add-on research cost is small • Statistical analysis possible	• Expensive and long time period • Few ongoing clinic trials • Requires collaboration from start • Trials may not reflect real conditions • Limited comparison options
3	Economic research attached to pilot study, with or without randomization	• Add-on research cost is small • Options are policy relevant • Matched case-control possible • Can start research in mid-pilot	• Few pilot programs available • Pilots often not designed with scientific evaluation in mind (e.g. before vs. after surveys) • Pilot conditions not real life • Limited comparison options
4	Economic research attached to routine government or NGO/donor programs, without randomization	• Reflects real life conditions (e.g. uptake and practices) • Research addresses key policy questions • Matched case-control possible	• No research infrastructure • No scientific design • Limited comparison options
DESIGNS INVOLVING SECONDARY DATA COLLECTION			
5	Collection of data from a variety of local sources to conduct a modeling study	• Relatively low cost • Short time frame feasible • Can compare several options and settings in research model • Can mix locally available and non-local data	• Results imprecise and uncertain • Actual real-life implementation issues not addressed
6	Extraction of results from previous economic studies	• Low cost • Results available rapidly • Gives overview from various interventions and settings	• Limited relevance and results not trusted by policy makers • Published results themselves may not be precise

TABLE A 4. AGGREGATING EQUATIONS FOR COST-BENEFIT AND COST-EFFECTIVENESS ANALYSIS

Cost-Benefit Analysis:

1) **Benefit-cost ratios (BCR)**
   - o BCR (benefit cost ratio = PVB / PVC) where PVB = Present Value of Benefit and PVC = Present Value of Cost
   - o It has to present an answer to the question: "Are the benefits greater than the costs

2) **Net present value (NPV)**
   - o NPV is the sum of all terms of discounted cash inflow/outflow (present value or PV)

$$PV = NCF_t /(1+i)_t$$

where

- o t - the time of the cash flow
- o i - the discount rate (the rate of return that could be earned on an investment in the financial markets with similar risk.)
- o NCFt is the net cash flow (the amount of cash, inflow minus outflow) at time t.
- o It provides an answer to the question: "What the investment worth is in today's money? "

3) **Internal rate of return (IRR):** Given the (period, cash flow) pairs (n, Cn) where n is a positive integer, the total number of periods N, and the net present value NPV, the internal rate of return is given by r in:

$$NPV = \sum_{n=0}^{N} \frac{C_n}{(1+r)^n} = 0$$

TABLE A 5. METHODOLOGY FOR BENEFIT ESTIMATION (CALCULATIONS, DATA SOURCES, EXPLANATIONS)

Impacts included	Variable	Data sources	Specific value/comment
1. HEALTH *(All calculations are made using disaggregated data inputs on disease and age grouping: 0-4 years, 5-14 years, 15+ years)*			
1.1 Health care savings *Calculation:* *[Prevalence or incidence X Attribution to poor sanitation X ((% seeking outpatient care X visits per case X unit cost per visit (medical and patient)) + (Inpatient admission rate X days per case X unit cost per day (medical and patient))] X Proportion of disease cases averted*	Diarrheal disease incidence (0-4 years)	DHS	
	Diarrheal disease incidence (over 5 years)	WHO stats	
	Helminthes prevalence	Global review	
	Hepatitis A and E incidence	National health statistics	
	Indirect diseases incidence (malaria, ALRI)	WHO statistics	
	Malnutrition prevalence	UNICEF/WHO statistics	
	Scabies and trachoma Incidence	National health statistics	
	Attribution of fecal-oral diseases to poor sanitation	WHO (Prüss et al. 2002)	Value = 88%
	Attribution of helminthes to poor sanitation	Global review	Value = 100%
	% disease cases seeking health care	DHS, SES, ESI household survey, health statistics	
	Outpatient visits per patient	Health facility statistics, ESI household survey	
	Inpatient admission rate		
	Inpatient days per admission		
	Health service unit costs		
	Other patient costs (transport, food)	ESI household survey	
	% disease cases averted	International literature review	See Annex B for review
1.2 Health morbidity-related productivity gains *Calculation:* *[Prevalence X Attribution to poor sanitation X Days off productive activities X Value of time] X Proportion of disease cases averted*	Days off productive activities	ESI household survey	
	Basis of time value: GDP per capita	National economic data World Bank data	Average product per capita (at sub-national level, where available) – 30% for adults, 15% for children
1.3 Premature mortality savings *Calculation:* *[Mortality rate X Attribution to poor sanitation X Value of life] X Proportion of disease cases averted*	Mortality rate (all diseases)	WHO statistics	(cross-checked with local stats)
	Basis of time value: GDP per capita	National economic data World Bank data	Annual value of lost production of working adults (human capital approach) , from the time of death until the end of (what would have been) their productive life
	Discount rate for future earnings	National governments	Cost of capital estimate (8%)
	Long-term economic growth	Assumption	
	Value-of-statistical-life	Developed country studies	Adjusted to local purchasing power by multiplying by GDP per capita differential

TABLE A 5. METHODOLOGY FOR BENEFIT ESTIMATION (CALCULATIONS, DATA SOURCES, EXPLANATIONS) (CONTINUED)

Impacts included	Variable	Data sources	Specific value/comment
1.4 Disability-adjusted life-years (DALY) averted *Calculation:* *DALY = YLD+YLL* *YLD: discounted disability based on weight and years equivalent time* *YLL: discounted future years of healthy life lost*	Duration of disability	ESI household survey	based on average length of each disease
	Disability weighting	WHO burden of disease project	
	Healthy life expectancy	WHO statistics	
	Discount rate for future disease burdens	National governments	Cost of capital estimate (8%)
	Morbidity and mortality rates	Various: see 1.1 and 1.3 (above)	
2. WATER (for household use) *(weighted average costs were estimated for each water source and for each household water treatment method)*			
2.1 Household water access savings *Calculation:* *Annual costs X % costs reduced, per water source*	Drinking water sources (%) in wet and dry seasons	ESI household survey	
	Annual financial cost per household, per water source	ESI household survey; ESI market survey	
	Annual non-financial cost per household, per water source	ESI household survey	
	Proportion of access cost reduction under scenario of 100% improved sanitation, per water source	ESI household survey; assumption	
2.2 Household water treatment savings *Calculation:* *(% households treating water per method X annual cost) X % households who stop treating*	Proportion of households treating their water, by method	ESI household survey	Validated by other national statistics (DHS, SES)
	Full annual cost per water treatment method	ESI household survey; ESI market survey	
	Proportion of households currently treating who stop treating under scenario of 100% improved sanitation	ESI household survey; assumption	As well as stopping to treat, households may switch to an alternative – cheaper – treatment method if the cleaner water sources enable different water purification methods
3. ACCESS TIME SAVINGS *(weighted average costs estimated for each age category and gender – young children, children and male and female adults)*			
Calculation: *% household members using OD X Time saved per trip due to private toilet X average trips per day X value of time*	Household composition (demographics)	ESI household survey	
	Sanitation practice, by age group	ESI household survey	
	Average round trip time to access site of open defecation	ESI household survey	For households moving from shared to private toilet, access time to shared toilets is used instead of OD
	Average number of round trips to defecation site per day	ESI household survey	
	Basis of time value: GDP per capita	National economic data World Bank data	Average product per capita (at sub-national level, where available) – 30% for adults, 15% for children

TABLE A 5. METHODOLOGY FOR BENEFIT ESTIMATION (CALCULATIONS, DATA SOURCES, EXPLANATIONS) (CONTINUED)

Impacts included	Variable	Data sources	Specific value/comment
4. EXCRETA REUSE GAINS *(reuse of excreta as fertilizer from either UDDT or double-vault pit latrine; and reuse of energy value from biogas digester)*			
Calculation: (% households using product themselves X value in own use) + (% households selling product X selling price)	% households using reuse methods	ESI household survey	
	% households using product themselves	ESI household survey	
	% households selling product to others	ESI household survey	
	Selling price	ESI household & market survey	
	Value in own use	ESI market survey; assumption	

TABLE A 6. DISEASES LINKED TO POOR SANITATION AND HYGIENE, AND PRIMARY TRANSMISSION ROUTES AND VEHICLES

Disease	Pathogen	Primary transmission route	Vehicle
DIARRHEAL DISEASES (GASTROINTESTINAL TRACT INFECTIONS)			
Rotavirus diarrhea	Virus	Fecal-oral	Water, person-to-person
Typhoid/ paratyphoid	Bacterium	Fecal-oral and urine-oral	Food, water + person-person
Vibrio cholera	Bacterium	Fecal-oral	Water, food
Escherichia Coli	Bacterium	Fecal-oral	Food, water + person-person
Amebiasis (amebic dysentery)	Protozoa [1]	Fecal-oral	Person-person, food, water, animal feces
Giardiasis	Protozoa [1]	Fecal-oral	Person-person, water (animals)
Salmonellosis	Bacterium	Fecal-oral	Food
Shigellosis	Bacterium	Fecal-oral	Person-person +food, water
Campylobacter Enteritis	Bacterium	Fecal-oral	Food, animal feces
Helicobacter pylori	Bacterium	Fecal-oral	Person-person + food, water
Protozoa			
Other viruses [2]	Virus	Fecal-oral	Person-person, food, water
Malnutrition	Caused by diarrheal disease and helminthes		
HELMINTHES (WORMS)			
Intestinal nematodes [3]	Roundworm	Fecal-oral	Person-person + soil, raw fish
Digenetic trematodes (e.g. Schistosomiasis Japonicum)	Flukes (parasite)	Fecal/urine-oral; fecal-skin	Water and soil (snails)
Cestodes	Tapeworm	Fecal-oral	Person-person + raw fish
EYE DISEASES			
Trachoma	Bacterium	Fecal-eye	Person-person, via flies, fomites, coughing
Adenoviruses (conjunctivitis)	Protozoa [1]	Fecal-eye	Person-person
SKIN DISEASES			
Ringworm (Tinea)	Fungus (Ectoparasite)	Touch	Person-person
Scabies	Fungus (Ectoparasite)	Touch	Person-person, sharing bed and clothing
OTHER DISEASES			
Hepatitis A	Virus	Fecal-oral	Person-person, food (especially shellfish), water
Hepatitis E	Virus	Fecal-oral	Water
Poliomyelitis	Virus	Fecal-oral, oral-oral	Person-person
Leptospirosis	Bacterium	Animal urine-oral	Water and soil-swamps, rice fields, mud

Sources: WHO http://www.who.int/water_sanitation_health/en/ and [75, 76]

[1] There are several other protozoa-based causes of GIT, including
- Balantidium coli – dysentery, intestinal ulcers
- Cryptosporidium parvum - gastrointestinal infections
- Cyclospora cayetanensis - gastrointestinal infections
- Dientamoeba fragilis – mild diarrhea
- Isospora belli / hominus – intestinal parasites, gastrointestinal infections

[2] Other viruses include:
- Adenovirus – respiratory and gastrointestinal infections
- Astrovirus – gastrointestinal infections
- Calicivirus – gastrointestinal infections
- Norwalk viruses – gastrointestinal infections
- Reovirus – respiratory and gastrointestinal infections

