

Costs, equity and affordability of sanitation in Bangladesh for low income rural households

Applying the life-cycle costs approach to the Bagherpara Upazila



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Abbreviations

ADP	Annual Development Programme
BMGF	Bill and Melinda Gates Foundation
CapEx	Capital expenditure
CapManEx	Capital maintenance expenditure
CoC	Cost of capital
DPHE	Department of Public Health Engineering
EKN	Embassy of the Kingdom of the Netherlands
ExpDS	Expenditure on direct support
ExpIDS	Expenditure on indirect support
GDP	Gross domestic product
GoB	Government of Bangladesh
HH	Household
LCCA	Life-cycle costs approach
MDGs	Millennium Development Goals
OpEx	Operational expenditure

Executive summary

This study has sought to apply a life-cycle costs approach (LCCA) to the sanitation and hygiene activities undertaken in Bagherpara Upazila from 2006-2011, the duration of BRAC WASH I. By international and Bangladesh standards both the poor and ultra-poor in the study area are below the lower regional poverty line.

The study addressed five key questions:

- What services do people get, at what cost?
- Are services affordable to the poorest?
- Are the costs of maintaining adequate services being met?
- Do the investments made by BRAC WASH provide good value for money?
- What are the cost benchmarks that can be used to ensure sustainable sanitation services to the poorest in Bangladesh?

The life-cycle costs approach is a methodology developed by the WASHCost project to explore the disaggregated costs for ensuring delivery of adequate, equitable and sustainable WASH services to a population in a specified area. The LCCA allows practitioners to: a) quantify the initial capital hardware costs of putting the sanitation infrastructure in place and the software costs for creating the demand for these services, b) quantify the ongoing costs of maintaining, supporting and sustaining behaviour change over time, and c) understand the value of money when the costs versus services are plotted.

In the five years of the BRAC WASH I programme, 15,900 latrines have been constructed in Bagherpara Upazila in low income rural areas. The majority of those constructed are hygienic toilets (with a pit, superstructure and water seal), although another additional outcome of the programme has been the conversion of 4,164 unhygienic latrines to hygienic latrines - through the installation of a water seal which separates users from faecal waste.

Fifty-three per cent of latrines in this period have been constructed for ultra-poor and poor households, financed either by the households themselves or through grants covering all or part of the construction costs. The remaining 47% were self-financed by non-poor households at an assumed higher unit cost. Taken together this means that between 2006/7 and 2011 there has been a 40% (from 46% to 86%) rise in coverage of households with hygienic latrines.

The study found that BRAC WASH has had a transformative effect on latrine construction in Bagherpara – especially for the ultra-poor who cannot afford to construct latrines. BRAC WASH grants ensure that this group have latrines that are more robust, don't need emptying so often and have the potential to produce organic compost.

Cost studies are only meaningful if we know what level of service is being provided. The data available from BRAC WASH I allowed for the determination of solid evidence for one of the service level indicators only "access", since extensive data collection had been done. In the five years since the inception of the project there has been a rise in coverage of 40% (from 46% to 86%). The service level indicators for use, environmental sustainability and reliability were collected at a later stage for 10% of the sample. Significant changes in all four service level indicators were reached specifically for poor households, which show an

estimated 50% increase in access and an estimated 30% and 45% increase for the other indicators.

The LCCA analysis, with the data available, shows that the combined one-off capital expenditure by BRAC WASH, the Government of Bangladesh, other development partners and individual households represents a relatively minor proportion of the medium to long term recurrent expenditure (i.e. on operation and maintenance, capital maintenance such as pit emptying and direct support) required to ensure that sanitation service improvements are maintained over time.

The BRAC WASH programme had a catalytic effect on latrine construction specifically for the ultra-poor who would not have a toilet without the BRAC WASH programme support. The poor spend a median of Taka 713 (US\$ 9) on latrine construction while the non-poor spend a median of Taka 6,163 (US\$ 75) per person. The ultra-poor construct mostly twin pits (which are under the grant agreement), while the poor build mostly single pits and the non-poor build mostly septic tanks and single pit offset latrines.

The cost of regular, smaller maintenance is the responsibility of households. The major finding is that the latrines provided by BRAC to the ultra-poor can be maintained and be hygienic at a low cost. The typical annual operating expenditure is Taka 402 (US\$ 5) per year per household for the ultra-poor households and Taka 948 (US\$ 12) per year for non-poor households.

The cost for regular maintenance, pit emptying and eventual renewal of latrines is generally expected to be covered by households. Capital maintenance findings show that the ongoing expenditure required to maintain a reasonable sanitation service can range from almost nothing to Taka 116 (US\$ 1.4) per year for single pit latrines. The ultra-poor and poor incur more costs with superstructure replacement, while the non-poor spend most on making their facilities stronger and prettier with tiles.

The costs incurred by households for building and maintaining latrines which remain hygienic and used years after construction in Bagherpara are at the lower end of the WASHCost international benchmarks.

Money spent by BRAC WASH on hygiene promotion – “direct support costs” – proves its value. Although the expenditure by the BRAC WASH programme was specifically targeted at the construction of toilets for those classified as ultra-poor, for behaviour change processes entire communities were targeted. For each dollar spent by BRAC WASH on targeting the poorest, in return, the poor spend US\$ 18 per person on latrine construction and about US\$ 2 per year on maintenance which is great value for money. When families have well-functioning toilets, the ultra-poor keep them just as clean as the poor and non-poor.

The proportion of direct support costs is substantial compared to the other programmes assessed in WASHCost. The annual expenditure on direct support from BRAC is three times higher than the total amount spent on capital expenditure software over the five-year project. The main costs in the BRAC WASH programme relate to permanent staff salaries in Bagherpara, whereas the extra expenditure on promotion activities and proportionate head office costs, for example, are relatively minor.

It is clear that without the BRAC WASH programme the ultra-poor would barely have access to sanitation. Without the grant for latrine construction, the twin pits and twin-pit offset latrines are not affordable to the ultra-poor amounting to almost 6% of the reported income. The amounts being spent by the poor on latrine construction clearly exceed the international benchmarks reaching 5% of reported household income which demonstrates a high willingness to pay for improved sanitation facilities. However, operational and capital maintenance requirements to deliver a basic service are affordable even to the lower socio-economic groups.

The improvements seen in the sanitation services from baseline to endline of BRAC WASH I clearly demonstrate that in the long term, continuous investment in behaviour change results in better service delivery. However, if service levels are to be maintained over time and to get the most out of the investments, it is essential that households, donors and programme managers need to understand how much is required to meet the ongoing, recurrent costs of service delivery and who will fund them. A reduction in the BRAC grant will lead to less coverage of the most vulnerable groups of the population.

The life-cycle costs methodology can be easily integrated in the monitoring instruments of BRAC WASH II to enable a complete analysis of costs and service levels achieved by the most disadvantaged and the potential towards sustainability of the investments being made.

1 Background

The WASH I programme of BRAC initiated a holistic sanitation and hygiene promotion programme to reach out to 37.5 million people in rural low-income areas, and aimed to ensure that 17.6 million people - spread over 150 upazilas - gained access to basic sanitation and maintained consistent hygiene practices. The programme goal was to facilitate, in partnership with the Government of Bangladesh and other stakeholders, the attainment of the Millennium Development Goals (MDGs) related to water, sanitation, and hygiene for all, especially for underprivileged groups, in rural Bangladesh, and thereby improve the health situation of the poor and enhance equitable development.

The BRAC WASH I programme had four major components:

- Water (renovation of existing/ traditional water sources, small piped water supply schemes, capacity development, innovation and technological options);
- Sanitation (installation and maintenance of improved latrines, micro-enterprise development, revolving fund for poor households, subsidy for ultra-poor, capacity building);
- Hygiene (behaviour change communication, advocacy, handwashing, formative research);
- School sanitation and hygiene education; public-private partnership (local sanitation entrepreneurs, local government institutions, Department of Public Health Engineering (DPHE), and other stakeholders).

In line with BRAC's commitment to the poor, the programme focused on providing sustained and well-used services to the poor and ultra-poor, and among these, to women in particular. BRAC WASH has provided hygiene education to 38.8 million people, sanitary latrines to 25.6 million people through loans, subsidies and mobilisation, and safe drinking water supply

to 1.8 million people through installing new options or repairing existing water sources during the first phase (2006-2011).

The BRAC WASH II programme started its 2nd phase in October 2011 in 25 additional upazilas with the support of the Embassy of the Kingdom of The Netherlands (EKN) and the Bill and Melinda Gates Foundation (BMGF).

The BRAC WASH I programme has been successful in bringing sanitation behaviour change and was able to provide access to safe water and sanitation infrastructures. The BRAC WASH I evaluation report brings out these facts very clearly, but also expresses concern over the challenges that need to be addressed, especially to sustain the service delivery (in absence of public/private services available to deliver programmes at the BRAC scale) and also to ensure reliable services over a period of time without continuous efforts being put on hygiene promotion and behaviour change.

2 Aims of the study

This report demonstrates the application of a life-cycle cost approach to the Bagherpara Upazila to provide insights into the costs for BRAC and for households to provide sustainable sanitation services. These are defined as sanitary latrines that are hygienic, safely used, provide the privacy required by users and do not impact negatively on the environment.

The study assesses value for money by comparing BRAC and household costs with the international cost benchmarks and allows for improved budgeting and targeting. The study aims to understand:

- The level of sanitation services received by the population (section 4);
- The life-cycle costs per person per year for having a hygienic latrine (section 5);
- Benchmark household expenditure on the construction of adequate (basic) sanitation facilities as well as on major and minor maintenance (section 5);
- Analyse after how many years after latrine construction major maintenance is required (section 5);
- Analyse differences in expenditure and affordability for different socio-economic groups as defined by BRAC (ultra-poor, poor and non-poor) (section 6).

The life-cycle costs approach is a methodology developed by the IRC WASHCost project to explore the real costs for ensuring the delivery of adequate, equitable and sustainable WASH services to a population in a specified area.

These costs include the construction and maintenance of systems in the medium and longer term, taking into account the need for hardware and software, operation and maintenance, capital maintenance and the need for direct and indirect support, including training, planning and institutional support to the poorest. The purpose of a life-cycle cost analysis is to give practitioners and planners a detailed overview of disaggregated expenditure that allows an assessment of past performance and enables improved targeting of future investment.

