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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wsp
water and sanitation program

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

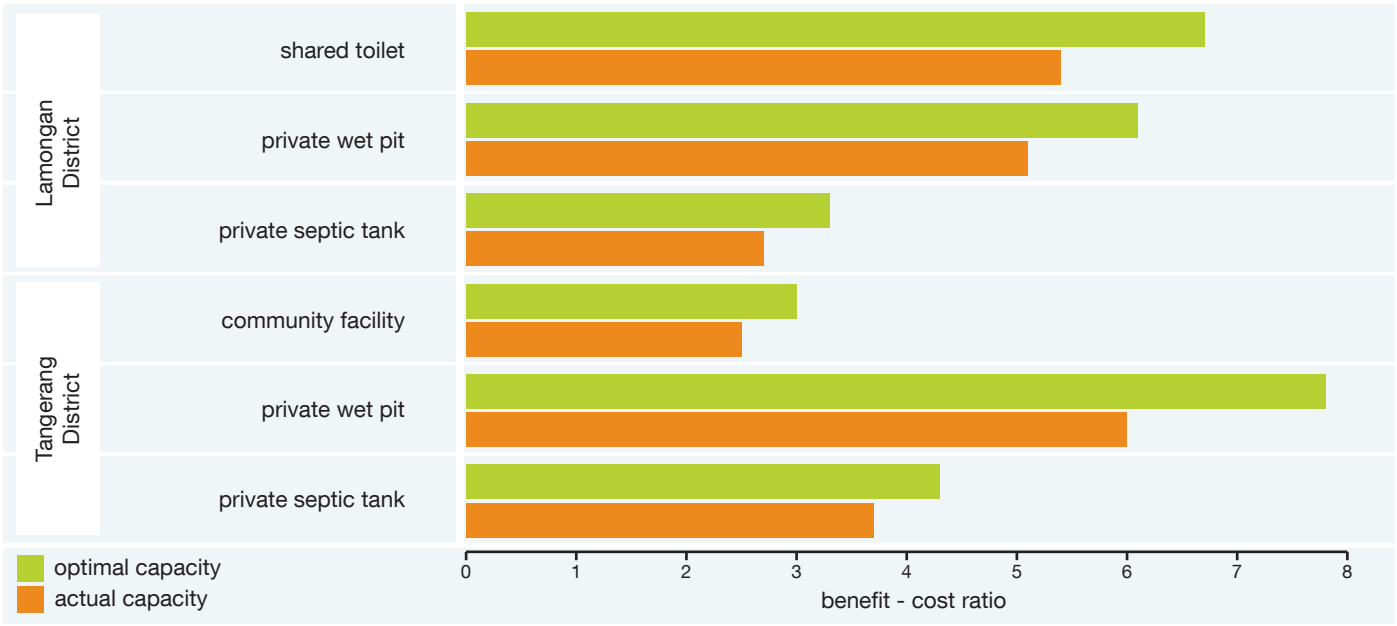
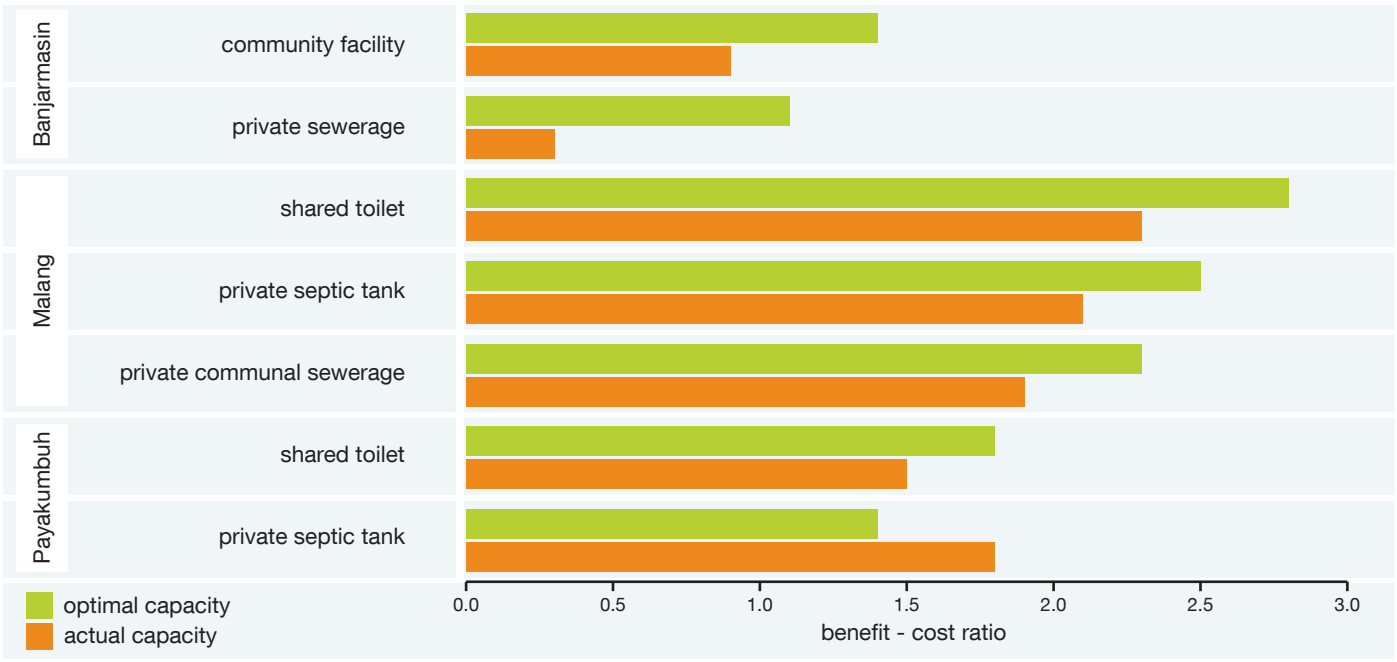


FIGURE B: BENEFIT-COST RATIOS OF DIFFERENT SANITATION OPTIONS IN THE THREE URBAN SITES



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$)