[3] Intestinal nematodes include:
- Ascariasis (roundworm - soil)
- Trichuriasis trichiura (whipworm)
- Ancylostoma duodenale / Necator americanus (hookworm)
- Intestinal Capillariasis (raw freshwater fish in Philippines)

TABLE A 7. WATER QUALITY MEASUREMENT PARAMETERS

Parameter	Test
E-coli (cfu/100 ml)	Coliscan
Biological Oxygen Demand (BOD_5) (mg/L)	5 day incubation
Chemical Oxygen Demand (COD) (mg/L)	5 day incubation
Dissolved Oxygen (DO) (mg/L)	Hach DO Probe
Nitrate (NO^{3-}) (mg/L)	Hach Photometer
Ammonia (NH^4)	Hach Photometer
Conductivity (µS/cm)	YSI Conductivity Meter
Turbidity (NTU)	TurbidiMeter
pH	pH Probe
Water temperature (°C)	Hach ThermoProbe
Residual chlorine (Cl) (in places provided with centralized chlorinated water supply) (mg/L)	Field Kit

TABLE A 8. HOUSEHOLDS SAMPLED VERSUS TOTAL HOUSEHOLDS PER VILLAGE/COMMUNITY

Site	Sampling of households	Sewerage/STF		Septic tank	Wet pit latrine	Dry pit latrine	Shared	Public	OD	Total
		With treatment	Without treatment							
Lamongan	Sample			140	26	34	72		28	300
	Total			300	300	300	300		300	
	% sampled		%	47%	9%	11%	24%	%	9%	%
Tangerang	Sample			85	28	7	26	23	131	300
	Total			300	300	300	300	300	300	
	% sampled	%	%	28%	9%	2%	9%	8%	44%	%
Banjarmasin	Sample	46		165	1	19	33	16	20	300
	Total	300		300	300	300	300	300	300	
	% sampled	15%	%	55%	0%	6%	11%	5%	7%	%
Malang	Sample	137		36	21	61	32		13	300
	Total	300		300	300	300	300		300	
	% sampled	46%	%	12%	7%	20%	11%	%	4%	%
Payakumbuh	Sample			117	3	11	27	15	127	300
	Total			300	300	300	300	300	300	
	% sampled	%	%	39%	1%	4%	9%	5%	42%	%
Total	Sample	**183**		**543**	**79**	**132**	**190**	**54**	**319**	**1500**
	Total	**1500**		**1500**	**1500**	**1500**	**1500**	**1500**	**1500**	
	% sampled	**12%**	%	**36%**	**5%**	**9%**	**13%**	**4%**	**21%**	%

TABLE A 9. SAMPLE SIZES OF OTHER SURVEYS IN STUDY SITES

Site	Group	Focus Group Discussion			Physical location surveys	Health facilities	
		Women[1]	Men[2]	Other groups[3]		Hospital	Clinic
Lamongan	Unimproved	4 x 3	4 x 3	7 x 3	Subdistrict Turi	• Local Public Hospital • Puskesmas Turi	
	Improved	4 x 3	4 x 3				
	Sub-total	24 persons	24 persons	21			
Tangerang	Unimproved	4 x 3	4 x 3	7 x 3	• Subdistrict Sepatan • Subdistrict Rajeg	• Local Public Hospital • Puskesmas Sepatan • Puskesmas Rajeg	• Polyclinic Sepatan Sarana Medika • Dr. Ashari's Clinic at Rajeg • 6 physician practices
	Improved	4 x 3	4 x 3				
	Sub-total	24 persons	24 persons	21			
Banjarmasin	Unimproved	4 x 3	4 x 3	7 x 3	• Subdistrict Central Banjarmasin	• Puskesmas Gadang Hanyar • Puskesmas Cempaka	
	Improved	4 x 3	4 x 3				
	Sub-total	24 persons	24 persons	21			
Malang	Unimproved	4 x 3	4 x 3	7 x 3	• Subdistrict Kedung kandang • Subdistrict Lowokwaru	• Local Public Hospital Saiful Anwar • Puskesmas Arjowinangun • Puskesmas Dinoyo	• 4 physician practices
	Improved	4 x 3	4 x 3				
	Sub-total	24	24	21			
Payakumbuh	Unimproved	4 x 3	4 x 3	7 x 3	Subdistrict North Payakumbuh	• 2 community health centres in North Payakumbuh Subdistrict (Puskesmas Tarok and Puskesmas Lampasi)	
	Improved	4 x 3	4 x 3				
	Sub-total	24	24	21			
Total	Unimproved	60	60				
	Improved	60	60				
	Total	120	120	105			

[1] 4 x 3 means 4 persons x 3 sessions
[2] idem
[3] 7 x 3 means 7 persons x 3 sessions
[4] public health centre

TABLE A 10. SELECTION OF PROGRAMS FOR PROGRAM APPROACH ANALYSIS

Program name	Location(s) covered	Implementing agents	
Selected programs			**Reason for inclusion**
WSLIC 2	South Sumatera, West Sumatera, NTB, East Java, West Java, Babel, South Sulawesi, West Sulawesi	Ministry of Health	• One Community Based Sanitation Program that used revolving fund scheme • Program has finished and thus program data are more complete
SANIMAS	South Sumatera, West Sumatera, NTB, East Java, West Java, Babel, South Sulawesi, West Sulawesi	Ministry of Public Works	One of Community Based Sanitation Program in Indonesia that has been implemented in almost all provinces in Indonesia.
Sewerage System	Bandung (West Java),Banjarmasin (South Kalimantan), Balikpapan (East Kalimantan), Jakarta (Jakarta), Medan (North Sumatera), Solo (Central Java), Tangerang (Banten), Yogyakarta (Yogyakarta)	Local water supply utilities/local health authority/PD PAL	Represents city scale off- site sanitation system
CBSS / Sanimas Malang	Malang City :	Local government/ Ministry of Public Works	• Example of program that is initiated, funded, and managed by the community • The initiator, Pak Agus Gunarto has received a presidential award for his effort in creating a sanitation model/system in his village. He also encourages other communities in the near village to establish their own system.
CLTS	West Sumatera, South Sumatera, Jambi, West Java, Banten, East Java, West Kalimantan, Nusa Tenggara Barat,	Ministry of Health	A promising community based sanitation program, which is different from other programs because no subsidy is given for the physical development
Non-selected programs			**Reason for exclusion**
Community Water Services and Health (CWSH)			Project is still on going (has just started). The Project has been delayed because of regulation changes on loan mechanism and foreign loan from Department of Finance (KMK 35)
Rural Water Supply and Sanitation in NTT Province (ProAir)			Focus more on clean water supply

ANNEX B. HEALTH IMPACT

TABLE B 1. RATES PER POPULATION FOR CASES OF DISEASE

	Average rural sites	Average urban sites	Lamongan	Tangerang	Banjarmasin	Malang	Payakumbuh
Direct diseases							
Mild diarrhea	8.43	3.16	10.81	6.05	3.37	2.66	3.45
Severe diarrhea	5.30	2.38	7.62	2.99	0.95	1.66	4.54
Helminthes	1.83	1.84	1.81	1.84	1.85	1.82	1.86
Scabies		3.70				7.57	3.52
Indirect diseases							
ALRI	2.41	2.09	1.65	3.17	4.18	1.81	0.27
Total	**17.96**	**13.17**	**21.89**	**14.04**	**10.35**	**15.50**	**13.64**

TABLE B 2. RATES PER 1000 POPULATION FOR DEATHS

	Average rural sites	Average urban sites	Lamongan	Tangerang	Banjarmasin	Malang	Payakumbuh
Direct diseases							
Diarrhea	1.5	1.7	1.4	1.6	1.6	1.7	1.8
Helminthes	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Indirect diseases							
Malnutrition	0.00	0.02	0.00	0.01	0.06	0.01	0.01
ALRI	0.38	0.42	0.36	0.40	0.42	0.38	0.48
Measles	0.17	0.19	0.16	0.18	0.18	0.17	0.21
Other indirect	0.01	0.05	0.01	0.01	0.12	0.01	0.01
Total	**2.06**	**2.41**	**1.97**	**2.16**	**2.42**	**2.26**	**2.54**

TABLE B 3. RATES PER 1000 POPULATION FOR DALYS

	Average rural sites	Average urban sites	Lamongan	Tangerang	Banjarmasin	Malang	Payakumbuh
Direct diseases							
Mild diarrhea	0.06	0.02	0.09	0.03	0.02	0.02	0.00
Severe diarrhea	0.03	0.01	0.04	0.02	0.01	0.01	0.03
Helminthes	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Scabies	0.00	0.00	0.00	0.00	-	0.01	0.00
Indirect diseases							
Malnutrition	0.000	0.000	0.000	0.000	0.001	0.000	0.000
ALRI	0.014	0.013	0.011	0.017	0.021	0.012	0.007
Measles	0.002	0.002	0.002	0.002	0.002	0.002	0.003
Other indirect	0.000	0.001	0.000	0.000	0.002	0.000	0.000
Total	**0.12**	**0.06**	**0.16**	**0.08**	**0.07**	**0.07**	**0.05**

TABLE B 4. COMPARISON OF DATA SOURCES FOR SELECTED DISEASES

Disease	Age	Data source	Type of data	Data value
				Lamongan
Diarrhea (mild)	Under 5	ESI Survey		
		INA-DR +COT[1]	Unit cost of Inpatient Health Care/day	• Public facility: 350 • Private facility: 480
		Local Public Hospital – Lamongan District	Rate of inpatient admission	16.9%
		OTC Medicines[2]	Pharmacy	10
	Age 5-14	ESI Survey		
		Local Public Hospital – Lamongan District	Rate of inpatient admission	10.3%
		INA-DR +COT	Unit cost of Inpatient Health Care/day	• Public facility: 381 • Private facility: 511
		OTC Medicines	Pharmacy	10
	Age 15+	ESI Survey		
		INA-DR +COT	Unit cost of Inpatient Health Care/day	• Public facility: 381 • Private facility: 511
		Local Public Hospital – Lamongan District	Rate of inpatient admission	8.7%
		OTC Medicines	Pharmacy	10
Diarrhea (severe)	Under 5	ESI Survey		
		INA-DR +COT[1]	Unit cost of Inpatient Health Care/day	• Public facility: 349 • Private facility: 479
		Local Public Hospital Lamongan District	Rate of inpatient admission	2.27%
	Age 5-14	ESI Survey		
		INA-DR +COT	Unit cost of Inpatient Health Care/day	• Public facility: 346 • Private facility: 476
		Local Public Hospital Lamongan District	Rate of inpatient admission	2.03%
		OTC Medicines	Pharmacy	13
	Age 15+	ESI Survey		
		INA-DR +COT	Unit cost of Inpatient Health Care/day	• Public facility: 346 • Private facility: 476
		Local Public Hospital Lamongan District	Rate of inpatient admission	1.8%
Scabies	Under 5	Local Public Hospital Lamongan District	Rate of inpatient admission	1.8%
	Age 5-14	Local Public Hospital Lamongan District	Rate of inpatient admission	1.4%
	Age 15+	Local Public Hospital Lamongan District	Rate of inpatient admission	0.7%
Malnutrition	Under 5	ESI Survey		
	Age 5-14	ESI Survey		
	Age 15+	ESI Survey		
Malaria	Under 5	ESI Survey		
	Age 5-14	ESI Survey		
	Age 15+	ESI Survey		
ALRI	Under 5	ESI Survey		
		Local Public Hospital Lamongan District	Rate of inpatient admission	11.74%
		INA-DR +COT	Unit cost of Inpatient Health Care/day	• Public facility: 277 • Private facility: 407