Infrastructure and many of its components have a different lifespan, the costs studied are to do with consumers having access to sanitation services for ever, not just for the lifespan of

latrines or the seals in the latrines. The delivery of sustainable services is therefore contingent on financial systems being in place to ensure that infrastructures can be replaced at the end of its useful life and to extend delivery systems in response to increasing demand.

This case study examines the historical expenditure by a range of actors on sanitation promotion and latrine construction in Bagherpara Upazila: BRAC WASH I, the Government of Bangladesh (GoB), other development partners and 1,000 households. Using this data, as well as assumptions gathered from key informants, the case study seeks to provide a demonstration of how the methodology can inform monitoring, financial planning and service sustainability.

3 Study and research approach

3.1 Location

The case study was focused on Bagherpara Upazila in Jessore district. Bagherpara has a population of 197,999 living in 191 rural villages. This upazila was chosen randomly from the accounts division financial expenditure sheet with the oldest intervention areas. These would allow the team to collect the required maintenance costs (see the sampling section). Population density is high by global standards at 908 inhabitants per km² although this is slightly under the national average of 1,034. The majority of residents, around 80%, rely on agriculture as the primary income source and the literacy rate is low at 53%¹.



3.2 Socio-economic categories used in the study

BRAC defines households as ultra-poor, poor and non-poor. A household is considered ultra-poor if it satisfies at least one of the following criteria: landless, homeless, head of family is day labourer AND it satisfies two of following criteria: disabled or older than 65 and female, less than 10 decimals² of agricultural land, no fixed income source.

¹ Information from the Bangladesh Bureau of Statistics and Banglapedia.

² A decimal (also spelled decimel) is a unit of area in India and Bangladesh approximately equal to 1/100 acre (40.46 m²). The unit is also commonly used in Uganda, especially in urban areas where land-sales are booming and traded plots are getting smaller and smaller. Source: Wikipedia.

This is a tighter definition than the national norm and it is important to note that those considered “poor” in Bagherpara by BRAC are considered very poor by Bangladesh standards with a reported income below the lower poverty line.

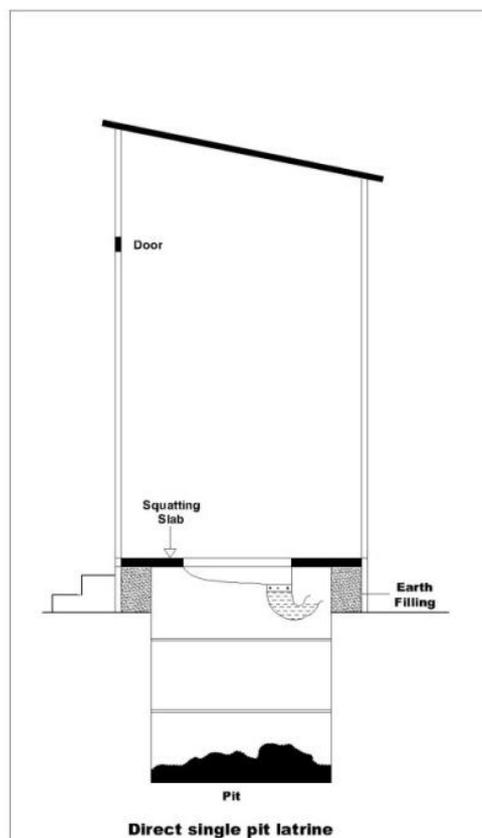
Table 1: Poverty lines considered by BRAC and Bangladesh

BRAC socio-economic poverty lines in the sample (based on reported household income) USD per person per day 2012		Bangladesh poverty lines (for Khulna rural) ³ USD per person per day 2012	
Ultra-poor	0.3	Lower poverty line	0.6
Poor	0.5	Upper poverty line	0.7
Non-poor	1	International poverty line	1.25

3.3 Sanitation facilities

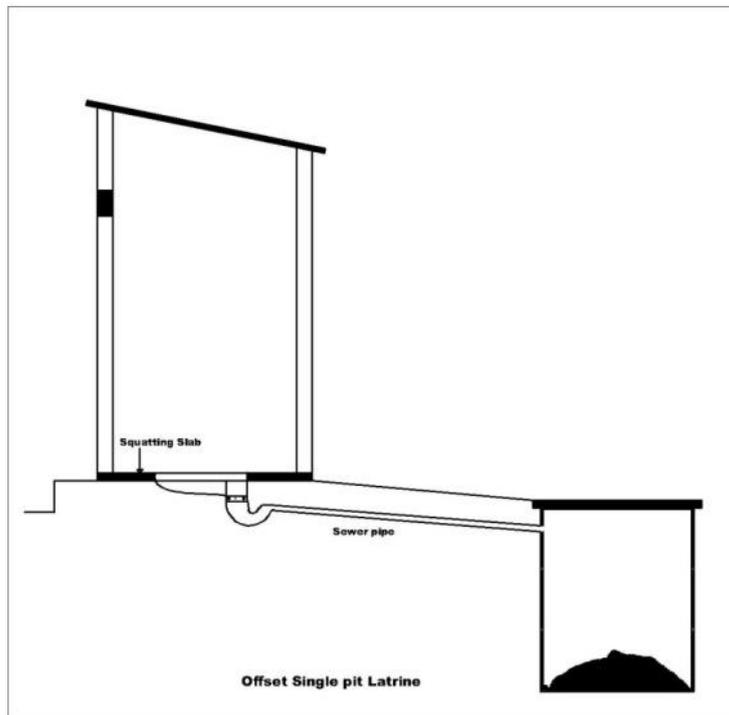
In the study area, the team has found there are mainly five types of latrines being built.

Single pit latrine: Built as a pit/tank and superstructure. Pit needs to be emptied at some point. There are no pipes connecting the structure to the pit. These latrines are found mostly among the poor households.

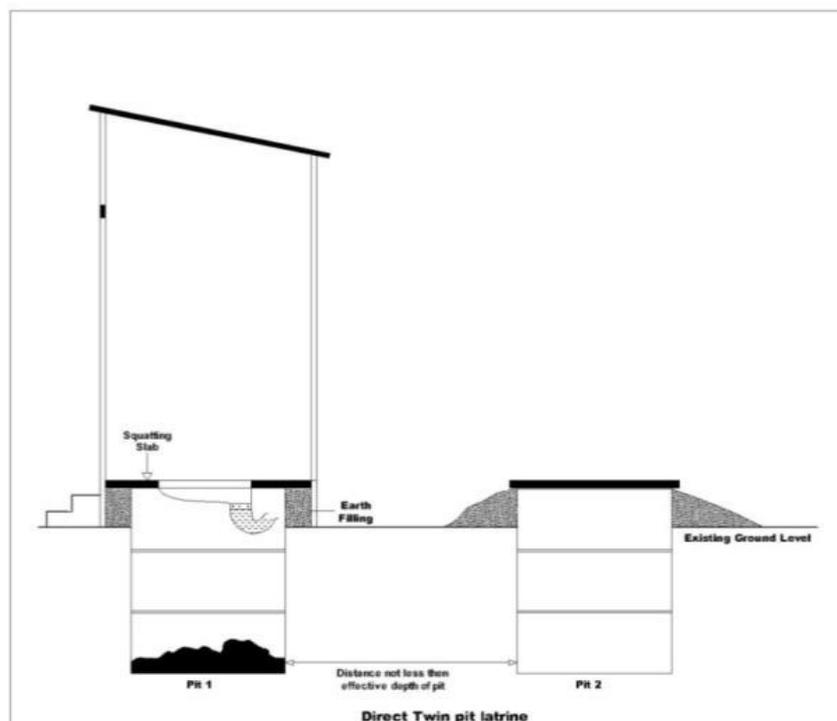


³ Source: Bangladesh Bureau of Statistics. *Report of the household income and expenditure survey 2010*. There are no specific poverty lines for Bagherpara specifically but only for the whole region.

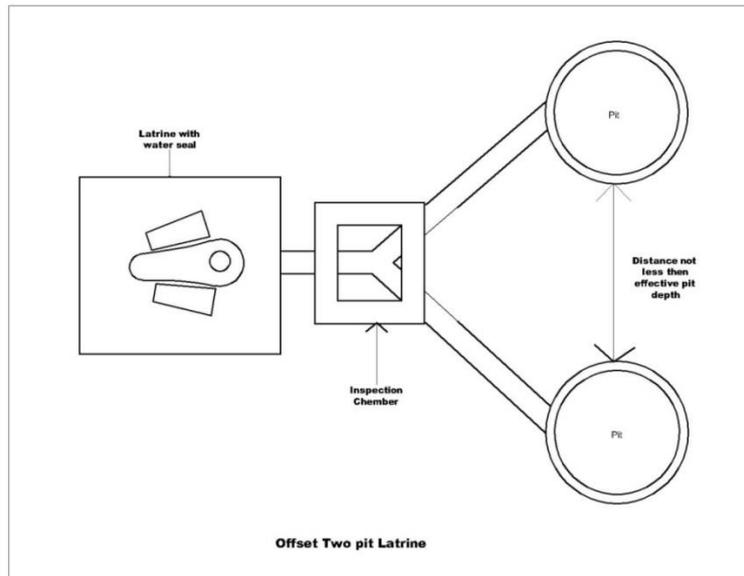
Offset single pit latrine: Built as a single pit but the pit is connected to the slab with a sewer pipe. This makes it easier to empty the pit and to add other pits to the latrine.



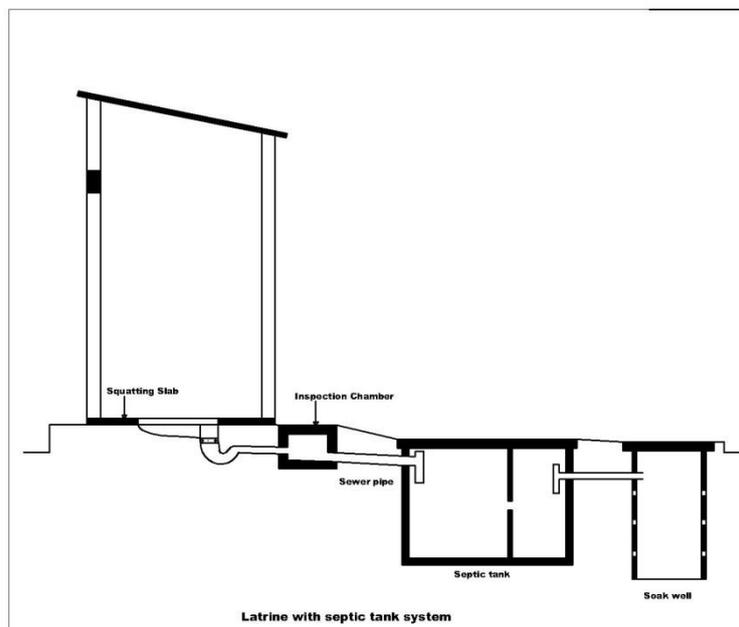
Twin-pit latrine: It has two separate pits built closely together. Once one pit is full the superstructure can be moved to the other pit. It has no pipe connection.