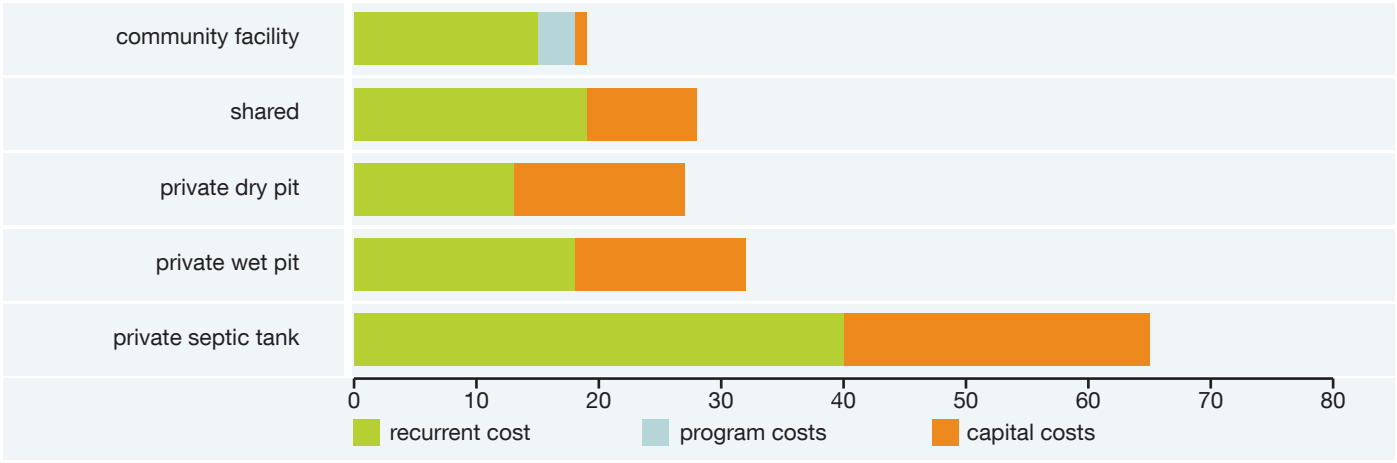


FIGURE D: BREAKDOWN OF ANNUAL ECONOMIC COSTS PER URBAN HOUSEHOLD (US$)

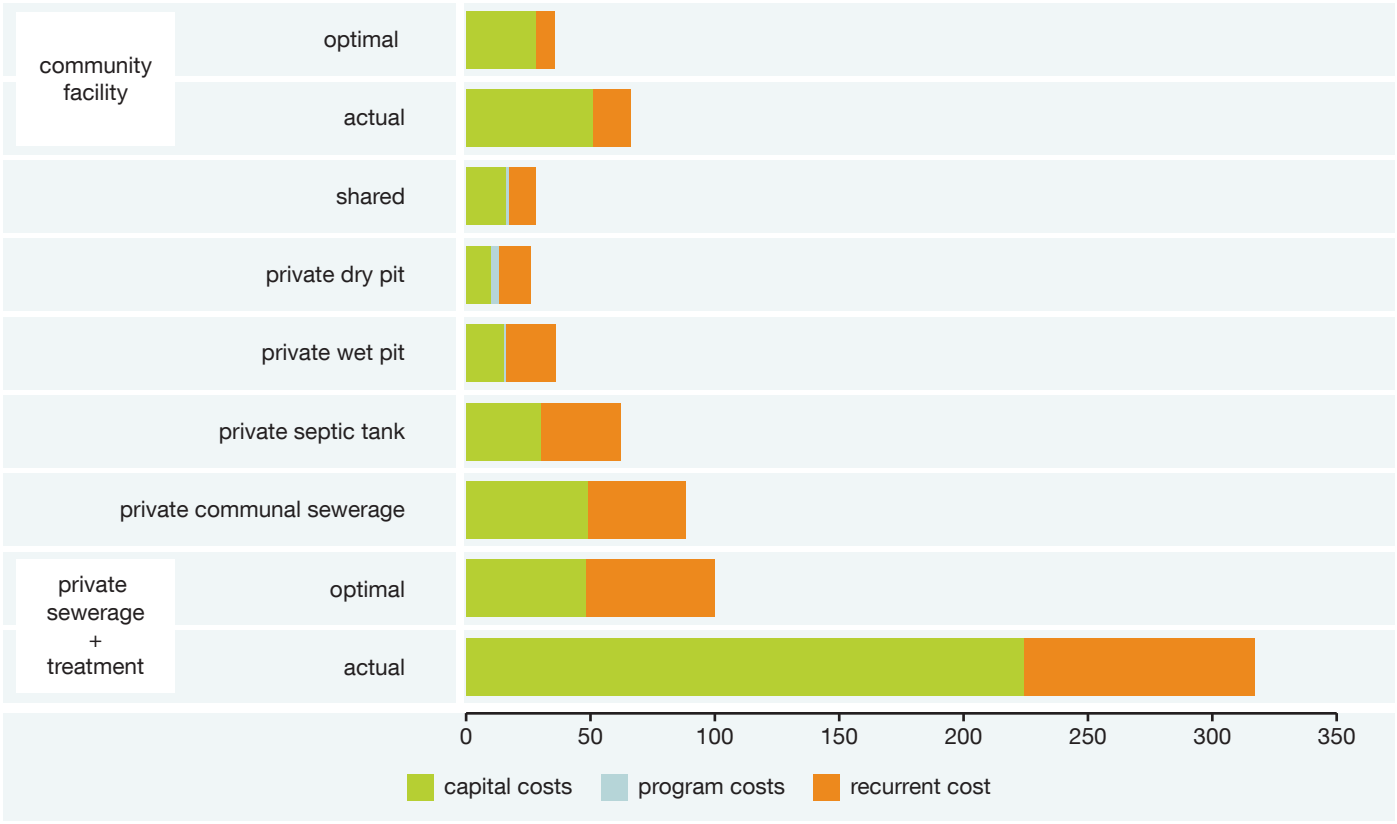
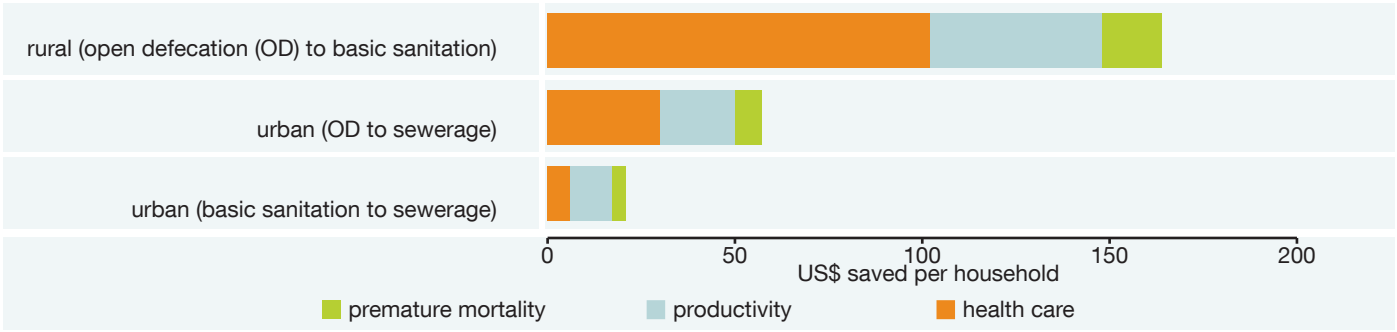