TABLE B 4. COMPARISON OF DATA SOURCES FOR SELECTED DISEASES (CONTINUED)

Disease	Age	Data source	Type of data	Data value
				Lamongan
		OTC Medicines	Pharmacy	27
	Age 5-14	ESI Survey		
		Local Public Hospital Lamongan District	Rate of inpatient admission	11.09%
		INA-DR +COT	Unit cost of Inpatient Health Care/day	• Public facility: 277 • Private facility: 407
		OTC Medicines	Pharmacy	27
	Age 15+	ESI Survey		
		Local Public Hospital Lamongan District	Rate of inpatient admission	8.22%
		INA-DR +COT	Unit cost of Inpatient Health Care/day	• Public facility: 254 • Private facility: 384
		OTC Medicines	Pharmacy	25
Hepatitis A,E	Under 5	ESI Survey		
	Age 5-14	ESI Survey		
	Age 15+	ESI Survey		

Remarks:
[1] INA –DRG - COT = Indonesia - Diagnosis Related Group – Cost of Treatment
[2] OTC Medicines = Over the Counter Medicines

TABLE B 5. DIARRHEAL INCIDENCE IN THE PAST YEAR (OR 2 WEEKS) IN ALL FIELD SITES, BY OPTION

Sanitation coverage	Households in sample	Age group			Total	Significant difference with OD
		<5	5-14	15+		
Open defecation	1570	20.9	23.2	20.2	20.8	0.072
Shared/public	304	4.5	3.4	4.0	4.0	0.362
Dry pit	784	11.5	11.2	9.8	10.4	0.083
Wet pit	517	6.9	6.6	6.9	6.9	0.940
Septic tank	2984	39.8	39.4	39.6	39.8	0.980
Sewerage	720	9.8	8.6	9.7	9.6	0.500

TABLE B 6. EVIDENCE ON TREATMENT SEEKING BEHAVIOR FOR OTHER DISEASES

Data source by disease. rural/ urban and year	Observations	% seeking treatment from					other provider	Total
		Public provider	Private formal clinic	Private informal care	Pharmacy	Self-treatment		
DIARRHEA DISEASE MILD								
ESI Survey 0-4 years old Rural 2009		11%	24.1%	2.7%	0%	0.6%	0.0%	38%
ESI Survey 4-15 years old Rural 2009		8%	16%	3%	2%	3%	0.7%	32%
ESI Survey 15+ years Rural 2009		3%	6%	1%	0%	12%	1.0%	23%
DIARRHEA DISEASE SEVERE								
ESI Survey 0-4 years old Rural 2009		31.9%	9%	0%	0%	0.0%		40.7%
ESI Survey 4-15 years old Rural 2009		15.5%	17.3%	3.0%	0%	1.7%		37.5%
ESI Survey 15+ years Rural 2009		5.9%	22.3%	5%	0%	4.9%		37.7%
INDIRECT : ALRI								
ESI Survey 0-4 years old Rural 2009		19.2%	16.0%	0.0%	0%	0.0%		35.2%
ESI Survey 4-15 years old Rural Year of data		12.3%	5.9%	0%	0%	0%		18.2%
ESI Survey 15+ years Rural 2009		9.8%	8.4%	4.1%	0%	4.9%		27.2%

TABLE B 6. EVIDENCE ON TREATMENT SEEKING BEHAVIOR FOR OTHER DISEASES (CONTINUED)

Data source by disease. rural/ urban and year	Observations	% seeking treatment from					other provider	Total
		Public provider	Private formal clinic	Private informal care	Pharmacy	Self-treatment		
DIARRHEA DISEASE MILD								
ESI Survey 0-4 years old Urban 2009		21.2%	21.4%	0.7%	0%	2.5%		45.7%
ESI Survey 4-15 years old Urban Year of data		11.2%	13.4%	0%	1%	3%		29.1%
ESI Survey 15+ years Urban 2009		10.1%	8.5%	2.7%	1%	3.4%		25.6%
DIARRHEA DISEASE SEVERE								
ESI Survey 0-4 years old Urban 2009		20.4%	15.2%	0.2%	0%	0.0%		35.8%
ESI Survey 4-15 years old Urban Year of data		9.2%	13.7%	2%	0%	0%		24.5%
ESI Survey 15+ years Urban 2009		12.5%	12.8%	4.6%	0%	1.7%		31.7%
INDIRECT : ALRI								
ESI Survey 0-4 years old Urban 2009		27.6%	9.7%	3.5%	0%	13.3%		54.2%
ESI Survey 4-15 years old Urban Year of data		13.8%	8.5%	0%	0%	4%		26.4%
ESI Survey 15+ years Urban 2009		11.4%	8.2%	5.7%	0.0%	6.7%		32.0%

TABLE B 7. UNIT COSTS ASSOCIATED WITH TREATMENT OF *SEVERE DIARRHEA* DISEASE (USD 2009)

Health provider	Outpatient cost (US$)		Inpatient cost (US$)		
	Health care	Incidentals[1]	ALOS[2]	Health care[3]	Incidentals[1]
Public/NGO					
Rural (ref)	9.63	1.85	0.39	33.41	0.48
Urban (ref)	9.63	1.94	0.42	33.41	0.48
Private formal					
Rural (ref)	19.25	1.85	0.39	45.92	0.48
Urban (ref)	19.25	1.94	0.42	45.92	0.48
Informal					
Rural (ref)	4.81	-	-	-	-
Urban (ref)	4.81	-	-	-	-

[1] Incidentals: non-health patient costs such as transport, food, and incidental expenses, per outpatient visit and per inpatient stay.
[2] ALOS: average length of stay.
[3] Inpatient health care costs are presented per stay

TABLE B 8. UNIT COSTS ASSOCIATED WITH TREATMENT OF *ALRI* (US$, 2009)

Health provider	Outpatient cost (US$)		Inpatient cost (US$)		
	Health care	Incidentals[1]	ALOS[2]	Health care[3]	Incidentals[1]
Public/NGO					
Rural (ref)	6.42	1.96	0.29	25.93	0.70
Urban (ref)	6.42	1.80	0.35	25.93	0.70
Private formal					
Rural (ref)	19.25	1.96	0.29	38.45	0.70
Urban (ref)	19.25	1.80	0.35	38.45	0.70
Informal					
Rural (ref)	0.0	-	-	-	-
Urban (ref)	0.0	-	-	-	-

[1] Incidentals: non-health patient costs such as transport, food, and incidental expenses, per outpatient visit and per inpatient stay.
[2] ALOS: average length of stay.
[3] Inpatient health care costs are presented per stay

TABLE B 9. UNIT COSTS ASSOCIATED WITH TREATMENT OF *MILD DIARRHEA* DISEASE (US$, 2009)

Health provider	Outpatient cost (US$)		Inpatient cost (US$)		
	Health care	Incidentals[1]	ALOS[2]	Health care[3]	Incidentals[1]
Public/NGO					
Rural (ref)	6.42	1.96	0.26	35.69	0.64
Urban (ref)	6.42	1.80	0.33	35.69	0.64
Private formal					
Rural (ref)	14.44	2.31	0.26	48.20	0.64
Urban (ref)	14.44	1.80	0.33	48.20	0.64
Informal					
Rural (ref)	2.89	-	-	-	-
Urban (ref)	2.89	-	-	-	-

[1] Incidentals: non-health patient costs such as transport, food, and incidental expenses, per outpatient visit and per inpatient stay.
[2] ALOS: average length of stay.
[3] Inpatient health care costs are presented per stay

ANNEX C. WATER QUALITY IMPACT

TABLE C 1. WATER QUALITY MEASUREMENT RESULTS

Sample No.	Turbidity (NTU)	Nitrate (mg/ liter)	Ammonia (as NH3)	Ammonia Max. Limit (Gov.Reg.)	pH	Sample Location	Source
1				0.5		Banjarmasin	Piped Water
2				0.5			Piped Water
3				0.5			Piped Water
4	18.9	7.9	0.92	0.5	6.69		Surface
5				0.5			Piped Water
6				0.5			Piped Water
7	0	0.44	0.23	0.5	6.85	Payakumbuh	Surface
8	0	0.77	0.23	0.5	6.16		Surface
9	0	0.32	0.25	0.5	7.76		Surface
10	0	0.33	34	0.5	7.11		Surface
11	11.2	2.3	0.12	0.5	5.22		Surface
12				0.5			Piped Water
13				0.5			Dug well
14				0.5			Dug well
15				0.5		Malang City	Piped Water
16				0.5			Piped Water
17				0.5			Piped Water
18			0.017	0.5			Borehole
19			0.09	0.5			Borehole
20	0	60.9	0.06	0.5	7		Surface
21	0	17.7	0.05	0.5	6.16		Surface
22	0		0.11	0.5			Dug well
23				0.5			Piped Water
24				0.5			Piped Water
25	0	28.7	0.11	0.5	6.98		Surface
26				0.5			Piped Water
27				0.5			Piped Water
28				0.5			Piped Water
29				0.5			Piped Water
30	0	29.8	0.09	0.5	5.29		Surface
31	0	19.4	0.09	0.5	6.65		Surface
32	>200		0.2	0.5	7.61		Surface (urban)
33	0		0.27	0.5			Dug well
34	6		0.15	0.5	7.44		Surface (urban)
35			0.1	0.5			Borehole
36			0.85	0.5			Borehole
37	0		1.1	0.5			Dug well
38	11		0.18	0.5	7.32		Surface (urban)
39	0		0.24	0.5		Tangerang	Dug well
40	0		<0.02	0.5			Dug well

TABLE C 1. WATER QUALITY MEASUREMENT RESULTS (CONTINUED)

Sample No.	Turbidity (NTU)	Nitrate (mg/liter)	Ammonia (as NH3)	Ammonia Max. Limit (Gov.Reg.)	pH	Sample Location	Source
40	0		<0.02	0.5			Dug well
41	0		0.1	0.5			Dug well
42	1		0.06	0.5			Dug well
43	0		0.24	0.5			Dug well
44	6		0.21	0.5			Dug well

TABLE C 2. POLLUTION FROM POOR SANITATION AND WASTEWATER MANAGEMENT (% OF HOUSEHOLDS)