Twin-pit offset latrine: It has two separate pits built closely together and connected with a sewer pipe. There is an inspection pit and a barrier to direct or stop the flow in the pipes. When one pit is full then the barrier is introduced and the flow is directed to the other pit. BRAC WASH is promoting the use of this technology because it allows the households to continue to use the latrine when one pit is full and delays as much as possible pit latrine emptying.



Offset septic tank: The septic tanks are made with bricks and a septic tank is connected to the superstructure with a pipe and then to a soak well. This latrine is only built by the non-poor households in the study area.



3.4 Sampling and data collection

The data sources that are used in this case study were collected from several sources to capture both costs and service levels received by the population. The data collection was

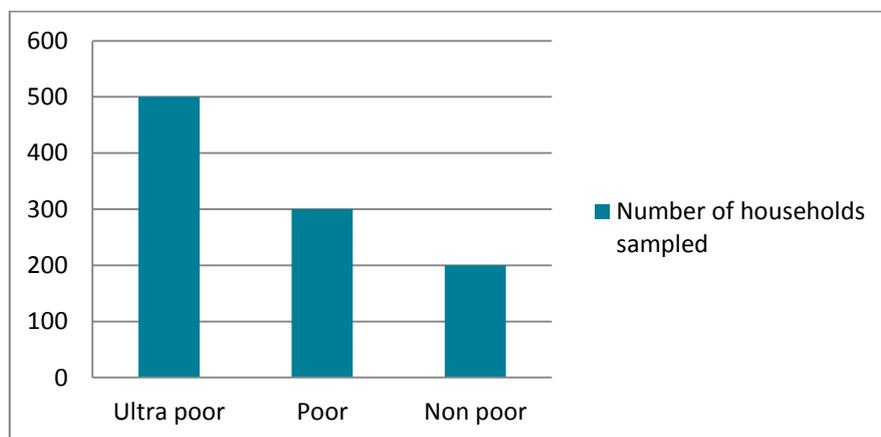
done in two main phases: the service levels and programmatic costs in 2012 and the household costs in 2013.

For the **service levels** the baseline household census data from 2006 was used as well as a random sampling survey. The random sampling was done by an estimated 10% of the total number of Village WASH Committees (VWC) in the upazila. As a result, 25 VWCs were selected which interviewed/surveyed 4,674 households in 2012 to obtain the service level findings for the study.

For the **costs**, the fund allocation for sanitation by the local government has been sourced from the Department of Public Health Engineering at Bagherpara, the costs for the BRAC WASH programme were collected from yearly financial statements from BRAC WASH I (2006-2011). The household costs per socio-economic group used as benchmark were collected in 2013 using a purposive sampling of 1,000 households with clean and actually used sanitation facilities constructed more than three years ago (see Annex 1). Purposive sampling had to be done to ensure that relevant cost information was collected for: only hygienic latrines, socio-economic groups and latrines older than three years.

Out of 251 VWCs in Bagherpara, 100 VWCs were visited using the method of *Hosmer-Lemeshow*, which focuses on the sample size along with the weight: 10 households from each were composed of 5 ultra-poor households, 3 poor households and 2 non-poor households (Figure 1). BRAC field staff used a lottery draw for selecting the households. More ultra-poor households were selected because they are the major beneficiaries of BRAC WASH activities and less is known about the (financial) sustainability of the services they received.

Figure 1: Household survey sample for benchmark sanitation costs



The team realises that because the costs and the service level data were collected at different times, service level data conclusions cannot be linked with costs that easily. However, the size of the sample leads the team to consider the findings presented in this study as valid.

Additional information required was shared by the BRAC WASH head office and field staff in the following areas:

- Aligning and classifying the unit costs identified with the LCCA methodology;

- Where necessary determining any assumptions on levels of recurrent expenditure by the BRAC programme specifically for WASH;
- Understanding the context and data available to construct sanitation service levels;
- Assumptions for determining the service level parameters.

For each phase of data collection roughly the following steps were taken:

- Month 1: Developing methodologies, pre-testing questionnaires with a first field trial, improving questionnaires;
- Month 2: Field staff training in head office and second field trial, finalising questionnaires;
- Month 3: Refresher training of field staff, sampling decision and data collection;
- Month 4: Data entry and cleaning;
- Month 5: Data analysis, presentation of preliminary results and feedback, discussion of next steps.

3.5 Classification of life-cycle costs

Expenditure made by BRAC WASH, national and local government, development partners, and households in Bagherpara Upazila has been classified according to the WASHCost life-cycle costs framework that makes a distinction between one-off capital investments and recurrent annual expenditure, as defined in Table 2.

In this study, expenditure data was analysed for capital expenditure (hardware and software), operational expenditure, capital maintenance expenditure and direct support costs.

No information was available for expenditure on indirect support (which concerns overall government costs at ministry or regional level with sanitation in rural areas) or the costs of capital. Capital costs are the costs of interest paid by households for getting (non-BRAC) loans which then would be spent in total or partly on sanitation products. However, based on WASHCost studies worldwide, indirect support costs and costs of capital for rural sanitation in low income areas are very small percentages of overall costs and not critical for sustainability. The results of the study are not compromised by lack of this information.



Family next to their latrine

Photo: I. Krukkert, IRC

Table 2: The life-cycle cost components of a sanitation service

Cost components		Definition
Capital expenditure The costs of providing a service where there was none before; or of substantially increasing the level of services	Capital expenditure hardware and software (CapEx)	One-off capital investment in latrine hardware such as labour costs and materials related to excavation, lining, slabs, superstructures as well as labour and other investments for activities such as community education, demand creation and hygiene promotion.
	Operational expenditure (OpEx)	Typically regular operating and minor maintenance expenditure, such as cleaning products.
Recurrent expenditures Service maintenance expenditure associated with sustaining an existing service at its intended level	Capital maintenance expenditure (CapManEx)	Asset renewal and replacement costs; occasional costs that seek to restore the functionality of a system, such as replacing a slab or emptying a septic tank.
	Expenditure on direct support (ExpDS)	Recurrent costs related to the costs of labour for long-term IEC programmes and the costs of supporting community-based organisations such as sanitation and hygiene groups, as well as local and intermediate level government institutions.
	Expenditure on indirect support (ExpIDS)	Expenditure on macro-level support, including planning and policy making, to decentralised district, municipal or local government.
	Cost of Capital (CoC)	Cost of interest payments on micro-finance and loans used to finance capital expenditure. Cost of any returns to shareholders by small scale private providers.

Source: Adapted from Fonseca et al. 2011. WASHCost Briefing note 1a: Life-cycle costs approach – costing sustainable services. IRC: The Hague.

3.5.1 Capital expenditure

BRAC WASH I financially supported the capital expenditure on latrine construction in three ways: 1) directly through grants to ultra-poor households, 2) through 0% interest loans to poor households (although this is ultimately classified as a household expenditure), and 3) through one-off capacity building, hygiene promotion and logistical support.

The Government of Bangladesh also provided subsidies for poor households through annual development programme (ADP) grants of typically Taka 520 per latrine as well as through general hygiene promotion activities. Other development partners also supplemented latrine construction through grants⁴.

Capital expenditure from households was collected through questionnaires and included materials (rings, ring slabs, bricks), mason work and transport costs.

⁴ Data sources: BRAC WASH I, derived from expenditure and receipts for Bagherpara Upazila (accessed at head office); GoB data was derived from "WaterAid policy brief May 2012"; Latrines constructed by other development partners was recorded at head office level.

3.5.2 Operational and minor maintenance expenditure

Operational expenditure was in its majority collected through household surveys for facilities older than three years and that were also hygienic. Expenditure included regular and small costs such as for brush, bucket, broom, liquid and powder cleaner, soap, siphon, latches, etc. A limitation found during the analysis is that a non-poor person may have their toilet cleaned by a paid cleaner, but the questionnaire does not have any provision to calculate such a cost.

3.5.3 Capital maintenance expenditure

The responsibility for pit emptying and latrine renewal lies with the household and was collected through household surveys for facilities older than three years and that were also hygienic. Costs included: replacement of superstructure, ring, ring slabs, pit emptying, roof, colouring, pan, pipes, etc.

3.5.4 Expenditure on direct support

BRAC WASH I provided continued support to Bagherpara between 2006 - 2011. This took many forms including continued capacity building and monitoring of behaviours as well as the facilitation of regular meetings for WASH committees and other co-ordinating roles at union and upazila level. These field activities are supported and guided by the BRAC head office in Dhaka⁵.

3.5.5 Direct support costs and costs of capital

Expenditure on indirect support - that is the government expenditure on macro-level support, including planning and policy making, as well as information on costs of capital (interest rates on the borrowed amount from donor agencies if any) - were not applicable to this case study.

Expenditure data collected from different years has been converted to 2012 values using the World Bank's GDP deflator figures. Additionally, in some cases, expenditure data has also been converted to US dollars using market exchange rates for 2012.

3.6 Classification of sanitation service levels

The sanitation service level framework developed by IRC WASHCost evaluates the services provided by the delivery of safe latrines using four indicators:

- 1) the type and accessibility of latrines to households (in line with national norms);
- 2) the use of sanitation facilities by members of the household;
- 3) the cleanliness, maintenance and pit emptying of the facilities; and
- 4) the environmental safety of faecal waste.

To calculate the access of households to latrines the figures from BRAC WASH I programme were used, while the other indicators (use, reliability and environmental safety) were derived using a survey covering 4,674 households. The criteria used are described in Table 3.