FIGURE E: HEALTH COSTS AVERTED OF IMPROVED SANITATION OPTIONS



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:

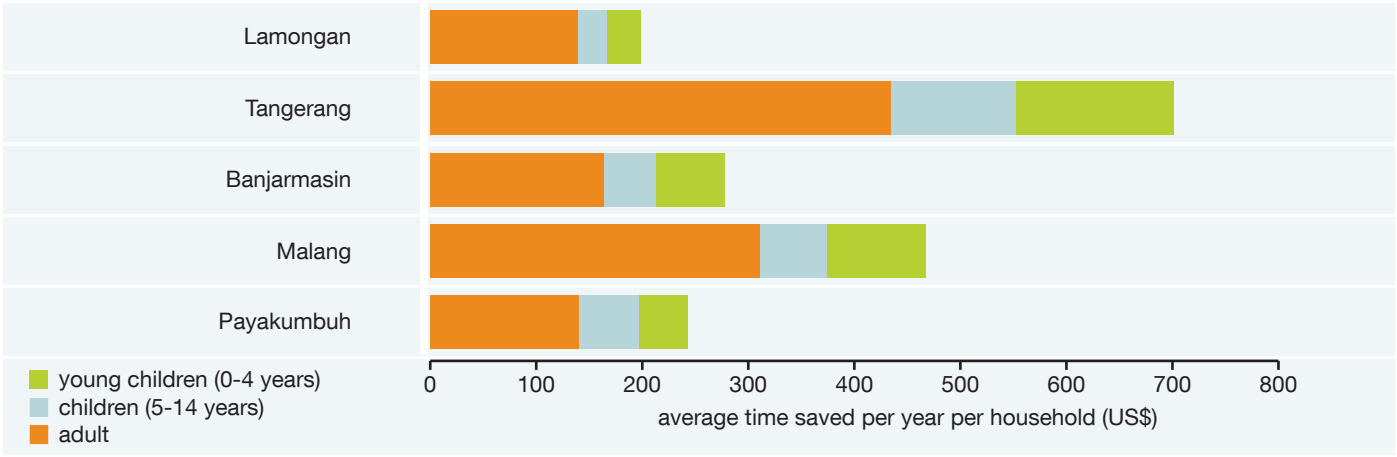
- Access time savings are obtained when a household has private access to an improved toilet at their home.
- The value of time saved per year is equivalent to 30% of the average annual income for adults. For children, half of the value of adults is used, recognizing that the OD practices of children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

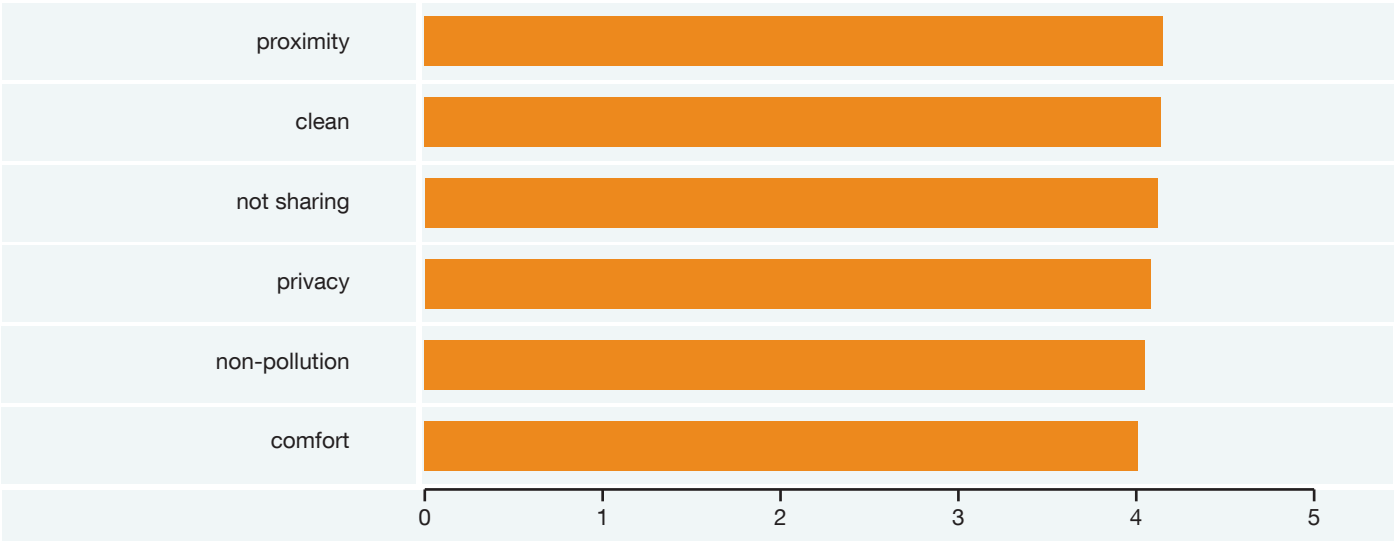
E7. BUSINESS BENEFITS

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)