Field site	Human excreta management (%)					Household wastewater (%)		
	Not isolated		Partial isolation		Full isolation	Drain to ground	Drain to water sources	to wastewater treatment facilities
	OD	Flush to water	Dry pit	Wet pit				
Lamongan	25.00%	1.80%	0.70%	5.10%	68%	87.00%	9.33%	1.33%
Tangerang	39.16%	2.50%	11.80%	11.50%	37%	84.33%	7.00%	0.67%
Banjarmasin	18.90%	8.40%	2.90%	3.90%	65%	83.33%	12.67%	1.33%
Malang	2.40%	17.60%	0	14.60%	65%	40.00%	10.33%	44.00%
Payakumbuh	42.30%	7.80%	0.30%	2.60%	47%	71.67%	1.33%	18.00%
Average rural	32.08%	2.15%	6.25%	8.30%	52.55%	85.67%	8.17%	1.00%
Average urban	21.20%	11.27%	1.07%	7.03%	59.10%	65.00%	8.11%	21.11%

Source: ESI 2 Field Surveys

TABLE C 3. WATER ACCESS AND COSTS

Field site	Location	Piped water (treated)		Non-piped protected source (including untreated piped)		Non-piped unprotected source	
		% access	Average monthly cost	% access	Average monthly cost	% access	Average monthly cost
Lamongan	Improved	0.00	1.64	23.01	2.38	0.00	0.00
	Unimproved	0.00	0.00	9.73	1.73	0.00	0.00
	OD	0.00	0.00	6.19	1.93	6.25	0.00
Tangerang	Improved	1.56	3.85	10.62	0.00	15.63	0.00
	Unimproved	0.00	0.00	0.88	0.00	12.50	0.00
	OD	0.00	0.00	34.51	0.00	43.75	0.00
Banjarmasin	Improved	37.50	4.81	2.65	6.74	0.00	0.00
	Unimproved	25.00	4.81	0.00	10.40	0.00	0.00
	OD	21.88	1.30	0.00	12.80	0.00	0.00
Malang	Improved	1.56	4.38	4.42	1.44	0.00	0.00
	Unimproved	0.00	4.81	0.00	0.00	0.00	0.00
	OD	0.00	0.00	0.88	1.16	0.00	0.00
Payakumbuh	Improved	4.69	1.93	1.77	0.00	0.00	0.00
	Unimproved	1.56	0.96	0.00	0.00	0.00	0.00
	OD	6.25	8	5.31	0	21.88	0.00
Average rural		0.26	0.91	14.16	1.01	13.02	0.00
Average urban		10.94	3.45	1.67	3.62	2.43	0.00

TABLE C 4. HOUSEHOLDS CITING POOR WATER QUALITY FROM THEIR PRINCIPAL DRINKING WATER SOURCE

Field site	Piped water (treated)						Non-piped protected source (including untreated piped)						Non-piped unprotected source					
	N	Bad appearance[1] (%)	Bad smell (%)	Bad taste (%)	Contain solids (%)	Any (%)	N	Bad appearance1 (%)	Bad smell (%)	Bad taste (%)	Contain solids (%)	Any (%)	N	Bad appearance1 (%)	Bad smell (%)	Bad taste (%)	Contain solids (%)	Any (%)
Banjarmasin	159	91.67	60.87	95.83	85.86	75.00	3	0.00	0.00	0.00	2.88	0.00	162	0.00	0.00	0.00	0.00	0.0
Malang	22	8.33	30.43	2.08	12.12	25.00	15	29.41	14.29	0.00	7.69	25.00	0	0.00	0.00	0.00	0.00	0.0
Payakumbuh	5	0.00	8.70	2.08	2.02	0.00	19	23.53	28.57	23.08	8.65	25.00	23	66.67	75.00	50.00	20.83	0.0
Lamongan	0	0.00	0.00	0.00	0.00	0.00	21	0.00	14.29	23.08	14.42	50.00	2	0.00	0.00	0.00	4.17	0.0
Tangerang	0	0.00	0.00	0.00	0.00	0.00	87	47.06	42.86	53.85	66.35	0.00	43	33.33	25.00	50.00	75.00	0.0
Average rural		0.00	0.00	0.00	0.00	0.00		23.53	28.57	38.46	40.38	25.00		16.67	12.50	25.00	39.58	0.0
Average urban		33.33	33.33	33.33	33.33	33.33		17.65	14.29	7.69	6.41	16.67		22.22	25.00	16.67	6.94	0.0

TABLE C 5. HOUSEHOLD RESPONSES TO POLLUTED WATER – REASONS FOR USING WATER SOURCES

Field site	Location	Piped water (treated)			Non-piped protected source (including untreated piped)			Non-piped unprotected source		
		Quality (%)	Quantity (%)	Cost (%)	Quality (%)	Quantity (%)	Cost (%)	Quality (%)	Quantity (%)	Cost (%)
Lamongan	Improved	0.00	0.00	0.00	4.44	5.82	4.67	0.00	0.00	0.00
	Unimproved	0.62	0.65	0.63	15.00	21.82	19.57	1.02	0.00	0.00
	OD	0.00	0.00	0.00	1.48	2.18	3.23	2.04	2.17	2.02
Tangerang	Improved	0.00	0.00	0.00	1.48	1.45	1.44	5.10	4.35	4.04
	Unimproved	0.21	0.22	0.21	13.89	10.18	11.49	17.35	15.22	19.19
	OD	0.00	0.00	0.00	15.19	14.36	14.36	32.65	33.70	31.31
Banjarmasin	Improved	13.07	13.17	13.63	0.19	0.18	0.18	0.00	0.00	0.00
	Unimproved	34.85	35.85	35.85	2.41	2.36	2.33	0.00	0.00	0.00
	OD	3.73	3.46	3.77	0.19	0.18	0.18	0.00	0.00	0.00
Malang	Improved	0.41	0.43	0.63	1.30	0.55	0.90	0.00	0.00	0.00
	Unimproved	18.26	16.20	16.14	20.93	18.18	18.85	2.04	2.17	4.04
	OD	0.00	0.00	0.00	0.93	0.55	0.90	0.00	0.00	0.00
Payakumbuh	Improved	3.53	3.67	3.56	1.67	1.64	1.62	1.02	1.09	1.01
	Unimproved	17.84	18.57	18.03	9.44	9.27	9.16	6.12	6.52	6.06
	OD	7.47	7.78	7.55	11.48	11.27	11.13	32.65	34.78	32.32
Average rural		0.14	0.14	0.14	8.58	9.30	9.13	9.69	9.24	9.43
Average urban		11.02	11.02	11.02	5.39	4.91	5.03	4.65	4.95	4.83

TABLE C 6. TREATMENT PRACTICES

Field site	Boiling	Chlorine	Filtering device	Filtering cloth	Settle-removal solid	Use mineral water	Nothing
Lamongan	86.8	0	0.7	0.3	13.7	9.7	7.7
Tangerang	90.7	0.7	3	10	63.7	10.7	2
Banjarmasin	88	0	0.7	0	22.3	5	6.4
Malang	91.7	0	1	0	3	10.7	0.3
Payakumbuh	91.7	0	0	2.7	0.3	9	1.2
Average rural	88.8	0.4	1.9	5.2	38.7	10.2	4.9
Average urban	90.5	0.0	0.6	0.9	8.5	8.2	2.6

TABLE C 7. ANNUAL TREATMENT COSTS (US$)

Field site	Boil	Filter	Chemical (Chlorine)	Solar	Homemade device	Stand and settle	Other
Lamongan	27	0	0	0	5	3	3
Tangerang	32	2	0	0	2	3	2
Banjarmasin	79	0	0	0	0	7	5
Malang	39	0	0	0	1	1	1
Payakumbuh	40	0	0	0	4	4	3

TABLE C 8. WATER ACCESS AND HOUSEHOLD TREATMENT COSTS INCURRED AND AVERTED

Variable	Annual average costs per household		Annual average costs saved per household following 100% sanitation coverage	
	Water source access	Water treatment	Water source access	Water treatment
Lamongan	5.68	14.98	0.95	0.83
Tangerang	7.70	14.72	0.73	0.83
Banjarmasin	11.55	33.93	1.97	10.84
Malang	8.28	20.92	1.10	3.16
Payakumbuh	10.49	23.02	1.36	2.04
Average rural	6.69	14.85	0.84	0.83
Average urban	10.11	25.95	1.48	5.35

ANNEX D. ACCESS TIME

TABLE D 1. PLACE OF DEFECATION OF HOUSEHOLDS WITH NO 'OWN' TOILET

	Women				Men				Children			
E1.3 + OD with answer on outside plot (4.5)	N	Neighbor (3)	Own plot (1.2)	Outside plot (4.5)	N	Neighbor	Own plot	Outside plot	N	Neighbor	Own plot	Outside plot
Lamongan	214	14.7	23.7	1.6	214	14.9	23.8	1.6	216	16.3	25.3	1.6
Tangerang	150	36.8	13.6	1.6	147	36.2	13.4	1.6	115	32.6	10.7	3.2
Banjarmasin	127	42.1	23.2	29.0	228	3.2	22.8	54.8	220	3.5	23.2	53.2
Malang	253	3.2	22.9	54.8	254	42.6	23.4	29.0	254	46.5	24.7	29.0
Payakumbuh	150	3.2	16.6	12.9	150	3.2	16.6	12.9	136	1.2	16.0	12.9
Average rural	171	18.2	18.0	5.4	170	18.1	17.9	5.4	156	16.7	17.4	5.9
Average urban	190	22.6	23.1	41.9	241	22.9	23.1	41.9	237	25.0	24.0	41.1

TABLE D 2. DAILY TIME SPENT ACCESSING TOILET FOR THOSE WITH NO TOILET

	Women		Men		Children	
	Time per trip and waiting	No. of times per day	Time per trip and waiting	No. of times per day	Time per trip and waiting	No. of times per day
Lamongan	2.5	1.0	2.6	1.0	2.23	1.0
Tangerang	5.1	1.4	4.2	1.4	4.34	1.3
Banjarmasin	10.3	2.5	12.4	2.3	11.96	2.3
Malang	5.0	1.0	5.0	1.0	5.00	1.0
Payakumbuh	6.0	1.6	6.0	1.6	6.44	1.6
Average rural	5	1	4	1	4	1
Average urban	8	2	9	2	8	2

TABLE D 3. PRACTICES RELATED TO YOUNG CHILDREN

	Parents accompanying young children	Of which:	
		% outside plot	No. of times per day
Lamongan	101	88.9	1.7
Tangerang	105	81.8	1.5
Banjarmasin	156	67.5	2.0
Malang	285	90.0	1.0
Payakumbuh	143	76.7	1.0
Average rural	116	85.4	1.6
Average urban	221	78.1	1.3

TABLE D 4. PREFERENCES RELATED TO TOILET CONVENIENCE, FROM HOUSEHOLD QUESTIONNAIRE

Site	Perceived benefits of sanitation (B6.1): proximity cited as satisfied or very satisfied		Those without toilet: reasons to get a toilet	
	Those with toilet	Those without toilet	Saves time (B7.16)	Proximity is an important characteristic (B7.17)
Lamongan	3.3	1.4	1.2	3.7
Tangerang	3.7	2.7	0.0	37.0
Banjarmasin	3.6	2.9	0.0	5.9
Malang	3.9	2.6	1.9	37.9
Payakumbuh	3.7	2.7	1.6	15.4
Average rural	3.5	2.1	0.6	20.4
Average urban	3.7	2.7	1.2	19.7