⁵ Data sources: Expenditure and receipts from Bagherpara Upazila, overhead costs incurred by BRAC WASH I (assumed at 7% of initial grant) - both accessed at head office level.

Table 3: Service levels indicators used for the study

Service level criteria	Indicators for assessing service level	Corresponding service level	Source data
Access	Hygienic toilets with septic tank and running water facility	Improved	Records from BRAC WASH I
	Hygienic latrine (i.e. one with a pit, superstructure and water seal) at household	Basic	
	Unhygienic latrine at household level	Sub-standard	
	No latrine at household level	No service	
Use	All household members use the latrine (including children over 5 years)	Basic/improved	Primary survey 10% sample HH (4,674)
	Some household members are assumed to use the latrine	Sub-standard	
	No use/open defecation	No service	
Environmental Protection	Environmentally safe disposal, with re-use (pit content used as bio-fertiliser after safe disposal)	Improved	
	Latrine does not pose an environmental risk (pit content disposed of properly)	Basic	
	Pit emptying occurs but there is a high risk of environmentally unsafe disposal (high risk of contamination)	Sub-standard	
	Open defecation assumed to pose a potentially significant environmental risk	No service	
Reliability	Regular routine O&M = If latrine is hygienic with septic tank and running water then it is assumed to have reliable O&M	Improved	
	Unreliable O&M = If latrine is unhygienic (i.e. one with a pit, superstructure and water seal) then it is assumed to have unreliable O&M	Basic	
	No O&M/Open defecation = If the latrine is unhygienic (without water seal) or there is no latrine then it considered to have no O&M	No service	

4 Findings on sanitation service levels

4.1 Overall service levels achieved

The data available from BRAC WASH I allowed for the determination of only the “access” indicator since extensive data collection had been done. The service level indicators for use, environmental sustainability and reliability were collected with household surveys using 10% of the sample.

This means that assessing the change in service levels between the start and end of the project is primarily a reflection of the number of hygienic toilets constructed (Table 4). In the five years since the inception of the project there has been a rise of 40% (from 46% to 86%) of all households that have a hygienic latrine, and due to the assumptions made, this is reflected in a matching 40% rise of those with latrines giving at least a basic level of

environmental protection. Significant improvements can be seen across all the service level criteria.

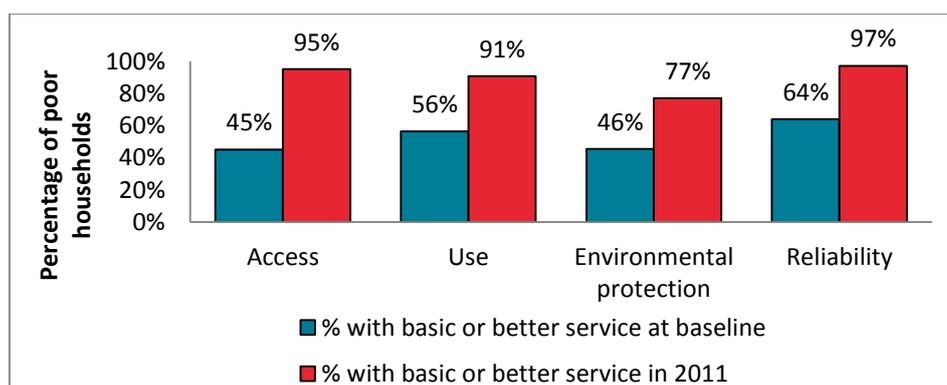
Table 4: Sanitation service levels before and after BRAC WASH I (both poor and non-poor households)

Service level criteria		No service	Sub-standard service	Basic service	Improved service
Access	Baseline (2006/7)	30%	25%	31%	15%
	Project end (2011)	2%	12%	58%	28%
	Difference	-28%	-13%	+27%	+13%
Use	Baseline (2006/7)	N/A	N/A	N/A	
	Sample data after project completion (2011)	2%	8%	89%	
	Difference	N/A	N/A	N/A	
Environmental protection	Baseline (2006/7)	30%	25%	46%	0%
	Sample data after project completion (2011)	2%	23%	72%	4%
	Difference	-28%	-2%	+26%	+4%
Reliability	Baseline (2006/7)	54%		31%	15%
	Sample data after project completion (2011)	14%		58%	28%
	Difference	-30%		+27%	+13%

4.2 Service levels for poor households

The improvements in service levels between the start and conclusion of BRAC WASH I are due to the financing and construction of new latrines by households, BRAC, the Government of Bangladesh and other development partners. The majority of the expenditure by agencies has been specifically targeted at improving services for poor households (Figure 2). This has led to significant changes in all four service level indicators for poor households, which show an estimated 50% increase in access and an estimated 30% and 45% increase in the other indicators.

Figure 2: Service level changes for poor households after BRAC WASH I



5 Findings on life-cycle costs

For this section, surveys were collected from 1.000 households which had a latrine for more than three years, which were used and hygienic. This is important because the costs presented can be considered as minimum benchmarks for the achievement of a basic level of service.

5.1 Impact of BRAC WASH on latrine construction for ultra-poor

The BRAC WASH programme provides financial support to the ultra-poor only for a very specific type of latrine: twin pits (mostly 2007-2011) and twin-pit offsets (after 2011). The first relevant finding is that the BRAC WASH programme had a catalytic effect on latrine construction (Figure 3) specifically for the ultra-poor (Figure 4) who would not have had a toilet without the BRAC WASH programme support.

Figure 3: Latrine construction per type of latrine in Bagherpara

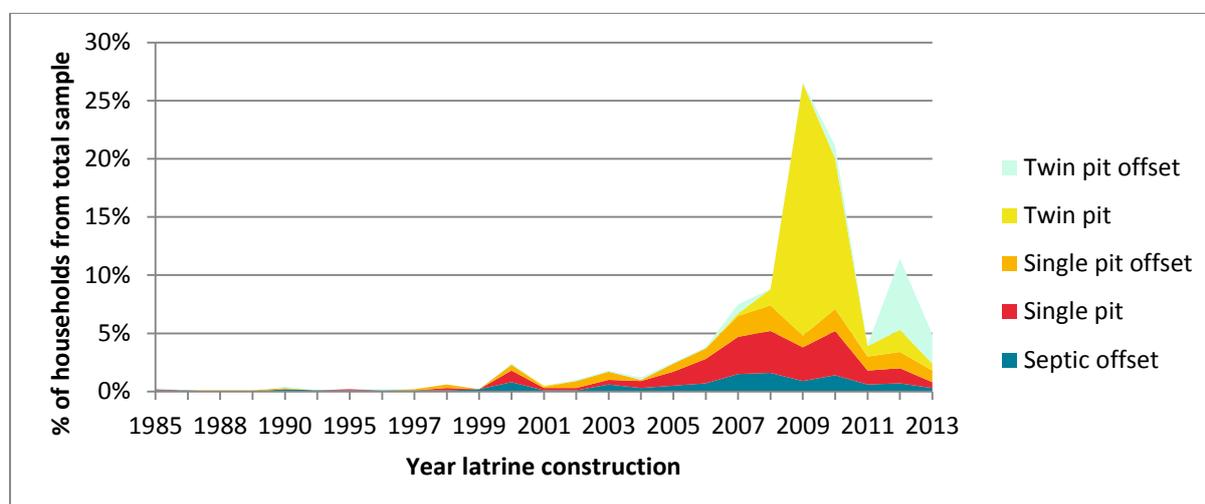
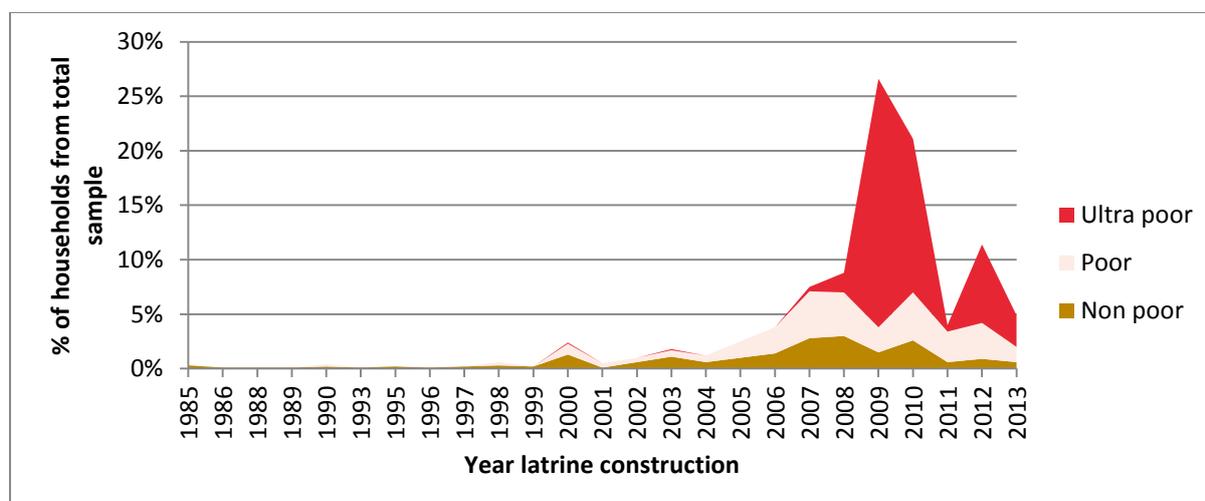


Figure 4: Latrine construction per socio-economic category in Bagherpara



5.2 Capital expenditure hardware and software

The capital expenditure data available relates to the construction of 15,900 latrines between the years 2006 and 2011 in Bagherpara Upazila. Just over half of these (53%) latrines were constructed for ultra-poor and poor households, financed either by households themselves or through grants covering all or part of the construction costs.

The remaining 47% latrines were self-financed by non-poor households and are pit latrines or latrines connected to septic tanks with higher unit costs. A number of different agencies were involved in the promotion and construction of these latrines, as summarised in Table 5.