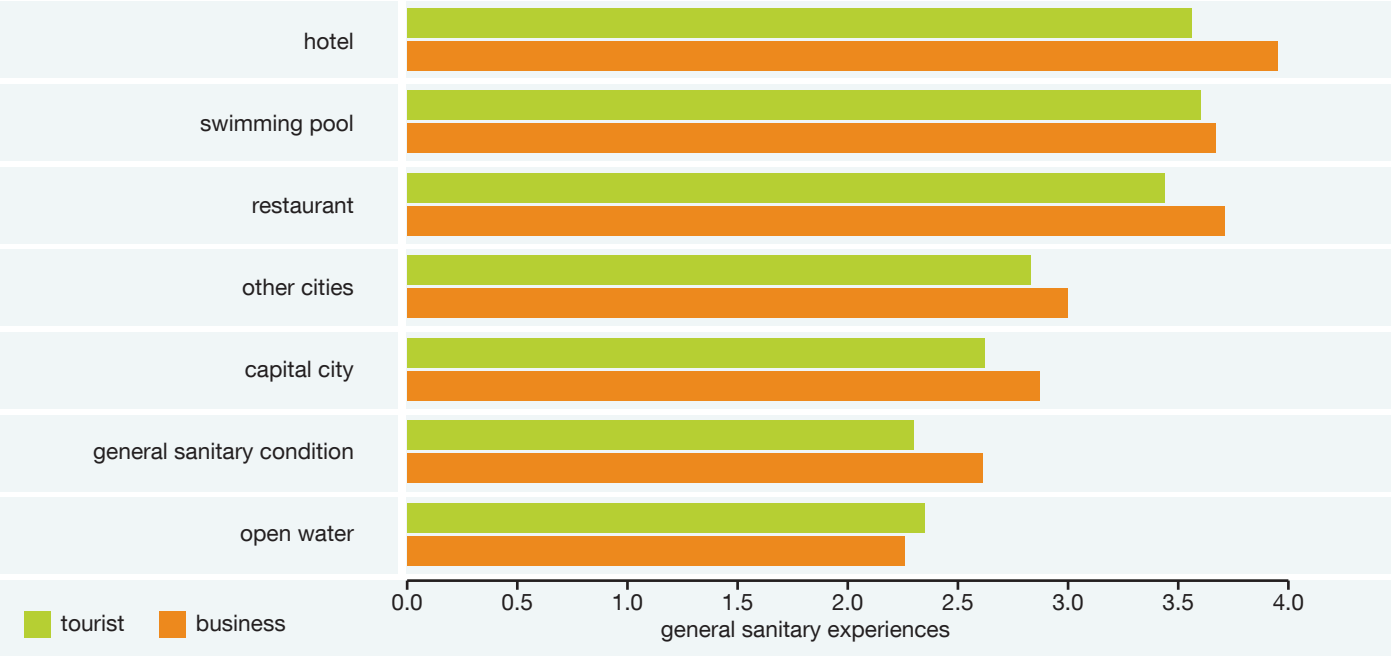


FIGURE I: SANITATION FACTORS CONCERNING VISITORS WHEN VISITING INDONESIA (UP TO 3 RESPONSES POSSIBLE PER RESPONDENT)

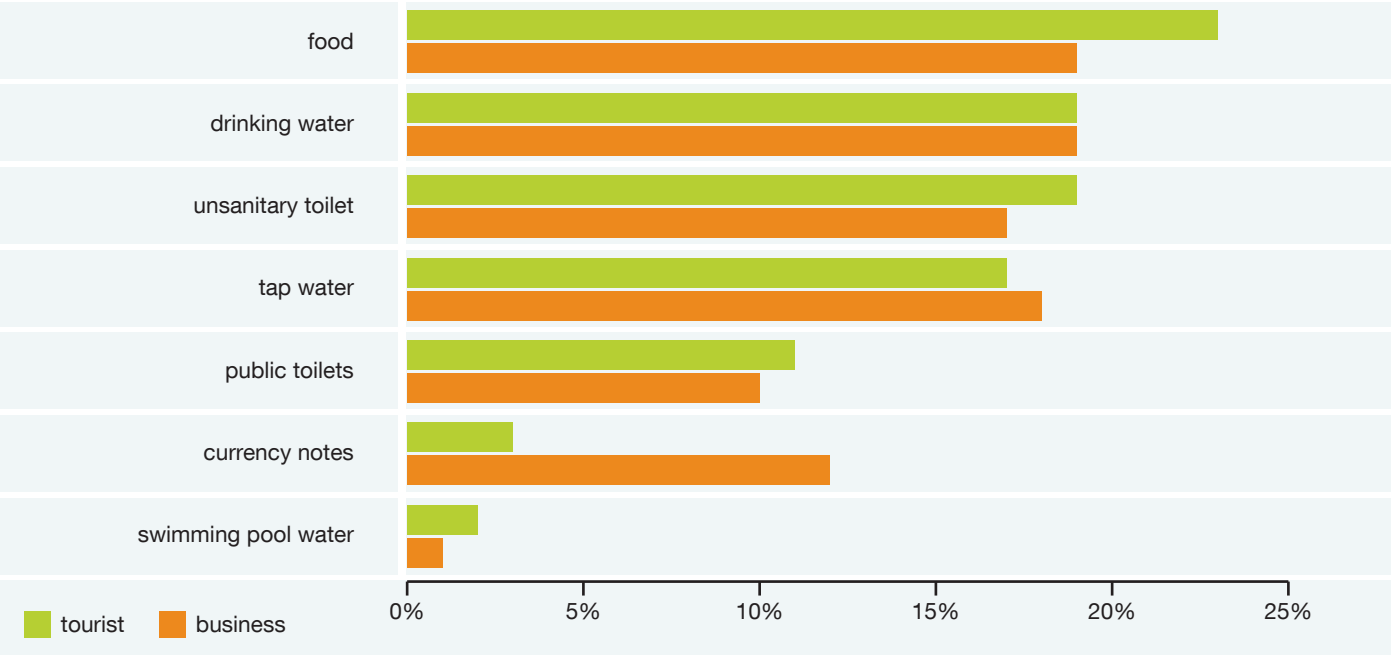


FIGURE J: IMPORTANCE OF ENVIRONMENTAL SANITATION CONDITIONS FOR LOCATING THE COMPANY (1 = UNIMPORTANT; 5 = IMPORTANT)

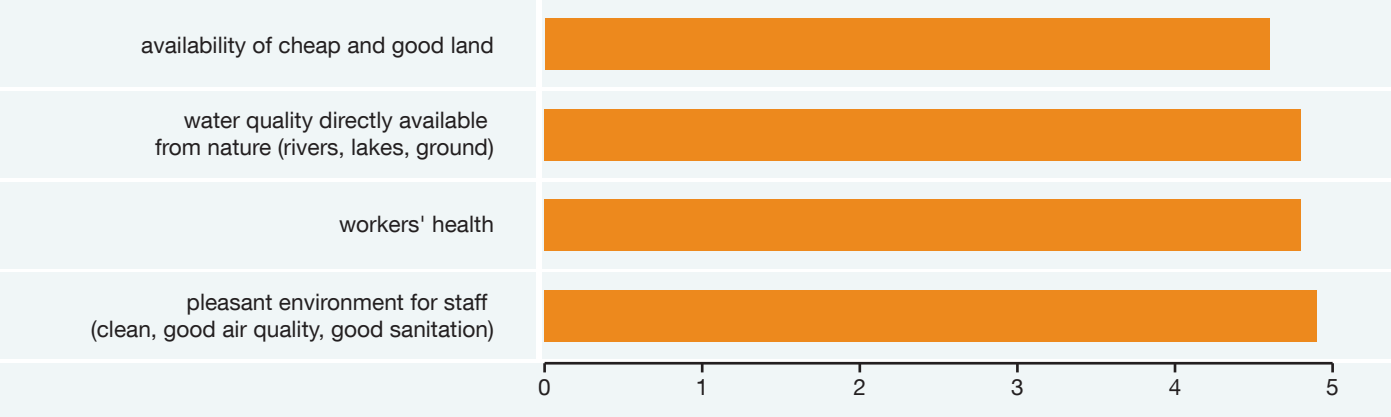


TABLE E: SELECTED INDICATORS OF FINANCING AND PROGRAM EFFECTIVENESS

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.