TABLE D 5. OPPORTUNITY COST OF TIME – WHAT RESPONDENTS WOULD SPEND AN EXTRA 30 MINS A DAY DOING (%)

Use time as Opportunity cost	Lamongan	Tangerang	Banjarmasin	Malang	Payakumbuh
Bathing	88%	92%	81%	94%	86%
Taking a rest	75%	80%	85%	86%	79%
Washing	72%	13%	48%	31%	39%
Cooking/Help cooking	72%	21%	51%	28%	36%
Shopping	32%	22%	39%	43%	6%
Business	18%	4%	10%	12%	4%

	Average Rural	Average Urban
Bathing	90%	87%
Taking a rest	78%	83%
Washing	42%	39%
Cooking/Help cooking	47%	38%
Shopping	27%	29%
Business	11%	9%

TABLE D 6. AVERAGE TIME SAVINGS PER YEAR, BY HOUSEHOLD MEMBER (HOURS)

Site	Young Children (0-4 years old)	Children (5-14 years old)	Adult	Total
Lamongan	33.9	42.7	41.0	117.6
Tangerang	142.0	138.3	140.0	420.3
Banjarmasin	59.3	54.2	54.5	168.1
Malang	80.6	96.3	97.3	274.1
Payakumbuh	37.2	57.4	50.8	145.3
Average rural	87.9	90.5	90.5	269.0
Average urban	59.0	69.3	67.5	195.8

TABLE D 7. AVERAGE ANNUAL VALUE OF TIME SAVINGS (US$)

Site	Young Children (0-4 years old)	Children (5-14 years old)	Adult
Lamongan	27.0	23.3	234.0
Tangerang	125.3	98.7	729.2
Banjarmasin	54.8	41.0	274.9
Malang	77.8	52.6	523.0
Payakumbuh	39.0	48.2	234.5
Average rural	76.1	61.0	481.6
Average urban	57.2	47.2	344.1

ANNEX E. INTANGIBLE USER PREFERENCES FOR SANITATION

TABLE E 1. LEVEL OF SATISFACTION WITH CURRENT TOILET OPTION, BY OPTION TYPE (0% = NOT SATISFIED, 100% = VERY SATISFIED)

Characteristic	Those with improved sanitation					Those with unimproved sanitation			
	Sewer/septic tank	Wet pit latrine	Dry pit latrine	Compost toilet	Average	Unimproved pit or bucket	Shared toilet	No toilet	Average
Toilet position					70%				54%
Cleanliness					69%				53%
Status					73%				58%
Visitors					72%				55%
Maintaining					70%				54%
Health					72%				53%
Conflict avoidance					74%				60%
Convenience for children					72%				52%
Convenience for elderly					74%				54%
Night use of toilet					74%				53%
Avoid rain					73%				52%
Showering					71%				57%
Dangerous animals					74%				53%

Source: Household survey

TABLE E 2. IMPORTANT CHARACTERISTICS OF A TOILET FOR THOSE CURRENTLY WITHOUT (0% = NOT IMPORTANT, 100% = VERY IMPORTANT)

Characteristic	Average score
Comfortable toilet position	80%
Cleanliness and freedom from unpleasant odours and insects	83%
Having a toilet not needing to share with other households	82%
Having privacy when at the toilet	82%
Proximity of toilet to house	83%
Pour-flush compared to dry pit latrine	83%
Having a toilet disposal system that does not require emptying (piped sewer vs septic tank)	76%
Having a toilet disposal system that does not pollute yours, neighbors', or your community's environment	81%

ANNEX F. EXTERNAL ENVIRONMENT

TABLE F 1. SCORING OF DIFFERENT TYPES OF LIVING AREA (1 = CLEAN, 2 = MINOR SOILING, 3 = MODERATE SOILING, 4 = MAJOR SOILING, 5 = EXTREME SOILING)

Site	Private plots		Community living areas (market. roadside. etc)		Other land (e.g. on edge of villages)	
	Human excreta	Solid waste	Human excreta	Solid waste	Human excreta	Solid waste
Lamongan	2.9	2.2	2.8	2.7	2.2	2.9
Tangerang	3.1	1.9	2.3	2.0	2.1	2.2
Banjarmasin	3.4	2.3	2.6	2.6	2.0	2.9
Malang	3.6	2.6	3.4	3.0	2.9	3.5
Payakumbuh	3.0	2.2	2.7	2.5	2.4	2.9
Av. Rural	3.0	2.1	2.5	2.4	2.1	2.6
Av. urban	3.3	2.4	2.9	2.7	2.4	3.1

Source: private plots: ESI household observation instrument; community: physical location survey

TABLE F 2. PROPORTION OF HOUSEHOLDS WITH AND WITHOUT TOILET WITH UNIMPROVED SANITATION PRACTICE

Site	Households with toilet		Households with no toilet		Other land (e.g. on edge of villages)	
	Open defecation (sometimes, often)	Open urination (sometimes, often)	Disposal child stool in environment[1]	Disposal from hanging latrine in environment[1]	Disposal child stool in environment[1]	See children defecating in yard[2]
Lamongan	2%	1%	2%	10%	1%	1%
Tangerang	5%	30%	11%	37%	1%	1%
Banjarmasin	0%	7%	0%	7%	0%	1%
Malang	0%	1%	0%	2%	0%	0%
Payakumbuh	0%	30%	5%	50%	0%	1%
Av. Rural	4%	15%	7%	24%	1%	1%
Av. urban	0%	13%	2%	20%	0%	1%

[1] Answering 'put in drain or ditch', 'thrown in garbage', 'buried in ground' and 'left in open')
[2] Answering 'sometimes' or 'often'

TABLE F 3. IMPLICATION OF CURRENT TOILET OPTION FOR EXTERNAL ENVIRONMENT (1 = NOT SATISFIED, 5 = VERY SATISFIED)

Characteristic	Improved sanitation				Unimproved
	Sewerage	Septic tank	Wet pit latrine	Dry pit latrine	OD
POLLUTION OF YOUR OR NEIGHBORS' ENVIRONMENT					
Lamongan	na	69%	64%	40%	28%
Tangerang	na	74%	79%	na	40%
Banjarmasin	75%	72%	56%	60%	58%
Malang	73%	75%	73%	na	49%
Payakumbuh	na	71%	44%	na	40%
Av. Rural	na	71%	71%	40%	34%
Av. urban	74%	73%	58%	60%	49%
SMELL AROUND HOUSE					
Lamongan	na	69%	63%	38%	29%
Tangerang	na	74%	79%	na	46%
Banjarmasin	75%	72%	58%	68%	61%
Malang	67%	71%	78%	na	62%
Payakumbuh	na	73%	58%	na	50%
Av. Rural	na	72%	71%	38%	37%
Av. urban	71%	72%	65%	68%	58%

remark: 0% - 100% range of not satisfied to very satisfied
Source: Household survey

TABLE F 4. PERCEPTIONS OF ENVIRONMENTAL SANITATION STATE, BY OPTION TYPE (1 = VERY BAD, 5 = VERY GOOD)

Site	Interv/ control	Perception of environmental sanitation state								
		Rubbish	Sewage	Standing water	Smoke	Smell	Dirt outside	Direct inside	Rodents	Insects
Lamongan	improved	54%	56%	56%	59%	43%	60%	60%	54%	56%
	unimproved	54%	55%	56%	57%	47%	59%	58%	57%	59%
Tangerang	improved	43%	52%	45%	46%	43%	46%	53%	34%	35%
	unimproved	37%	40%	39%	43%	40%	41%	52%	34%	34%
Banjarmasin	improved	52%	52%	52%	59%	39%	52%	53%	44%	49%
	unimproved	52%	52%	53%	59%	38%	50%	52%	44%	46%
Malang	improved	52%	68%	66%	69%	57%	61%	62%	52%	51%
	unimproved	23%	65%	67%	71%	55%	62%	64%	50%	48%
Payakumbuh	improved	53%	55%	58%	57%	48%	57%	60%	55%	53%
	unimproved	50%	51%	54%	57%	47%	57%	60%	54%	54%
Av. Rural improved		49%	54%	50%	52%	43%	53%	57%	44%	45%
Av. Rural unimproved		46%	48%	47%	50%	44%	50%	55%	45%	46%
Av. Urban improved		52%	58%	58%	62%	48%	57%	58%	50%	51%
Av. Urban unimproved		42%	56%	58%	62%	47%	57%	59%	49%	49%

remark: 0% - 100% range of not satisfied to very satisfied

TABLE F 5. RANKING IMPORTANCE OF ENVIRONMENTAL SANITATION, BY OPTION TYPE (1 = NOT IMPORTANT, 5 = VERY IMPORTANT)

Site	Interv /control	Perceived importance of environmental sanitation management								
		Rubbish	Sewage	Water	Smoke	Smell	Dirt outside	Direct inside	Rodents	Insects
Lamongan	improved	70%	70%	66%	63%	67%	63%	62%	67%	66%
	unimproved	78%	77%	69%	64%	70%	65%	65%	69%	67%
Tangerang	improved	84%	81%	80%	78%	81%	77%	77%	88%	86%
	unimproved	79%	81%	79%	77%	78%	79%	79%	84%	85%
Banjarmasin	improved	83%	81%	79%	78%	80%	79%	79%	82%	79%
	unimproved	80%	79%	78%	77%	79%	78%	79%	80%	79%
Malang	improved	83%	77%	75%	72%	78%	78%	79%	85%	85%
	unimproved	84%	82%	79%	78%	81%	82%	87%	86%	87%
Payakumbuh	improved	69%	68%	59%	58%	66%	58%	60%	65%	64%
	unimproved	71%	71%	62%	59%	69%	58%	57%	58%	64%
Av. Rural improved		77%	75%	73%	71%	74%	70%	70%	78%	76%
Av. Rural unimproved		78%	79%	74%	70%	74%	72%	72%	76%	76%
Av. Urban improved		78%	75%	71%	69%	75%	71%	72%	77%	76%
Av. Urban unimproved		79%	78%	73%	71%	76%	72%	74%	75%	77%

remark: range 0% - 100% describes the range of very bad condition to very good condition