Table 5: Total capital expenditure contribution per source of funds in Bagherpara Upazila

Source of funds	Type of expenditure	N ^o of latrines constructed	CapEx hardware	CapEx software	CapEx hardware per latrine (Taka 2012/3 USD ⁶)
BRAC WASH I	Grant CapEx hardware	4,966	10,307,686*	1,368,533*	2,242 Tk/27 US\$
Government (ADP)	Partial subsidy CapEx hardware	721 partly subsidised	374,920*	93,730*	562 Tk/7US\$
Other development partners	Grant CapEx hardware	144	465,048*	NA	3,488 Tk/43 US\$
Self-financed: Ultra-poor households without grant component	Household CapEx hardware	500 (sample)	364,760	NA	0 Tk**
Self-financed: Poor households	Household CapEx hardware	300 (sample)	2,507,464	NA	3,420 Tk**/42 US\$
Self-financed: Non-poor households	Household CapEx hardware	200 (sample)	7,679,639	NA	29,583 Tk**/361 US\$

*Taka 2011; **median Taka 2012/13

Hardware grants by BRAC WASH I financed the construction of 4,966 latrines for exclusively ultra-poor households at a cost of Taka 10,307,686 and represents approximately three times the combined expenditure of government and other development partners. Additionally

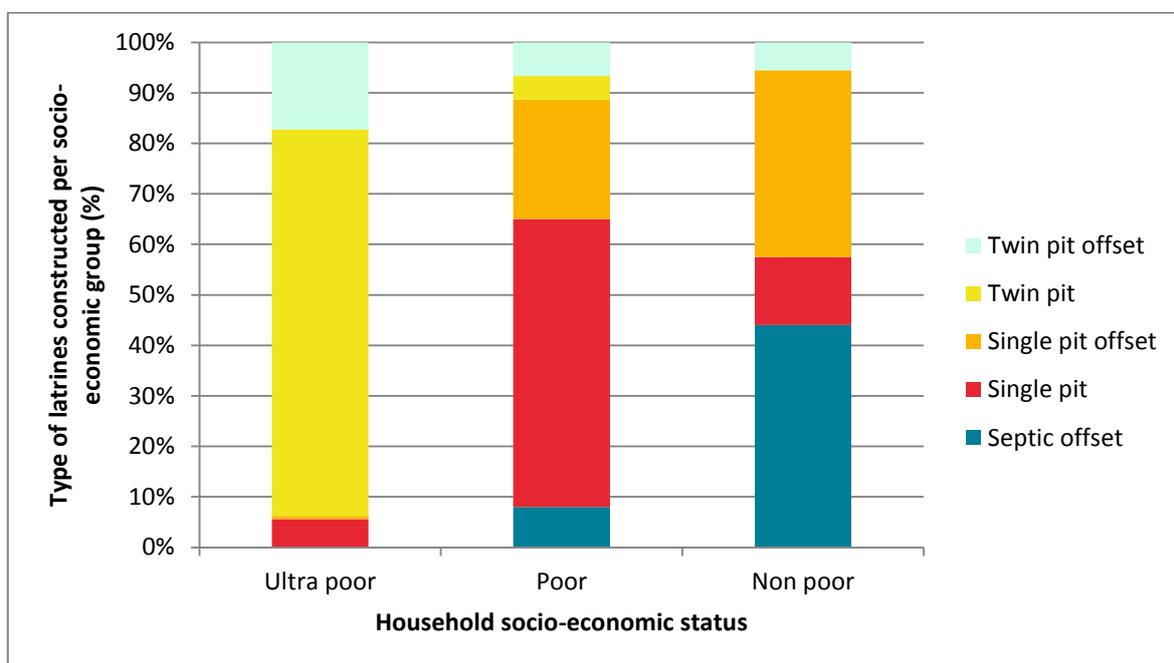
⁶ Average exchange rate 2007-2011, Taka 1 = US\$ 81.86. 2012 exchange rate Taka 1 = US\$ 70.06.

the BRAC WASH programme is shown to be the primary contributor to one-off software activities including the establishment and training of WASH committees, social mobilisation and hygiene promotion in schools and in the community. It is probable that these one-off software activities, alongside the considerable amount spent on annual direct support expenditure, has prompted the significant investments in the district for the construction of latrines by poor households.

5.2.1 Choice of latrines per socio-economic status

The ultra-poor receive support from BRAC WASH to build twin pit and twin-pit offset latrines. This is reflected in the analysis of which type of latrines are built by each socio-economic group. The poor, who do not receive a grant, construct mostly single pit latrines and the non-poor build both offset septic tanks and single pit offsets (Figure 5).

Figure 5: Type of latrines constructed per socio-economic status in Bagherpara



5.2.2 Benchmark costs of construction

All the costs were collected from cleaned and used latrines. The costs spent by households per socio-economic status are shown in Table 6 and the costs per technology in Table 7. The non-poor spend significantly more than the ultra-poor and the poor. But there is a small difference in the amount paid by the poor who do not get a grant and therefore build the cheaper single pits and single pit offset latrines – these are also promoted by BRAC who supports entrepreneurs and therefore ensures access to materials to those that want to build their own latrines.

Table 6: Total capital expenditure per person per socio-economic status (Taka/US\$ 2012-13)

	Socio-economic status						Total	
	Ultra-poor		Poor		Non-poor			
Total CapEx per person (median)	570 Tk	7 US\$	713 Tk	9 US\$	6,163 Tk	75 US\$	629 Tk	8 US\$
Total CapEx per person excluding BRAC grant (median) ⁷	0	0	713 Tk	9 US\$	6,163 Tk	75 US\$	443 Tk	5 US\$

Table 7: Total capital expenditure per latrine type (Taka/US\$ 2012-13)

	Latrine type									
	Septic offset		Twin-pit offset		Twin pit		Single pit offset		Single pit	
Total CapEx per person (median)	8,431 Tk	103 US\$	1,167 Tk	14 US\$	546 Tk	7 US\$	2,608 Tk	32 US\$	523 Tk	6 US\$
Total CapEx per person excluding BRAC grant (median) ⁸	8,431 Tk	103 US\$	542 Tk	7 US\$	0	0	2608 Tk	32 US\$	523 Tk	6 US\$

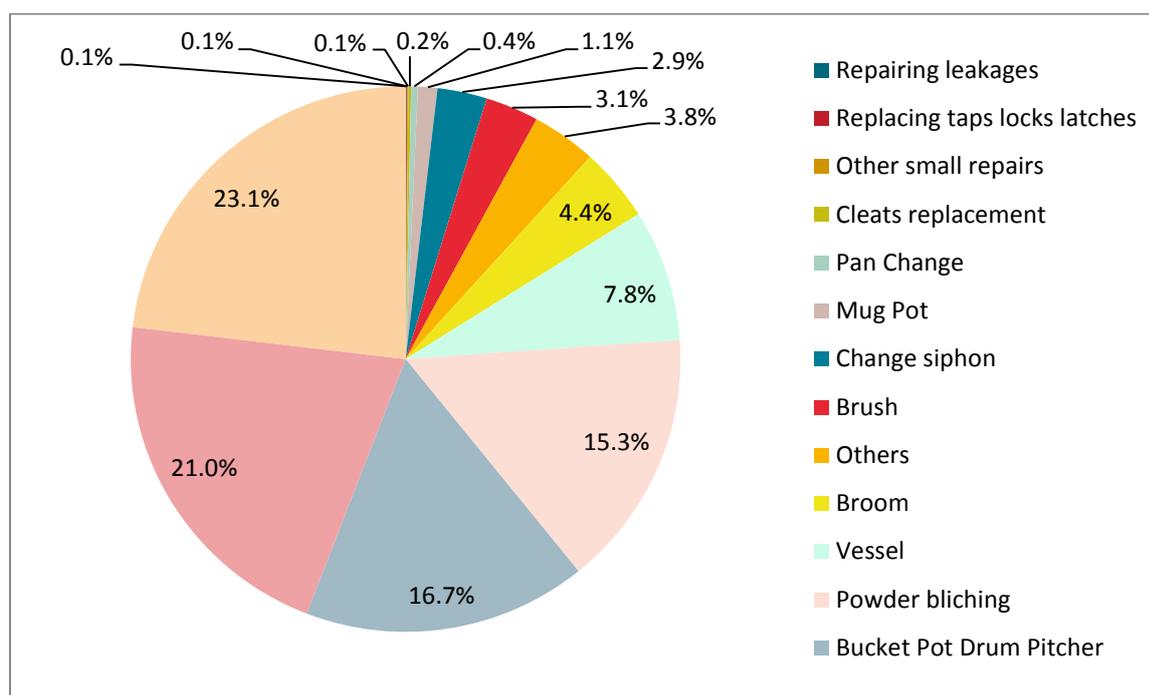
5.3 Expenditure on operations and maintenance

The major finding is that the latrines provided by BRAC to the ultra-poor can be maintained and be hygienic at a low cost. Cleaning products take up most of the operation and minor maintenance expenditure per year, as shown in Figure 6.

⁷ This is the amount that the households actually pay.

⁸ Ibid.

Figure 6: Breakdown of yearly household operational expenditure with latrines in Bagherpara



5.3.1 Benchmark costs for minor maintenance

The cost of regular, minor maintenance is the responsibility of households. The benchmark data below shows the minimum level of expenditure taking place on latrines that are adequately maintained. The typical annual operating expenditure is Taka 402 (US\$ 5) per year per household for the ultra-poor households and Taka 948 (US\$ 12) per year per household for the non-poor. This concerns only family latrines and shared toilets have not been part of the study. Details per person and per type of latrine can be found in Table 8 and Table 9. The non-poor tend to buy more expensive cleaning products than the poor. The overall median per person per year is US\$ 1. The non-poor tend to buy more expensive cleaning products than the poor.