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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

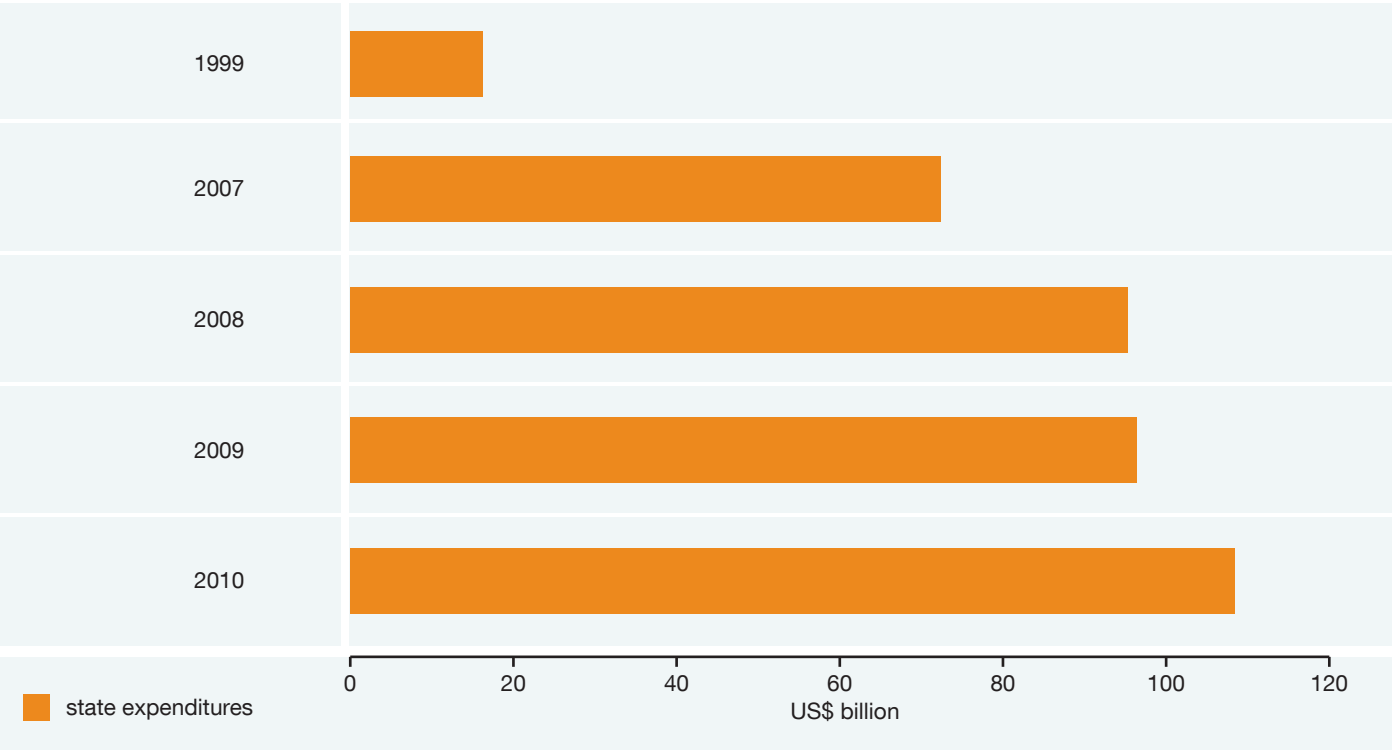
I. Introduction

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)