ANNEX G. TOURISM

TABLE G 1. PLACES VISITED (% RESPONDENTS) AND ENJOYMENT OF STAY

Hotel tariff	No of visi-tors	Place 1 (Jakarta)			Place 2 (historical/ temple sites)			Place 3 (beaches)			Place 4 (natural or forest)			Place 5 (within Indonesia)		
		no of visitors to this place	%	Score*	no of visitors to this place	%	Score*	no of visitors to this place	%	Score*	no of visitors to this place	%	Score*	no of visitors to this place	%	Score*
TOURIST																
1-29	18	18	13.3%	3.06	13	14.0%	3.08	13	17.8%	3.31	15	18.5%	3.47	17	14.5%	3.18
30-59	37	34	25.2%	3.21	28	30.1%	3.21	20	27.4%	2.85	24	29.6%	3.50	32	27.4%	3.22
60-89	43	40	29.6%	3.33	26	28.0%	3.62	17	23.3%	3.00	17	21.0%	3.82	29	24.8%	3.35
90-119	25	24	17.8%	3.63	16	17.2%	3.31	11	15.1%	2.64	15	18.5%	3.20	21	17.9%	3.05
120-149	11	11	8.1%	3.36	6	6.5%	3.17	6	8.2%	3.17	6	7.4%	3.83	10	8.5%	3.20
150+	10	8	5.9%	3.50	4	4.3%	2.75	6	8.2%	2.67	4	4.9%	2.75	8	6.8%	2.38
TOTAL	144	135	100%		93	100%		73	100%		81	100%		117	100%	
BUSINESS																
1-29	1	1	0.9%	4.00	0	0.0%	0.00	0	0.0%	0.00	0	0.0%	0.00	1	1.5%	3.00
30-59	19	16	14.5%	3.56	9	23.7%	3.44	6	18.8%	3.50	8	25.8%	4.13	13	20.0%	3.54
60-89	34	29	26.4%	3.79	12	31.6%	2.33	12	37.5%	2.58	13	41.9%	3.08	26	40.0%	3.42
90-119	23	20	18.2%	3.40	6	15.8%	2.83	6	18.8%	1.50	2	6.5%	2.50	9	13.8%	2.56
120-149	21	19	17.3%	3.53	7	18.4%	2.14	4	12.5%	2.00	4	12.9%	2.00	9	13.8%	2.44
150+	12	10	9.1%	3.80	4	10.5%	3.25	4	12.5%	4.25	4	12.9%	3.75	7	10.8%	3.43
TOTAL	110	95	86%		38	100%		32	100%		31	100%		65	100%	

Source: ESI Tourism Survey.
Key: * Visitors surveyed were asked to rank from a maximum score of 5 ("very much") to a minimum of 1 ("not at all").

TABLE G 2. GENERAL SANITARY EXPERIENCE (SCORE: 5 = VERY GOOD, 1 = VERY POOR)

Category	Hotel tariff	No of visitors	General sanitary condition	Hotel	Swimming pool	Open water	Restaurant	Capital city	Other cities
Tourist	<30	18	1.83	2.94	3.44	2.72	3.11	2.55	2.57
	30-59	37	2.49	3.49	3.50	2.46	3.19	2.71	2.59
	60-89	43	2.24	3.68	3.74	2.21	3.56	2.44	3.16
	90-119	25	2.71	3.96	3.90	2.42	3.76	2.96	3.08
	120-149	11	2.18	3.80	3.25	2.29	3.60	2.90	2.83
	150+	10	1.80	3.20	3.22	1.71	3.50	2.00	2.20
Business	<30	1	3.00	3.00	2.00	-	3.00	0.00	0.00
	30-59	19	3.00	3.74	3.67	2.78	3.58	3.27	3.00
	60-89	34	2.68	3.94	3.50	2.20	3.67	2.88	3.31
	90-119	23	2.61	3.96	3.56	2.29	3.68	2.77	2.50
	120-149	21	2.33	4.00	4.07	1.75	4.00	2.65	2.80
	150+	12	2.25	4.27	3.82	2.60	3.67	2.80	3.67

Source: ESI Tourism Survey.

TABLE G 3. SANITARY EXPERIENCE IN RELATION TO TOILETS AND HAND WASHING (SCORE: 5 = VERY GOOD, 1 = VERY POOR)

Category	Quality of toilets in the place					Toilet availability		Water and soap for hand washing (5 = always)		
	Hotel	Restaurant	Airport	Bus station	City	% could not find when needed	impact on stay (5 = significant)	Restaurant	Bus station	City
Tourist	3.52	3.13	2.90	1.93	1.97	0.70	2.82	3.27	1.90	2.33
Business	3.53	3.25	3.10	2.14	1.94	0.48	3.00	3.33	2.12	2.18

Source: ESI Tourism Survey.

TABLE G 4. WHAT FACTORS WERE MOST CONCERNING? (% RESPONDENTS CITING THE REASON, MAXIMUM 3 RESPONSES PER RESPONDENT)

Category	Drinking water	Tap water	Swimming pool water	Food	Currency notes	Shaking hand	Unsanitary toilet	Public toilets
Tourist	19	17	2	23	3	1	19	11
Business	19	18	1	19	12	2	17	10

Source: ESI Tourism Survey.

TABLE G 5. HEALTH ISSUES

Category	Average no of days of symptoms	Average no of days of incapacitation	No Medical Care (%)	Outpatient (%)	Inpatient (%)	Shop (%)	Av. Cost (USD)
Tourist	3.08	1.91	64.88	26.93	0.0	27.80	24.75
Business	3.21	2.00	47.50	42.50	0.0	25.00	67.50

TABLE G 6. INTENTION TO RETURN TO INDONESIA

Category	Return to Indonesia? (%)				Advise friends to come? (%)			
	Yes	No	Maybe	Do not know	Yes	No	Maybe	Do not know
Tourist	76.38%	2.85%	16.60%	4.17%	71.75%	10.95%	14.18%	3.13%
Business	93.30%	2.27%	4.43%	0.00%	76.47%	6.22%	18.54%	3.46%

TABLE G 7. REASONS NOT TO RETURN TO INDONESIA

Category	Sanitation	Not safe	Cost	No need
Tourist	44.83%	33.63%	17.97%	16.25%
Business	47.00%	35.63%	23.33%	17.50%

ANNEX H. BUSINESS

TABLE H 1. RATING OF ENVIRONMENTAL SANITATION CONDITIONS IN THE LOCATION OF THE BUSINESS SURVEY INTERVIEW (SCORE: 1 = BEST; 5 = WORST)

Variable	Restaurants	Hotels	Garment factories	Food processing
Water quality in rivers	3.5	4.0	2.0	NA
State of canals and rainwater drainage	2.5	2.0	3.0	NA
Management of sewage	2.3	2.0	2.0	NA
Management of industrial wastewater	2.3	2.0	2.0	2.0
Household coverage with private toilets	2.0	2.0	2.0	2.0
Toilets in public places	2.2	2.0	3.0	3.0
Household/office solid waste	1.8	2.0	2.0	4.0
Management of industrial solid waste	2.0	3.0	2.0	4.0
Air quality from vehicles	2.0	-	3.0	3.0
Air quality from solid waste	2.0	1.0	3.0	4.0
Air quality from excreta	1.8	2.0	2.0	3.0

Source: ESI Business Survey.

TABLE H 2. IMPORTANCE OF ENVIRONMENTAL SANITATION CONDITIONS FOR LOCATING THE COMPANY (SCORE: 1 = UNIMPORTANT; 5 = IMPORTANT)

Variable	Restaurants	Hotels	Garment factories	Food processing
Workers' health	4.8	4.5	5	5
Water quality directly available from nature (rivers, lakes, ground)	4.8	4.5	5	5
Pleasant environment for your staff (clean, good air quality, proper sewerage and sanitation)	5	4.5	5	5
Availability of cheap and good land	4.4	4.5	5	5

Source: ESI Business Survey.

ANNEX I. COST TABLES

TABLE I 1. LAMONGAN AVERAGE COST PER HOUSEHOLD FOR DIFFERENT SANITATION AND HYGIENE OPTIONS, USING FULL (ECONOMIC) COST (US$, 2009) DISCOUNT RATE 8%

Cost Item	Hygiene[1]	Shared	Dry pit	Wet pit	Septic tank
INVESTMENT COSTS: INITIAL ONE-OFF SPENDING					
1. Capital	2	99	43	56	564
Average Annual	0.9	15	11	14	57
2. Program	na	0.1	0.0	0.0	0.2
Average Annual	na	0.0	0.0	0.0	0.0
SUB-TOTAL	2	99	43	56	564
RECURRENT COSTS: AVERAGE ANNUAL SPENDING					
3. Operation	7	4	7	7	13
4. Maintenance	0	7	13	13	21
5. Program	-	-	-	-	-
SUB-TOTAL	7	11	20	20	34
AVERAGE ANNUAL COST CALCULATIONS					
Duration[2]	3	10	5	5	8
Cost/household	10	26	30	33	91
Cost/capita[3]	2	5	6	7	18
OF WHICH:					
% capital	9%	57%	35%	42%	63%
% program	23%	0%	0%	0%	0%
% recurrent	68%	43%	65%	58%	37%
Observations[4]		72	34	26	140

[1] Mainly annual soap cost
[2] Refers to length of life of hardware before full replacement
[3] Based on 5 persons per HH
[4] Number of households (respondents)

TABLE I 2. TANGERANG AVERAGE COST PER HOUSEHOLD FOR DIFFERENT SANITATION AND HYGIENE OPTIONS, USING FULL (ECONOMIC) COST (US$, 2009) DISCOUNT RATE 8%

Cost Item	Hygiene[1]	Community	Shared	Dry pit	Wet pit	Septic tank
INVESTMENT COSTS: INITIAL ONE-OFF SPENDING						
1. Capital	2	151	160	62	85	550
Average Annual	1	15	24	16	21	56
2. Program	-	28	0.2	0.2	0.2	0.1
Average Annual	-	3	0	0	0	0
SUB-TOTAL	2	179	161	62	85	550
RECURRENT COSTS: AVERAGE ANNUAL SPENDING						
3. Operation	11	0	4	7	7	13
4. Maintenance	0	0.8	2.0	1.9	1.9	3.3
5. Program	-	-	-	-	-	-
SUB-TOTAL	11	0	4	7	7	13
AVERAGE ANNUAL COST CALCULATIONS						
Duration[2]	3	20	10	5	5	20
Cost/household	12	18	28	22	28	69
Cost/capita[3]	2	4	6	4	6	14
OF WHICH:						
% capital	8%	84%	85%	69%	76%	81%
% program	0%	16%	0%	0%	0%	0%
% recurrent	92%	1%	15%	30%	24%	19%
Observations[4]		23	26	7	28	85

[1] Mainly annual soap cost
[2] Refers to length of life of hardware before full replacement
[3] Based on 5 persons per HH
[4] Number of households (respondents)

TABLE I 3. BANJARMASIN AVERAGE COST PER HOUSEHOLD FOR DIFFERENT SANITATION AND HYGIENE OPTIONS, USING FULL (ECONOMIC) COST (US$, 2009)