Table 8: Yearly operational expenditure per person, per socio-economic status (Taka/US\$ 2012-13)

Latrine Type	Taka 2012-13	US\$ 2012-13
Ultra-poor	84 Tk	1 \$
Poor	104 Tk	1 \$
Non-poor	198 Tk	2 \$
Total	103 Tk	1 \$

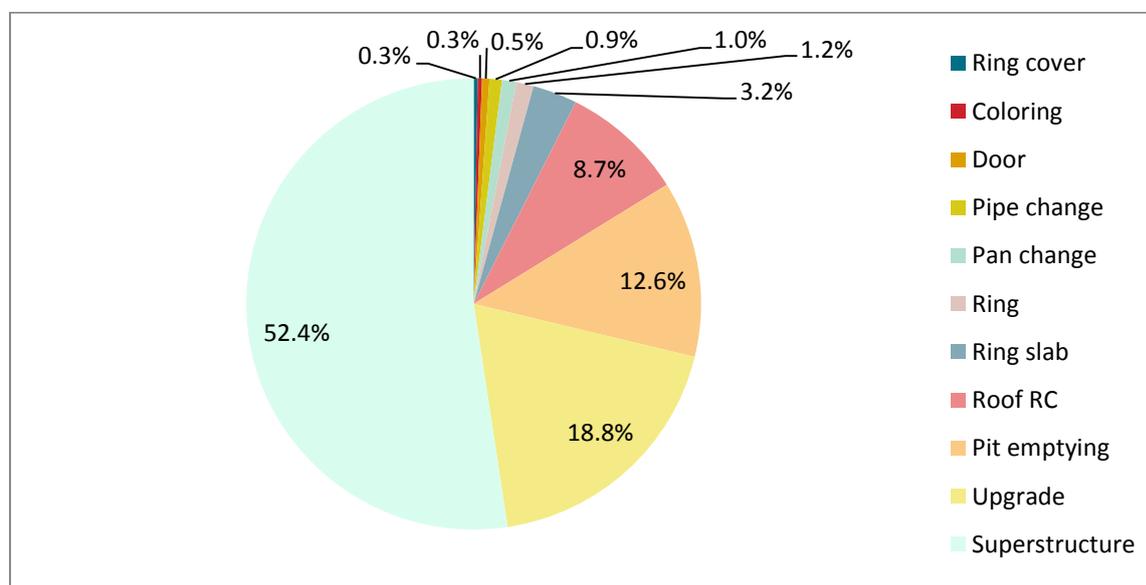
Table 9: Yearly operational expenditure per latrine type, per person (Taka/US\$ 2012-13)

Latrine Type	Taka 2012-13	US\$ 2012-13
Septic offset	213 Tk	3 \$
Twin-pit offset	118 Tk	1 \$
Twin pit	83 Tk	1 \$
Single-pit offset	148 Tk	2 \$
Single pit	88 Tk	1 \$

5.4 Expenditure on capital maintenance

The cost of regular maintenance, pit emptying and eventual renewal of latrines is generally expected to be covered by households. This expenditure is irregular in nature and often unexpected. With good regular minor maintenance, this expenditure can be avoided. Overall, superstructure upgrade and pit emptying take up most of the household costs with capital maintenance (Figure 7).

Figure 7: Breakdown of household capital maintenance expenditure with latrines in Bagherpara (averaged per year)



The capital maintenance costs vary per type of latrine constructed (Figure 8). The costs for upgrading offset septic tanks are mostly carried by the non-poor as they usually opt for this type of latrine. For twin pits and single pits, major repairs related to the superstructure take up most of the costs. Pit emptying related costs are faced by those households that have single pits. Because costs of maintenance are so intrinsically linked to the types of latrines constructed, the costs for different socio-economic groups are also different (Figure 9). The

ultra-poor and poor incur more costs for superstructure replacement, while the non-poor spend most on making their facilities stronger and prettier with tiles.

Figure 8: Breakdown of HH capital maintenance expenditure per latrine (Taka 2012-13)

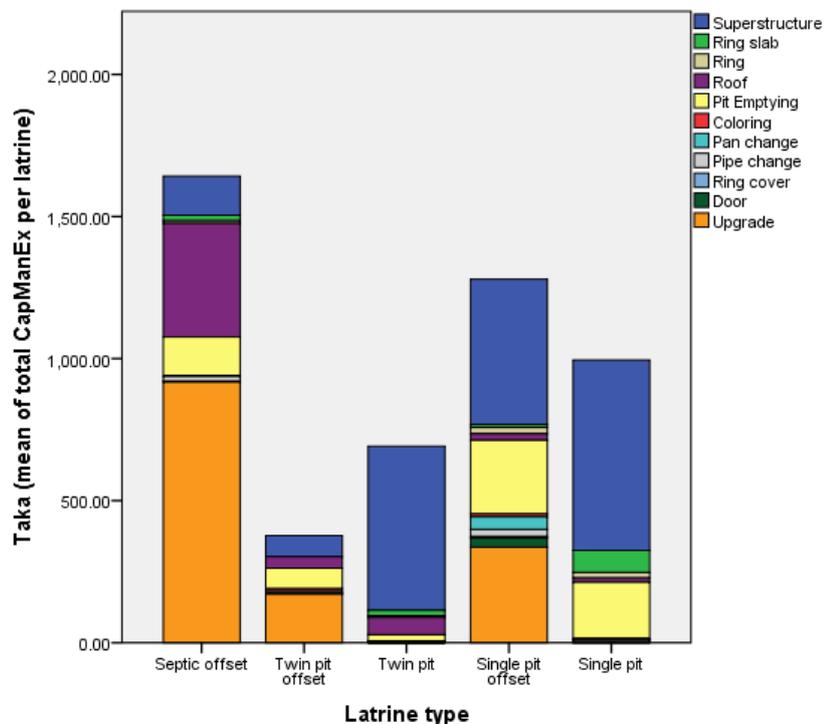
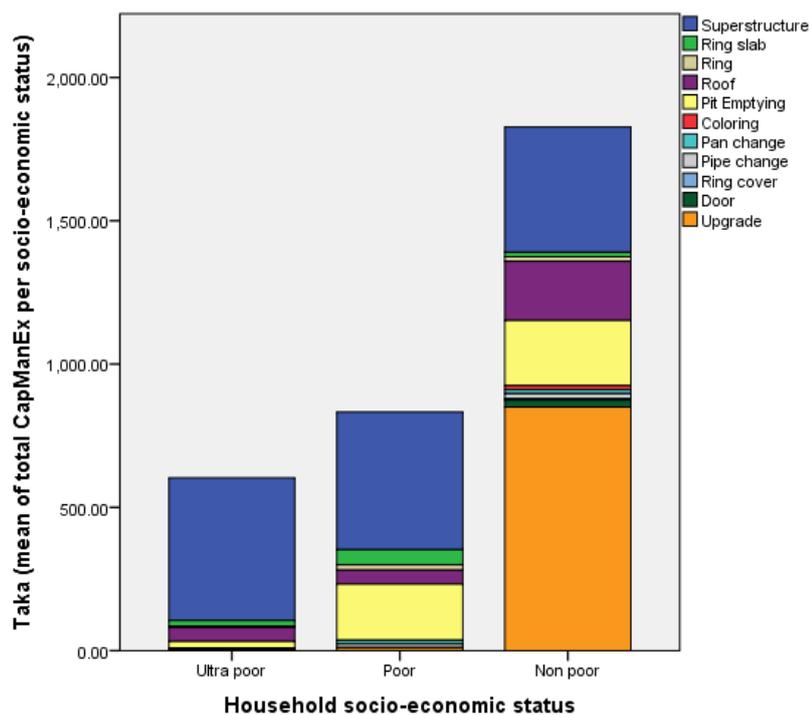


Figure 9: Breakdown of HH total capital maintenance expenditure per socio-economic group (Taka 2012-13)



5.4.1 Benchmark costs for major maintenance and replacement

Capital maintenance findings show that the ongoing expenditure required to maintain a reasonable sanitation service can range from almost nothing to Taka 116 (US\$ 1.4) per year for single pit latrines (Table 10 and Table 11). This can mean that the operational expenditure is taking place and therefore major replacements can be further delayed. However, it can also mean that given the fact that the majority of latrines are recent these costs have not yet “kicked in”. For instance, for capital maintenance related to superstructure, households have to spend money on major maintenance only after three years (Figure 10).

Figure 10: Capital maintenance expenditure with superstructure per latrine type

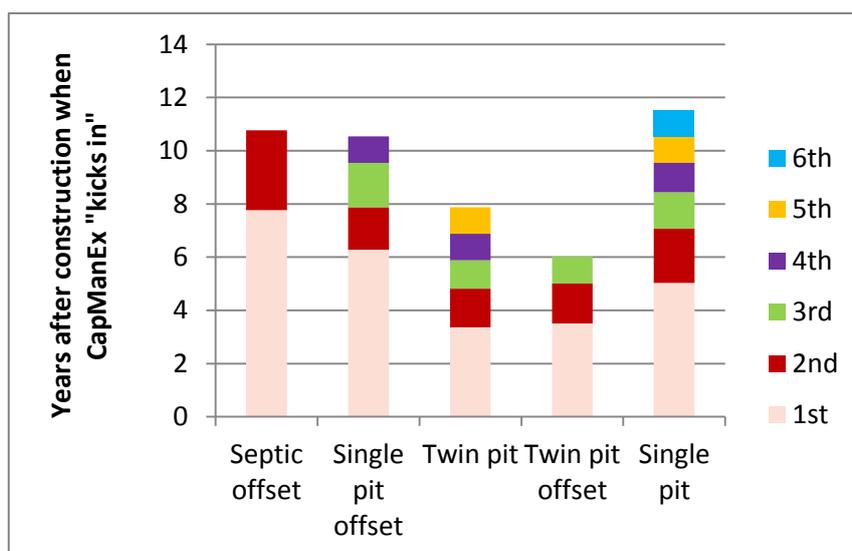


Table 10: Capital maintenance expenditure per person and per household per socio-economic status, averaged per year (Taka/US\$ 2012-13)

Latrine Type	Taka 2012-13	US\$ 2012-13
Ultra-poor	92 Tk	1 \$
Poor	87 Tk	1 \$
Non-poor	0 Tk	0 \$
Total	80 Tk	1 \$

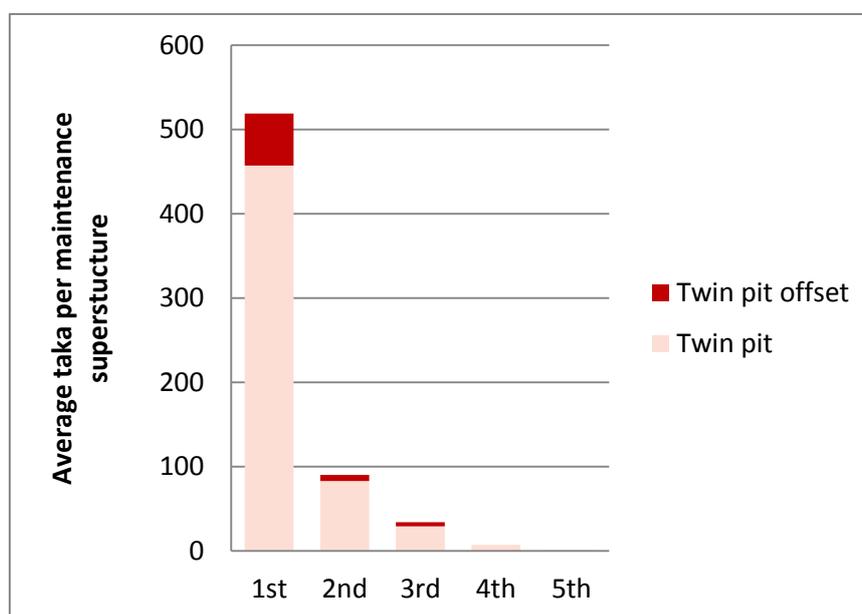
Note: this table shows the average per year which seems negligible compared with the graphs above which show the overall expenditure, this is because capital maintenance expenditure occurs in ‘lumps’ every couple of years as one-off larger expenditure but to compare across the types of households, we had to average per year.