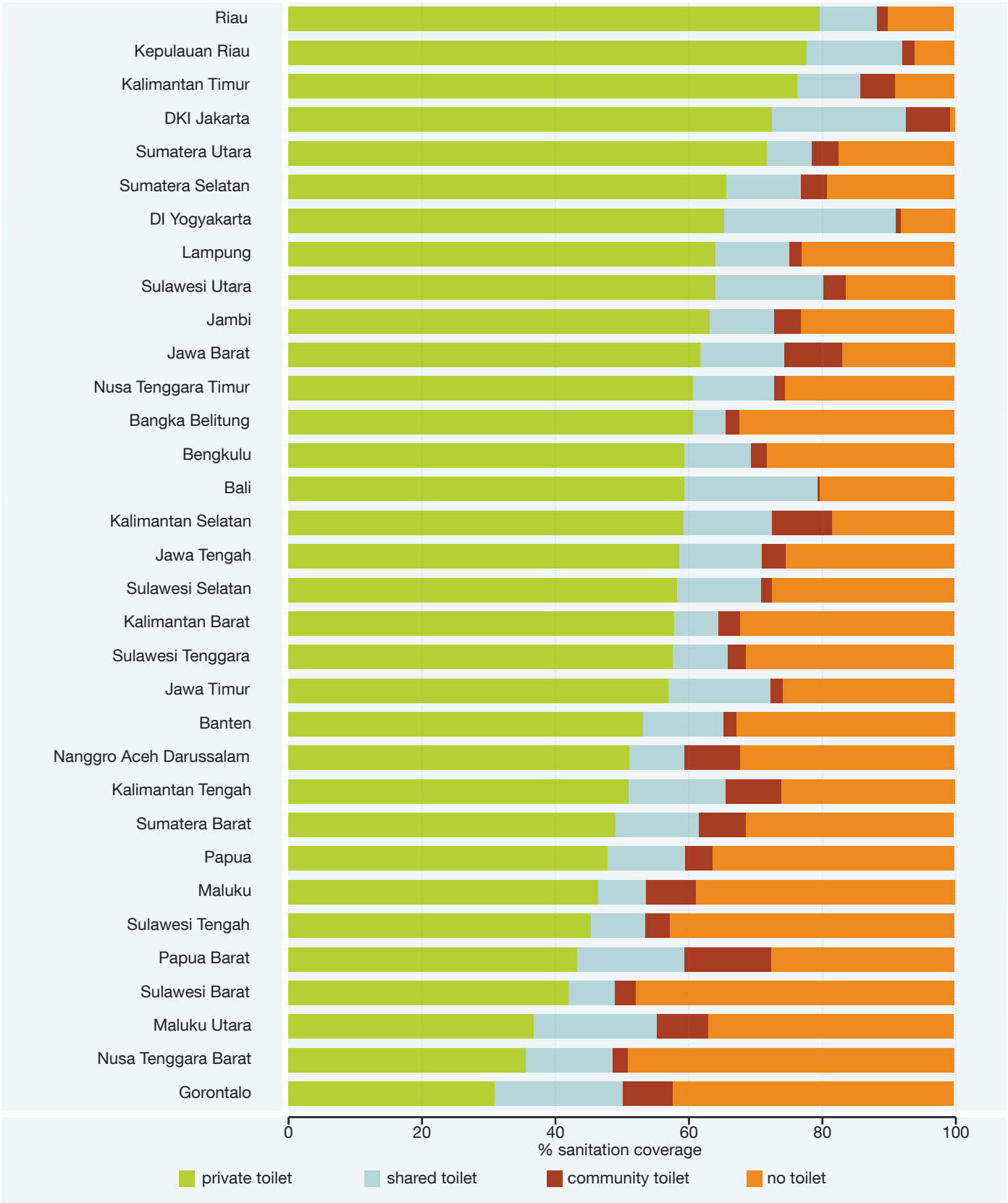
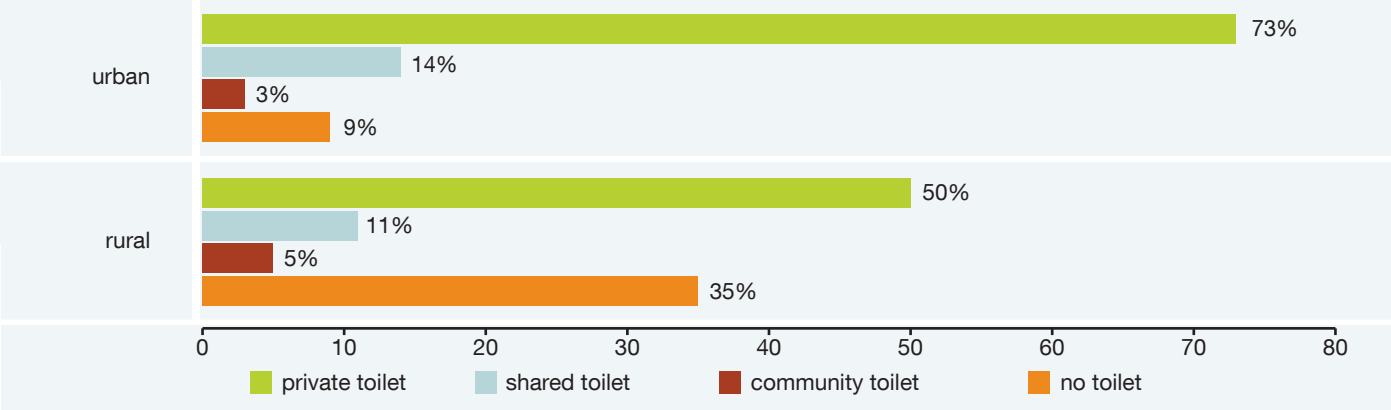


FIGURE 3: VARIATIONS IN SANITATION COVERAGE BY RURAL/URBAN (SUSENAS 2007)



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?

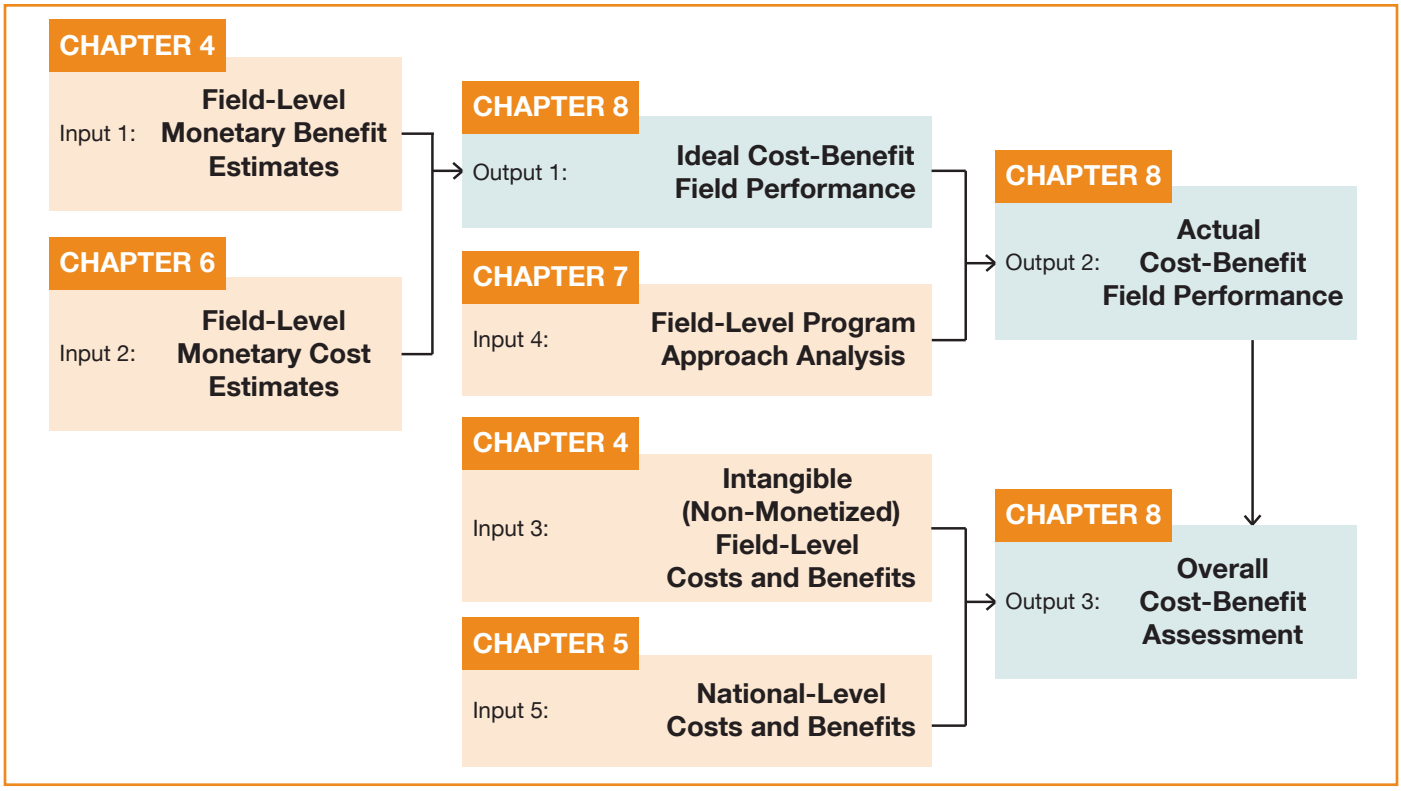
III. Methods

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.