Cost Item	Hygiene[1]	Community	Shared	Dry pit	Wet pit	Septic tank	Sewerage
INVESTMENT COSTS: INITIAL ONE-OFF SPENDING							
1. Capital	2	316	88	45	48	221	473
Average Annual	1	32	13	11	12	22	48
2. Program	0	0	0.2	0.2	0.2	0.4	0.4
Average Annual	-	-	0	0	0	0	0
SUB-TOTAL	2	316	89	45	48	221	473
RECURRENT COSTS: AVERAGE ANNUAL SPENDING							
3. Operation	8	4	2	na	7	7	13
4. Maintenance	-	3	5	10	na	13	39
5. Program	-	-	-	-	-	-	-
SUB-TOTAL	8	7	7	10	7	20	52
AVERAGE ANNUAL COST CALCULATIONS							
Duration[2]	3	20	10	5	5	20	20
Cost/household	9	39	20	21	19	43	100
Cost/capita[3]	2	8	4	4	4	9	20
OF WHICH:							
% capital	10%	83%	65%	54%	63%	52%	48%
% program	0%	0%	0%	0%	0%	0%	0%
% recurrent	90%	17%	35%	46%	37%	48%	52%
Observations[4]		16	33	19	1	165	46

[1] Mainly annual soap cost
[2] Refers to length of life of hardware before full replacement
[3] Based on 5 persons per HH
[4] Number of households (respondents)

TABLE I 4. MALANG AVERAGE COST PER HOUSEHOLD FOR DIFFERENT SANITATION AND HYGIENE OPTIONS, USING FULL (ECONOMIC) COST (US$, 2009)

Cost Item	Hygiene[1]	Shared	Dry pit	Wet pit	Septic tank	Sewerage
INVESTMENT COSTS: INITIAL ONE-OFF SPENDING						
1. Capital	2	106	56	71	319	479
Average Annual	1	11	8	18	80	49
2. Program	-	-	-	-	-	-
Average Annual	-	-	-	-	-	-
SUB-TOTAL	2	106	56	71	319	479
RECURRENT COSTS: AVERAGE ANNUAL SPENDING						
3. Operation	12	7	7	7	7	7
4. Maintenance	-	na	10	13	27	32
5. Program	-	-	-	-	-	-
SUB-TOTAL	12	7	17	20	34	39
AVERAGE ANNUAL COST CALCULATIONS						
Duration[2]	3	10	5	5	20	20
Cost/household	12	18	25	38	114	87
Cost/capita[3]	2	4	5	8	23	17
OF WHICH:						
% capital	7%	61%	33%	46%	70%	56%
% program	0%	0%	0%	0%	0%	0%
% recurrent	93%	39%	67%	54%	30%	44%
Observations[4]		32	61	21	36	137

[1] Mainly annual soap cost
[2] Refers to length of life of hardware before full replacement
[3] Based on 5 persons per HH
[4] Number of households (respondents)

TABLE I 5. PAYAKUMBUH AVERAGE COST PER HOUSEHOLD FOR DIFFERENT SANITATION AND HYGIENE OPTIONS, USING FULL (ECONOMIC) COST (US$, 2009)

Cost Item	Hygiene[1]	Shared	Dry pit	Wet pit	Septic tank
INVESTMENT COSTS: INITIAL ONE-OFF SPENDING					
1. Capital	2	118	22	61	567
Average Annual	1	18	6	15	58
2. Program	-	26	25.6	25.6	0.1
Average Annual	0.0	3.8	3.9	3.10	3.11
SUB-TOTAL	2	143.7	47.7	86.8	354.4
RECURRENT COSTS: AVERAGE ANNUAL SPENDING					
3. Operation	7	4	na	7	11
4. Maintenance	-	6	na	11	16
5. Program	-	-	-	-	-
SUB-TOTAL	7	9	-	18	26
AVERAGE ANNUAL COST CALCULATIONS					
Duration[2]	3	10	5	5	20
Cost/household	8	31	12	40	87
Cost/capita[3]	2	6	2	8	17
OF WHICH:					
% capital	12%	57%	46%	38%	67%
% program	0%	12%	54%	16%	3%
% recurrent	88%	30%	0%	46%	30%
Observations[4]		27	11	3	117

[1] Mainly annual soap cost
[2] Refers to length of life of hardware before full replacement
[3] Based on 5 persons per HH
[4] Number of households (respondents)

TABLE I 6. SUMMARY OF AVERAGE COST PER HOUSEHOLD IN RURAL AREAS FOR DIFFERENT SANITATION AND HYGIENE OPTIONS, USING FULL (ECONOMIC) COST (US$, 2009)

Cost Item	Hygiene[1]	Community	Shared	Dry pit	Wet pit	Septic tank
INVESTMENT COSTS: INITIAL ONE-OFF SPENDING						
1. Capital	2	151	130	53	70	557
2. Program	-	28	0.1	0.2	0.2	0.2
SUB-TOTAL	2	179	130	53	70	557
RECURRENT COSTS: AVERAGE ANNUAL SPENDING						
3. Operation	9	0	4	7	7	9
4. Maintenance	-	0.8	4.5	7.4	7.3	-
5. Program	na	na	na	na	na	na
SUB-TOTAL	9	1	9	14	14	9
AVERAGE ANNUAL COST CALCULATIONS						
Duration[2]	3	20	10	5	5	20
Cost/household	10	19	28	27	32	82
Cost/capita[3]	2	4	6	5	6	16
OF WHICH:						
% capital	9%	80%	69%	48%	55%	69%
% program	0%	15%	0%	0%	0%	0%
% recurrent	90%	5%	31%	52%	44%	31%
Observations[4]	208	23	98	41	54	224

[1] Mainly annual soap cost
[2] Refers to length of life of hardware before full replacement
[3] Based on 5 persons per HH
[4] Number of households (respondents)

TABLE I 7. SUMMARY OF AVERAGE COST PER HOUSEHOLD IN URBAN AREAS FOR DIFFERENT SANITATION AND HYGIENE OPTIONS, USING FULL (ECONOMIC) COST (US$, 2009)

Cost Item	Hygiene[1a]	Community		Shared	Private dry pit	Urban wet pit	Urban septic tank	Urban Communal sewerage[1b]	Urban sewerage + treatment	
		Optimal	Actual						Optimal	Actual
INVESTMENT COSTS: INITIAL ONE-OFF SPENDING										
1. Capital	2	316	503	104	41	60	369	479	473	2,198
2. Program	-	-	-	13	13	13	13.0	-	0.4	3.0
SUB-TOTAL	2	316	503	117	54	73	382	479	473	2,201
RECURRENT COSTS: AVERAGE ANNUAL SPENDING										
3. Operation	9	4	6	3	7	8	7	13	13	36
4. Maintenance	-	3	5	8	10	13	23	32	39	54
5. Program	na	na	na	na	na	na	na	na	na	na
SUB-TOTAL	9	7	11	11	17	21	30	45	52	90
AVERAGE ANNUAL COST CALCULATIONS										
Duration[2]	3	20	20	10	5	5	20	20	20	20
Cost/household	10	39	62	28	31	37	70	87	100	317
Cost/capita	2	8	12	6	6	7	14	17	20	63
OF WHICH:										
% Capital	9%	83%	83%	55%	34%	40%	53%	56%	48%	71%
%Program	0%	0%	0%	7%	11%	8%	2%	0%	0%	0%
% Recurrent	91%	17%	17%	38%	55%	53%	45%	44%	52%	29%
Observations[3]		29	92	92	116	318	137	46	46	46

[1a] Mainly annual soap cost
[1b] Malang city
[1c] Banjarmasin city
[2] Refers to length of life (years) of hardware before full replacement
[3] Number of households (respondents)

ANNEX J. FINANCIAL COSTS

TABLE J 1. LAMONGAN FINANCIAL VERSUS NON-FINANCIAL COSTS, IN US$

Cost category		Hygiene	Shared	Dry pit	Wet pit	Septic tank	
						Optimal	Actual
Investment	Financial	-	80	30	41	550	241
	Non-financial	2	19	13	14	14	57
	Sub-total	2	99	43	56	564	298
Recurrent	Financial	7	11	20	19	34	34
	Non-financial	-	-	-	-	-	-
	Sub-total	7	11	20	19	34	34
Annual equivalent	Financial	23	19	20	23	77	63
	Non-financial	10	7	10	10	14	23
	Sub-total	33	26	30	33	91	86

TABLE J 2. TANGERANG FINANCIAL VERSUS NON-FINANCIAL COSTS, IN US$

Cost category		Hygiene	Community	Shared	Dry pit	Wet pit	Septic tank	
							Dry pit	Wet pit
Investment	Financial	0	179	161	43	44	550	481
	Non-financial	2	0	-	20	41	-	-
	Sub-total	2	179	161	62	85	550	481
Recurrent	Financial	11	1	6	9	9	16	16
	Non-financial	-	0	-	-	-	-	-
	Sub-total	11	1	6	9	9	16	16
Annual equivalent	Financial	0	19	26	13	13	59	52
	Non-financial	12	0	4	12	17	13	13
	Sub-total	12	19	30	24	30	72	65

TABLE J 3. BANJARMASIN FINANCIAL VERSUS NON-FINANCIAL COSTS, IN US$

Cost category		Hygiene	Community		Shared	Dry pit	Wet pit	Septic tank	Sewerage	
			Optimal	Actual					Optimal	Actual
Investment	Financial	0	287	474	65	22	24	195	415	2,141
	Non-financial	2	28	28	23	23	23	26	58	58
	Sub-total	2	316	503	88	45	48	221	473	2,198
Recurrent	Financial	8	7	11	12	10	20	34	52	93
	Non-financial	-		0	-	-	-	-	-	-
	Sub-total	8	7	11	12	10	20	34	52	93
Annual equivalent	Financial	8	36	59	22	16	27	34	72	136
	Non-financial	1	3	3	3	6	6	-	3	6
	Sub-total	9	39	62	25	21	32	34	75	141

TABLE J 4. MALANG FINANCIAL VERSUS NON-FINANCIAL COSTS, IN US$

Cost category		Hygiene	Shared	Dry pit	Wet pit	Septic tank	Communal sewerage
Investment	Financial	-	94	35	38	281	420
	Non-financial	2	13	22	32	38	59
	Sub-total	2	106	56	71	319	479
Recurrent	Financial	12	12	17	20	34	39
	Non-financial	-	-	-	-	-	-
	Sub-total	12	12	17	20	34	39
Annual equivalent	Financial	-	24	19	23	56	74
	Non-financial	12	4	12	15	11	13
	Sub-total	12	28	31	38	67	87

TABLE J 5. PAYAKUMBUH FINANCIAL VERSUS NON-FINANCIAL COSTS, IN US$

Cost category		Hygiene	Unimproved private latrine	Shared	Dry pit	Wet pit	Septic tank	
							Ideal	Actual
Investment	Financial	0	241	138	36	76	550	337
	Non-financial	2	-	6	12	11	17	17
	Sub-total	2	241	144	48	87	567	354
Recurrent	Financial	7	7	9	11	18	26	26
	Non-financial	-	-	-	-	-	-	-
	Sub-total	7	7	9	11	18	26	26
Annual equivalent	Financial	0	25	26	20	30	72	50
	Non-financial	8	7	4	3	10	12	12
	Sub-total	8	31	31	23	40	84	62