Table 11: Capital maintenance expenditure per latrine type, per household, averaged per year (Taka/US\$ 2012-13)

Latrine Type	Taka 2012-13	US\$ 2012-13
Septic offset	0 Tk	0 \$
Twin-pit offset	0 Tk	0 \$
Twin pit	110 Tk	1.4 \$
Single-pit offset	27 Tk	0.3 \$
Single pit	116 Tk	1.5 \$

Going one step further in the analysis, and anticipating the requirements for capital maintenance expenditure by the ultra-poor and poor, which is critical for sustainability, the average cost for the first superstructure replacement of the twin-pit latrines (after three years) is about Taka 450 (US\$ 5.5) per latrine (Figure 11). Subsequent expenditure on major maintenance is less.

Figure 11: Capital maintenance expenditure with superstructure per instalment



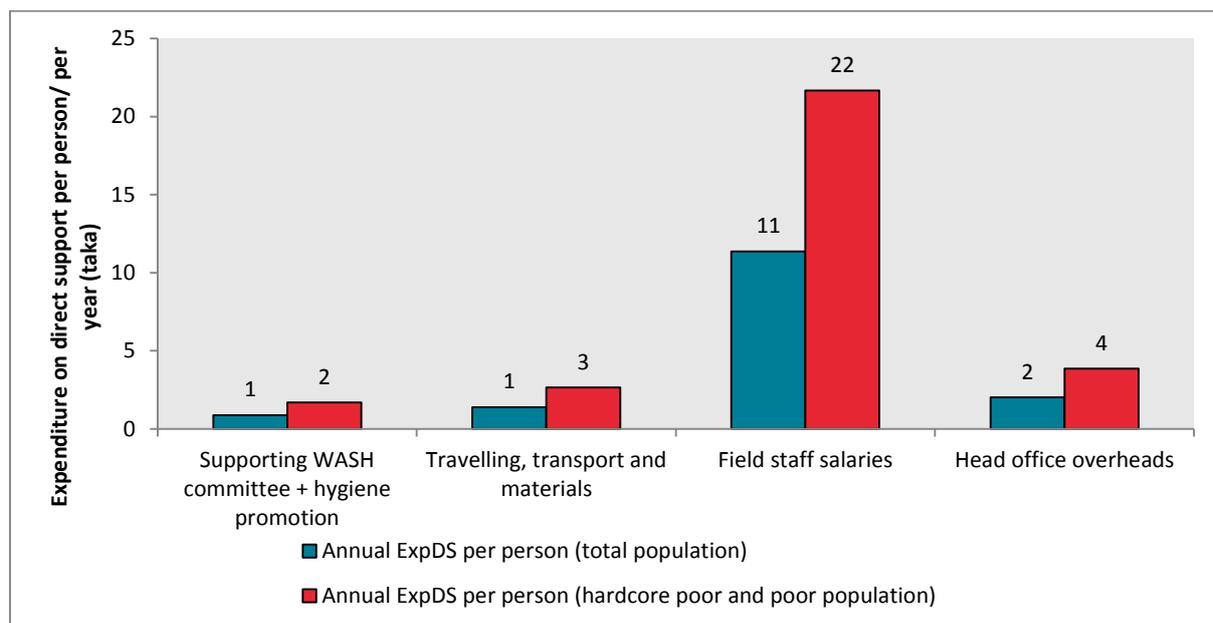
5.5 Expenditure on direct support

The expenditure on direct support (ExpDS) has only been incurred by BRAC, the proportionate expenditure on Bagherpara between 2006-2011 totalled Taka 16,490,988 (2012/3), which comes down to Taka 3,298,612 (US\$ 40,290) per year (2012/3). The primary expenditure relates to the salaries of field staff (73%) with other items such as head office overheads and ongoing hygiene promotion, representing between five and 10% each (Figure 12).

Given the average total population of Bagherpara of 212,088 (between 2006 and 2011), the annual expenditure on direct support equated to Taka 15.5 (US\$ 0.2) per person per year in 2011 when divided by the overall population in the district or Taka 33 (US\$ 0.4) per person per year when divided by the main target population: the poor and the ultra-poor (representing approximately 47% of the population).

The main conclusion is that for each dollar spent targeting the poorest, in return, the poor spend US\$ 18 per person on latrine construction and about US\$ 2 per year on maintenance which is great value for money.

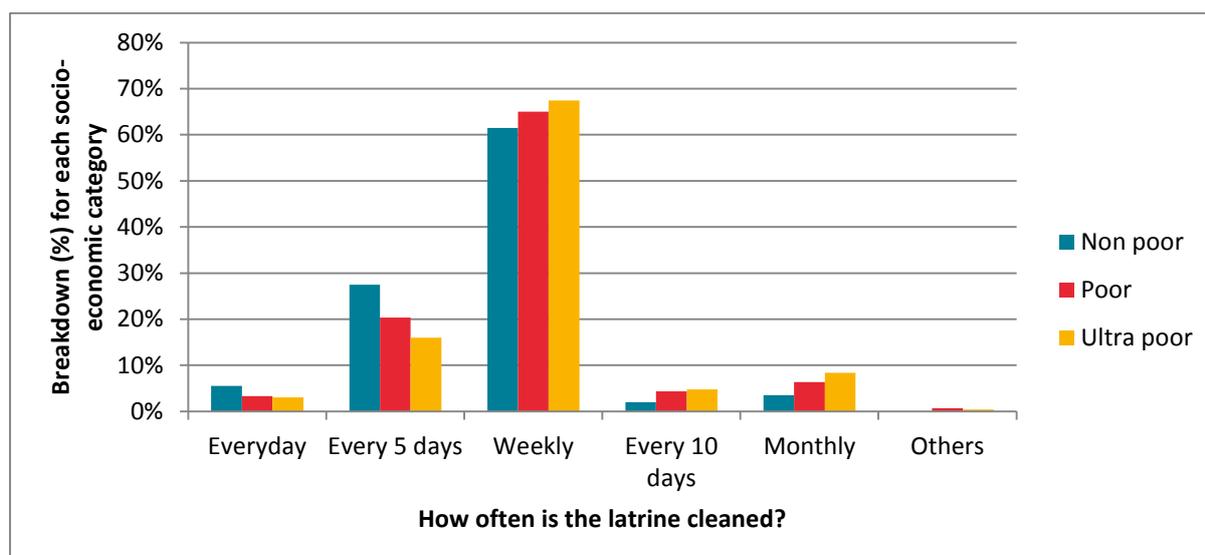
Figure 12: Expenditure on direct support per person/per year (Taka 2011)



Worth noting is that the annual expenditure on direct support from BRAC is three times higher than the total amount spent on capital expenditure software over the five-year project. This provides an interesting insight into the BRAC WASH approach, where priority has been placed on providing ongoing support to service delivery post-construction over intermittent or one-off hygiene promotion activities. Perhaps understandably, the main costs of this approach relate to permanent staff salaries in Bagherpara, whereas the extra expenditure on promotion activities and proportionate head office costs, for example, are relatively minor.

Although the expenditure by the BRAC WASH programme was specifically meant for the construction of toilets for those classified as ultra-poor, entire communities were targeted for behaviour change processes. The level of expenditure on activities promoting behaviour change has influenced whole communities: all the socio-economic groups have a similar pattern of hygiene behaviour as to how often they clean their latrines (Figure 13).

Figure 13: Hygiene behaviour of different socio-economic groups



6 Equity and affordability findings

With the grant, the ultra-poor households are spending almost as much as the poor on latrine construction, but BRAC WASH is providing higher quality latrines to the ultra-poor (Figure 14). Without the BRAC WASH programme the ultra-poor would barely have access to sanitation. The ultra-poor and the poor are also spending almost the same on recurrent maintenance (minor and major). The non-poor spend less regularly on major maintenance (when they do it's mostly to upgrade the facilities), but spend more on minor recurrent maintenance buying more expensive cleaning products. The poor need to spend more on pit emptying for instance which is reflected in the yearly costs.