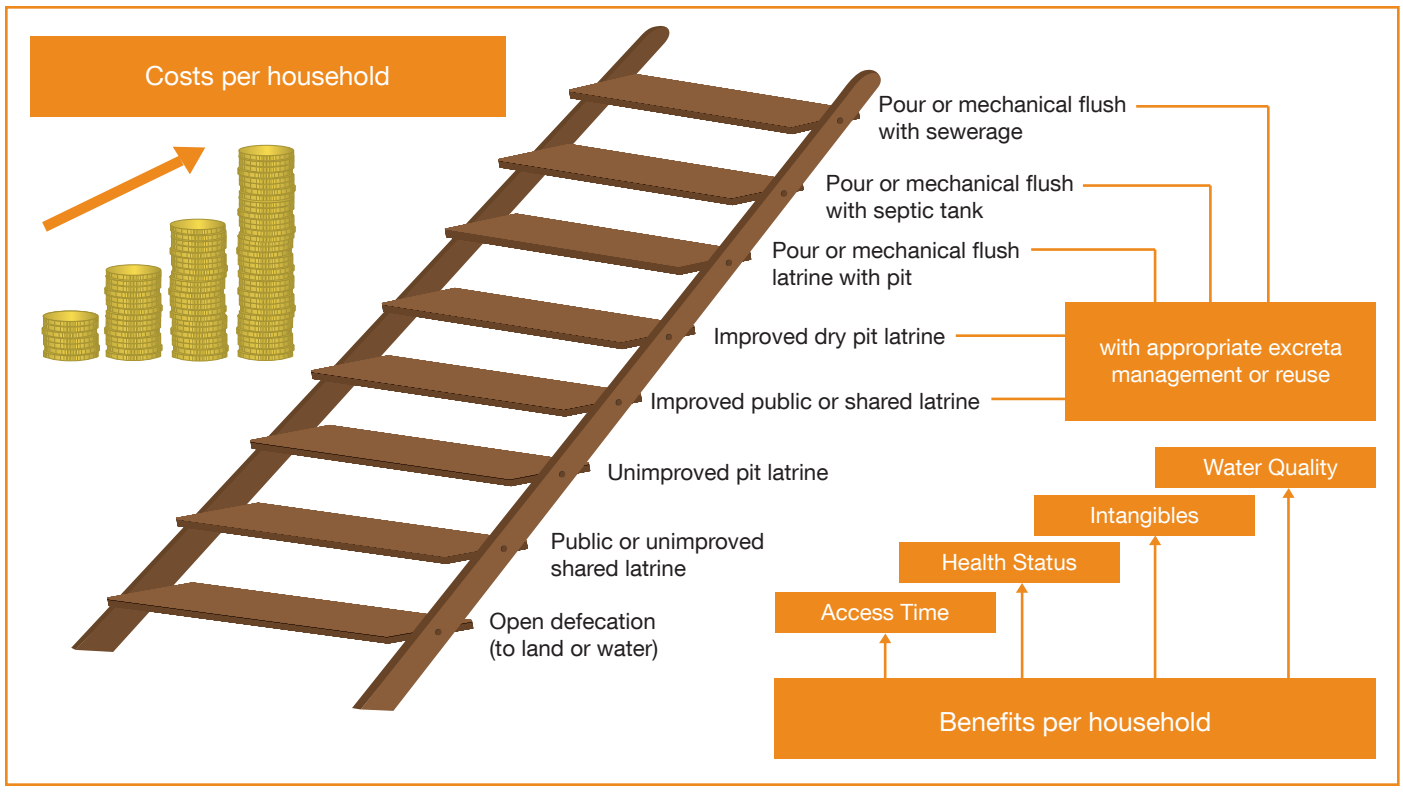
To qualify as an economic evaluation study, cost-benefit analysis compares at least two intervention options. It usually includes comparison with the baseline of 'do nothing'. However, comparing two sanitation options will rarely be enough: ideally the analysis should compare all sanitation options that 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

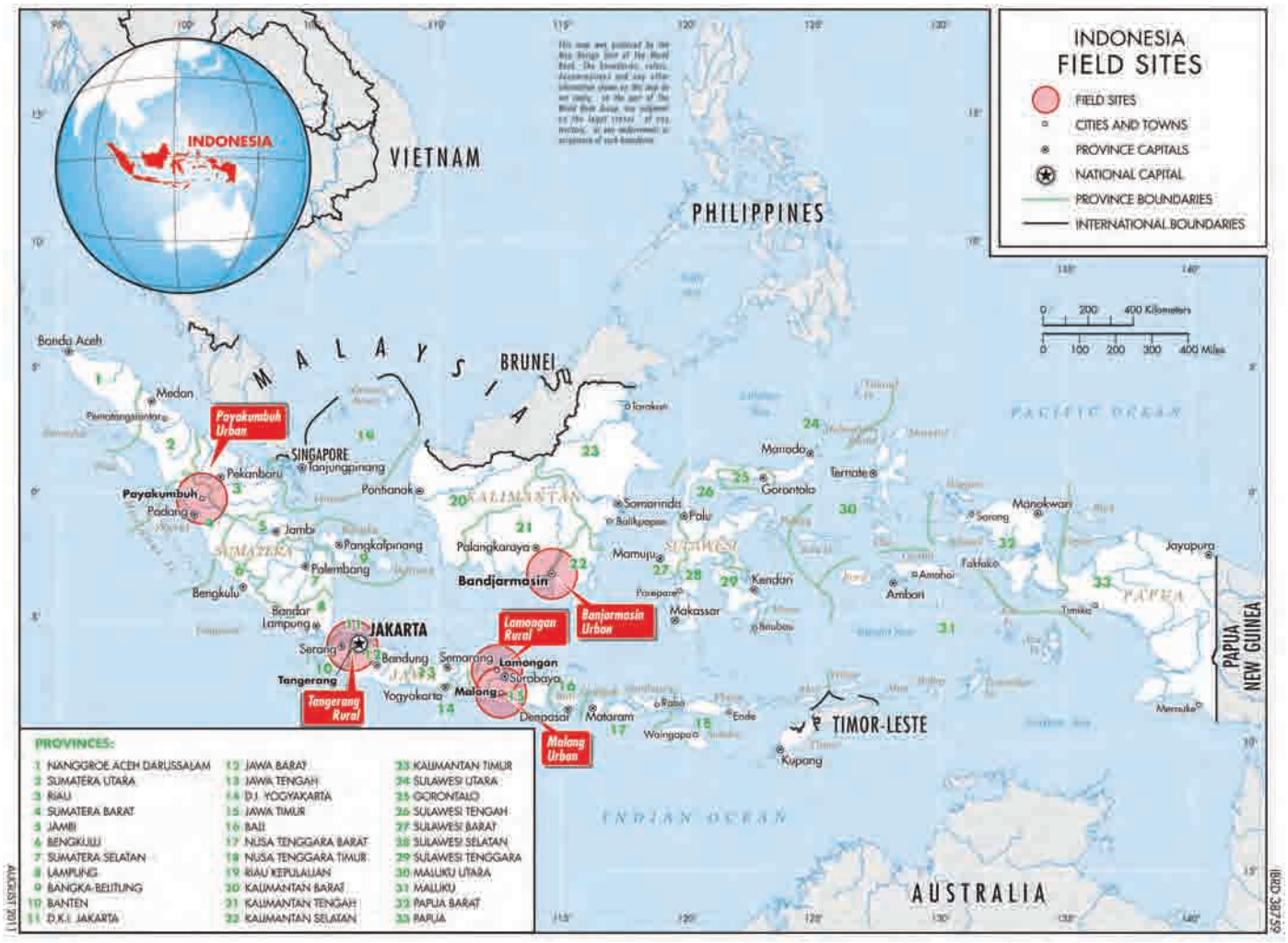
Economic evaluation of sanitation interventions should be based on sufficient evidence of impact, thus giving unbiased estimates of economic efficiency. Hence the appropriate attribution of causality of impact is crucial, requiring a robust study design. Table A3 presents alternative study designs for 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.