ANNEX K. SANITATION OPTIONS BY ASSET QUINTILE

TABLE K 1. PROPORTION OF RURAL HOUSEHOLDS SELECTING DIFFERENT SANITATION OPTIONS, BY ASSET QUINTILE

Asset quintile	Community toilets	Shared	Dry pit	Wet pit	Septic tank
Very poor 20%	6%	2%	2%	0%	5%
Poor 20%	5%	7%	3%	3%	9%
Non poor 20%	1%	1%	2%	3%	13%
Upper non poor 20%	1%	2%	0%	3%	14%
Wealthiest 20%	1%	1%	2%	2%	10%

TABLE K 2. PROPORTION OF URBAN HOUSEHOLDS SELECTING DIFFERENT SANITATION OPTIONS, BY ASSET QUINTILE

	Community toilets	Shared	Dry pit	Wet pit	Septic tank	Communal sewerage	Sewerage with treatment
Very poor 20%	2%	4%	3%	0%	4%	1%	2%
Poor 20%	2%	2%	3%	1%	5%	4%	1%
Non poor 20%	1%	2%	2%	1%	9%	5%	1%
Upper non poor 20%	0%	2%	2%	0%	11%	5%	1%
Wealthiest 20%	0%	1%	2%	1%	14%	4%	1%

ANNEX L. INCREMENTAL COSTS OF MOVING UP THE SANITATION LADDER

TABLE L 1. INCREMENTAL COSTS OF MOVING UP THE SANITATION LADDER (US$, 2009)

Cost item	Community toilet	Shared toilet	Private dry pit	Private wet pit	Private septic tank	Communal sewerage	Private sewerage
Lamongan							
Shared toilet			-56	-44	465		
Private dry pit	-	-		13	521		
Private wet pit	-	-	-		508		
Tangerang							
Community toilet		-19	-117	-94	371		
Shared toilet	-		-98	-76	390		
Private dry pit	-	-		23	488		
Private wet pit	-	-	-		465		
Banjarmasin							
Community toilet		-227	-271	-268	-95		158
Shared toilet			-44	-41	133		385
Private dry pit	-			3	176		428
Private wet pit	-	-			173		425
Private septic tank							252
Malang							
Shared toilet			-50	-36	212	373	
Private dry pit				14	262	423	
Private wet pit					248	408	
Private septic tank						160	
Communal sewerage	-						
Payakumbuh							
Shared toilet			-96	-57	210		
Private dry pit	-	-	-	39	306		
Private wet pit					267		
Private septic tank							

ANNEX M. PROGRAM APPROACH ANALYSIS

TABLE M 1. HOUSEHOLD CHOICES AND OTHER INTERVENTIONS

Site	Rural/ urban	Number of households interviewed	Was household given a choice to participate? (%)		Was household given a choice of options (%)		Hygiene awareness (%)		Water intervention offered (%)	
			Yes, voluntary	No, not voluntary	Yes, choice available	No, choice not available	Yes	No	Yes	No
1	Rural	300	-	-	-	-	-	-	-	-
2	Rural	300	100	-	96.4	3.6	85.7	14.3	64.3	35.7
3	Urban	300	93.8	6.3	87.5	12.5	66.7	33.7	12.5	87.5
4	Urban	300	98.6	1.4	94.6	5.4	60.5	39.5	10.9	89.1
5	Urban	300	100	-	71.4	28.6	100	-	71.4	28.6
…	…									

TABLE M 2. FINANCING FROM HOUSEHOLD AND PROJECT SOURCES

Site	Rural/ urban	Number of households interviewed	Household pays for facility		Non cash household contribution			Project value input
			Yes	No	No	Labor	Materials	
1	Rural	300	100	-	-	-	-	
2	Rural	300	30.4	69.6	44.4	52.8	2.8	
3	Urban	300	24.2	75.8	95.6	2.2	2.2	
4	Urban	300	74.8	25.2	97.2	2.8	-	
5	Urban	300	-	100	85.7	14.3	-	
…	…							

TABLE M 3. APPROPRIATE TECHNOLOGY

Site	Rural/ urban	Number of households interviewed	% households with insufficient water for flushing		% households with pit flooding		% households with pit overflow	
			Sometimes	Often	Sometimes	Often	Sometimes	Often
1	Rural	300	0	0	3.7	6.3	3	2
2	Rural	300	0	0.3	0	0	0	0
3	Urban	300	0.3	0	0	1.3	0	1.3
4	Urban	300	0.3	0.3	0	0	0	0
5	Urban	300	0	0	0	0	0	0
…	…							

TABLE M 4. ACTUAL PROGRAM PERFORMANCE IN RELATION TO KEY SELECTED INDICATORS FOR PROGRAM EFFECTIVENESS

Impact	Indicator	Lamongan	Tangerang	Banjarmasin	Malang	Payakumbuh
Health (sanitation intervention)	% household members using improved toilet regularly	81%	82%	70%	84%	84%
Health (hygiene intervention)	% households (always) washing hands after defecation	45%	11%	6%	11%	23%
	% latrines with signs of feces around toilet	7.67%	8.67%	18.73%	5%	9.33%
Water source	Rural: % of tubewells and dug wells tested which have zero E Coli	100%	100%	-	-	-
	Urban: main water source - tested samples which have zero E Coli	-	-	100%	100%	100%
Water treatment	% households using non-boiling household water treatment methods	85%	70%	23%	70%	57%
Access time	% household members using own toilet instead of off-plot options	87%	74%	72%	82%	59%
	Men	89%	64%	73%	83%	60%
	Women	88%	76%	72%	81%	56%
	Children 5-14	89%	72%	73%	82%	58%
	Children 0-4					
Re-use	Own use: % households applying human excreta in own land or using human excreta for biogas	-	-	-	-	-
	Sales: % households selling human excreta or biogas	-	-	-	-	-
Intangibles	Average score (as % of maximum score of 5) of satisfaction questions	3%	3%	9%	9%	4.7%
External environment	Average score (as % of maximum score of 5) of external environment questions relating to sewage	4%	4%	8%	8%	4.8%

TABLE M 5. SELECTED KEY INDICATORS FOR PROGRAM EFFECTIVENESS

Impact	Indicator area	Actual proposed indicator
FOR QUANTITATIVE CBA		
Health (sanitation intervention)	• Extent of use of improved toilet	• Proportion of household members using improved toilet instead of previous unimproved option
Health (hygiene intervention)	• Decreased incidence of disease(s) caused by poor sanitation.	• Rate of patient admission to health care facilities.
Health (hygiene intervention)	• Extent of hand washing with soap after defecation, or • Hygienic state of improved toilet.	• Proportion of households, who answered 'yes' to washing hands after defecation, • Proportion of improved latrines in which there are signs of feces around toilet (observational questionnaire).
Water source	• Water quality is adequate from nearest low-cost source (rural area) and from piped supply (urban area).	• Rural area: % of tube wells and dug wells tested to contain zero E. coli, • Urban area (areas with piped water): % tested samples in which chlorine is at adequate level.
Water treatment	• Households feel safe to use cheaper and simpler household treatment methods	• Proportion of households using non-boiling household water treatment methods
Access time	• Extent of use of own toilet compared to off-plot sanitation facilities or OD	• Proportion of household members using own toilet instead of off-plot options (can split by men, women, children 5-14, children <5)
Reuse	• Extent of actual reuse of human excreta out of all households with reuse options	• Own use: proportion of households applying human excreta in own land or using human excreta for biogas • Sales: proportion of households selling human excreta or biogas
FOR QUALITATIVE ANALYSIS		
Intangibles	• Degree of satisfaction with key aspects of toilet facility	• Average score (as % of maximum score of 5) of all relevant satisfaction questions
External environment	• Degree of continued soiling of external environment with human excreta	• Average score (as % of maximum score of 5) of two external environment questions relating to sewage (visibility and smell questions)

ANNEX N: STEPS OF THE FIELD SURVEY IMPLEMENTATION

Briefing for field coordinators

Field coordinators were recruited in Jakarta. Before leaving for the field, they were briefed and received training on their responsibilities in the field study. They were also involved in a pilot test of the household questionnaire and observational component, and the health facility study.

Each coordinator was responsible for all data collection processes in the field where she/he was assigned, including FGD implementation and all required arrangements with local stakeholders to get their support and inputs. In each site, the Field Coordinator was assisted by one local counterpart. The local counterpart assisted the Field Coordinator to recruit interviewers/enumerators, obtain survey permit from the local authorities, help with enumerators training, and support all data collection processes. The criteria of enumerator recruitment were:

- Experienced with activities related to local communities and local government,
- Good verbal communication skills,
- Understand sanitation issues,
- Fully committed to get the data collection done.

There were 8 interviewers in each survey site. Most of them were graduated from public health faculty or health workers/cadres. Most interviewers were women.

Training for interviewers

The selected candidates for interviewers/enumerators in each site were given an intensive 3 day training on conducting the field survey. The training was facilitated by the ESI Team from PT. MLD who was also assisted by each field coordinator and local counterparts. The training aimed at giving the interviewers/enumerators an adequate level of comprehension to conduct the HH survey. There were classroom sessions as well as field testing in a village near the training location. The interview tests were evaluated in the classroom to assess whether the questionnaires were practical enough.

Field preparation and household interviews

The field preparation encompassed determining a base camp, preparing interviewers training, and contacting all related parties to ensure successful survey, such as getting research permit at village level. The samples or respondents were gathered from the field sites by creating a list of targeted households, with special focus on families with children under-five. The process involved field personnel, such as enumerators and local health cadres and involved the following steps:

- Visiting the selected villages to identify and record the number and names of under-five children in those villages,
- Visiting local midwifery clinics or midwife practitioners to get additional data of families with under-five children,
- Once the respondent candidates list was completed, the field personnel selected them randomly to be interviewed.

The household survey team collected data by visiting the respondents' houses. With household questionnaires in hand, the enumerators interviewed the housewives for 40-60 minutes, including a direct observation of their toilet facilities. The household survey did not encounter significant problems, except for revisiting the house when the selected respondents were not at home because they were working.

To ensure the quality of data collection in the field, the interviewers and the field coordinator conducted data reconciliation every end of the day after the interviews. There were three stages to verify the questionnaire responses:

1. The first stage: peer review among interviewers. The result of an interviewer was verified by another interviewer until all questionnaire responses of that day were all cross-checked. The purpose of this stage was to make sure that all questions in the questionnaires were properly filled out,

2. The second stage: the field coordinator thoroughly reviewed all questionnaire responses. The purpose of this stage was to ensure no mistakes in filling in of the questionnaire,

3. The third stage: the field coordinator randomly revisited some respondents to verify that the respondents were really interviewed by the interviewers.

These verification stages were conducted during the field surveys to ensure prompt actions were taken following identification of problems related to the questionnaires. For instance, should there be a questionnaire that has not been properly filled out, the field coordinator would ask the interviewer to visit the respondent of that particular questionnaire again and would make sure that all questions are answered. If the interviewer failed to meet a certain respondent until the second visit, then the respondent would be replaced with the following person in the respondent list. Employing such verification method in this study resulted in zero non-response or error response rate and credible confidential data to be processed. At the same time, there were parallel data collection activities in each site survey (see below).

wsp
water and
sanitation program