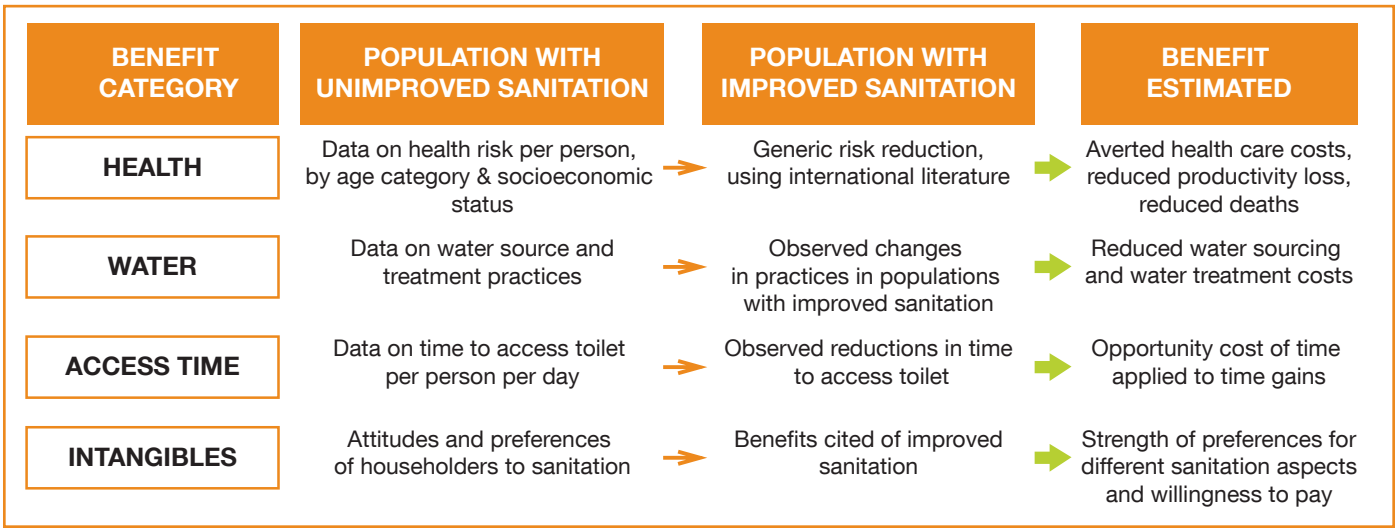
The specific methods for the sanitation benefits are described below. For a mathematical representation of the methodology, refer to the aggregating equations in Table A4.

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



[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

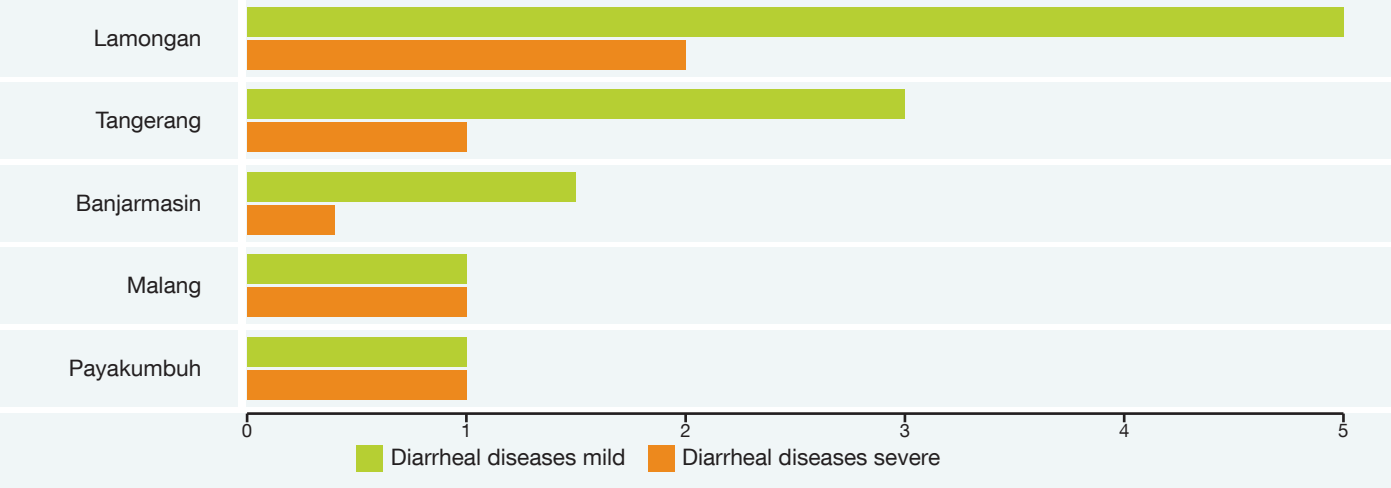


TABLE 11: PROPORTION OF POPULATION SEEKING HEALTH CARE FOR MILD DIARRHEAL DISEASE, BY AGE GROUP

	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$)