Figure 14: Capital expenditure per socio-economic status per household (ultra-poor costs paid by BRAC grant)

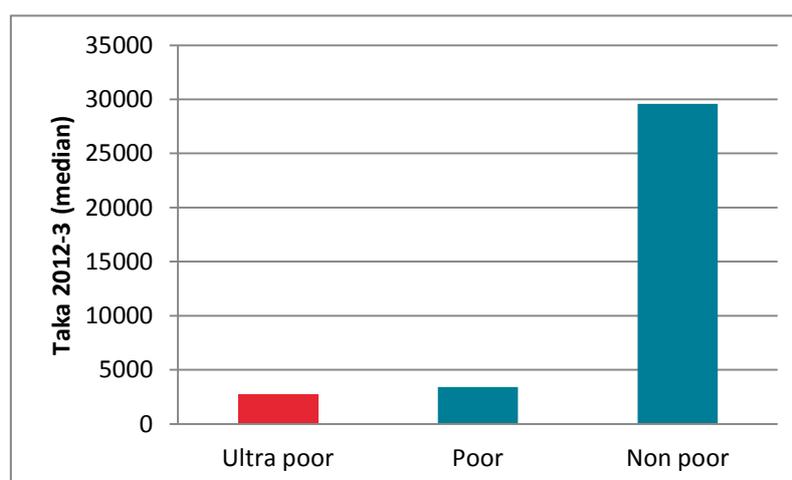
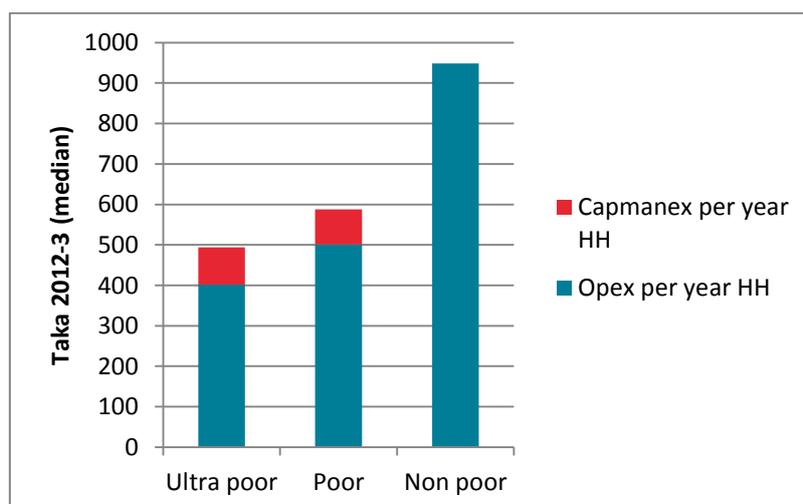


Figure 15: Recurrent expenditure per socio-economic status per household



The existing literature on benchmarks for affordability of water and sanitation services is limited and related mostly to the percentage of overall household budget spent on water and sanitation services. The most quoted amount is the three to five percent of household expenditure as an affordability rule⁹.

Table 12 presents different calculations on the percentage of expenditure by households on sanitation only. It shows clearly that without the grant for latrine construction, the twin pits and twin-pit offset latrines are not affordable to the ultra-poor amounting to almost 6% of the reported income. The amounts being spent by the poor on latrine construction clearly exceed the international benchmarks amounting to 5% of the reported household income (Figure 16).

It is well known that the higher the income of households, the higher the rate of underreporting on their real income. This might explain the reported approximate 19% of household income spent on latrine construction by the non-poor. Alternatively it might demonstrate a high willingness to pay for improved sanitation facilities. We have no other information to explain this amount.

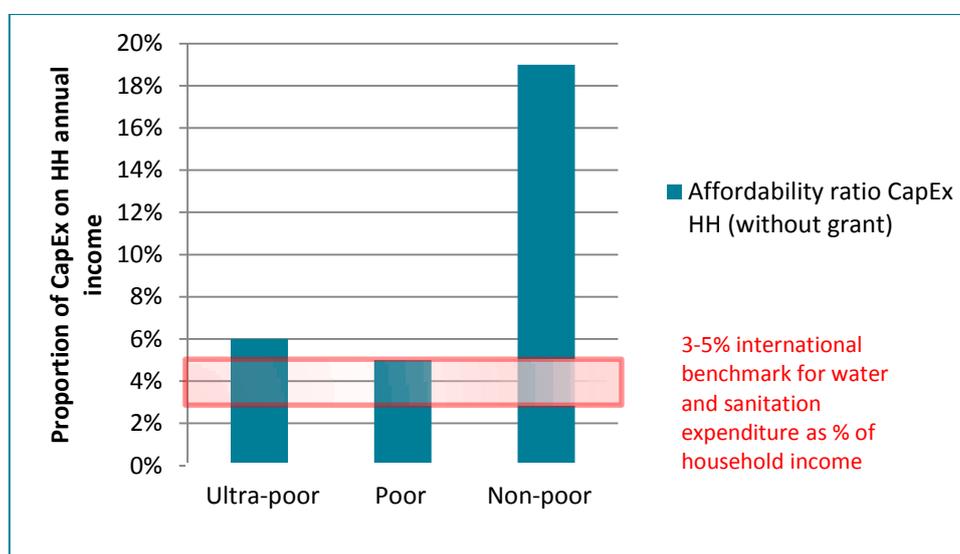
⁹ Damme, H., Hans M.G. and White, A., 1984. Technology Choices for the Decade. In *Water and Sanitation: economic and sociological perspectives*. Orlando, FL, USA: Academic Press, pp. 151-172. ; Mcphail, A. & Bank, T.W., 1993. The "Five Percent Rule" For Improved Water Service: Can Households Afford More? In *World Development*, 21(6), pp.963-973; Saunders, R.J. & Warford, J.J., 1976. *Village water supply: Economics and policy in the developing world*. (World Bank research publication). [online] Baltimore, MD, USA: Johns Hopkins University Press.

Table 12: Summary of affordability calculations

Affordability measured as % of HH reported income per year	Ultra-poor	Poor	Non-poor
CapEx as % of HH income with grant	0.0	4.9	18.7
CapEx as % of HH income without grant	5.7	4.9	18.7
OpEx as % of HH income per year	0.8	0.7	0.6
CapManEx as % of HH income averaged per year	0.2	0.1	0.0
CapManEx as % of HH income when first payment is minimum 450 Taka three years after construction	0.9	0.6	0.3
Total recurrent (OpEx + year where CapManEx occurs)	1.7	1.3	0.9

Operational and capital maintenance requirements to deliver a basic service are affordable even to the lower socio-economic groups. It is clear that the BRAC WASH I programme was largely successful in promoting latrine construction among not only ultra-poor, but also the poor households. Without the grant and without any other country measures (social tariffs, targeted assistance, reduced VAT, income support, etc.) to reach the ultra-poor, a reduction in the grant will lead to less coverage of the most vulnerable groups of the population.

Figure 16: Affordability of latrine construction per socio-economic groups



7 Conclusions and recommendations

The study has answered the research questions it has set out to investigate. One of the results is that the BRAC WASH programme has the most detailed available dataset in the sector on rural household construction and maintenance costs and service levels achieved for basic sanitation services.

The life-cycle cost methodology can be easily integrated in the monitoring instruments of BRAC WASH to enable a complete analysis of costs and service levels achieved and the potential towards sustainability.

7.1.1 Cost benchmarks

Cost benchmarks for hygienic latrines allow for the monitoring of the potential sustainability of services, equity in access and affordability for different socio-economic groups. The BRAC WASH programme had a catalytic effect on latrine construction specifically for the ultra-poor, who would not have had a toilet without the BRAC WASH programme support. The poor spend a median of Taka 713 (US\$ 9) on latrine construction while the non-poor spend a median of Taka 6,163 (US\$ 75) per person. The ultra-poor construct mostly twin pits (which are under the grant agreement), while the poor build mostly single pits and the non-poor mostly septic tanks and single-pit offset toilets.

The latrines provided to the ultra-poor by BRAC can be maintained and be hygienic at a low cost to the households. The typical annual operating expenditure is Taka 402 (US\$ 5) per year per household for the ultra-poor households and Taka 948 (US\$ 12) per year for non-poor households.

The costs for major maintenance vary per type of latrine constructed (Figure 8). Costs for upgrading dominate the costs concerning offset septic tanks. For twin pits and single pits, major repairs related to the superstructure take up most of the costs. Pit emptying related costs are relevant for single pits. The ultra-poor and poor incur more costs with superstructure replacement, while the non-poor spend most on modernising their facilities. Ongoing expenditure required to maintain a reasonable sanitation service can range from almost nothing to Taka 116 (US\$ 1) per year for single pit latrines.

The typical single pit latrines are cheaper to construct, however, many of its components will require regular replacement otherwise the service is likely to break down. In comparison, the twin pits are more expensive to construct but are more robust and will break down less frequently when not maintained. Without the grant for latrine construction, the twin pits and twin-pit offset latrines are not affordable to the ultra-poor, amounting to almost 6% of their reported income. The amounts being spent by the poor on latrine construction clearly exceed the international benchmark, 5% of reported household income.

Direct support costs by BRAC WASH equated in 2011 to Taka 15.5 (US\$ 0.2) per person per year when divided by the overall population in the district or Taka 33 (US\$ 0.4) per person per year when divided by the main target population: the poor and the ultra-poor. In either case, the proportion of direct support costs is substantial compared to the other projects assessed by WASHCost. The main direct support costs of this approach relate to permanent staff salaries in Bagherpara, whereas the extra expenditure on promotion activities and proportionate head office costs are relatively minor.

The improvement in the sanitation services from baseline to endline by BRAC WASH clearly demonstrates that in the long term, investment in behaviour change results in better, sustained service levels.

7.1.2 Value for money and comparison with WASHCost international benchmarks

The main conclusion is that for each dollar that BRAC WASH staff spends on targeting the poorest with changing hygiene practices, grants for latrine construction and mobilisation of local markets for latrine construction, in return, the poor spend US\$ 18 per person on latrine construction and about US\$ 2 per year on maintenance.

The costs incurred by households in Bagherpara for building and maintaining latrines which remain hygienic and are used years after construction are at the lower end of the WASHCost international benchmarks.

At US\$ 1 a person a year, minor maintenance is at the lower end of the WASHCost international benchmarks. Although major maintenance is taking place irregularly, at a minimum of Taka 450 (US\$ 5.5) for major maintenance of each facility, (which comes down to about US\$ 1 per person), the latrines last longer and households are spending less than the international WASHCost benchmarks.

Critical to the success of the programme are the direct support costs spent on the target population after the construction of the facilities. The costs are lower than the WASHCost benchmarks (for sanitation these benchmarks were based on a small sample of countries), but service delivery was very good. The BRAC WASH programme has given very good value for money.

7.1.3 Recommendations

If service levels are to be maintained over time in Bangladesh, especially for sanitation, donors, programme managers and households need to understand how much is required to meet the ongoing, recurrent costs of a service delivery.

The ultra-poor and the poor in the study are under the international and national poverty lines, nevertheless, the grant for latrine construction supports only the ultra-poor. The construction costs for the poor are at the international affordability benchmarks. Nevertheless, there is a high willingness to pay for sanitation facilities in this socio-economic group. A small grant support for construction of latrines by the poor could be catalytic and contribute to high coverage rates since the largest absolute number of the population in Bangladesh falls in this category.

The poor are building single pit latrines and therefore receive a lower service than the ultra-poor. Both the poor and the ultra-poor will soon be faced with the inevitable investments required to empty latrines and replace some of the infrastructure. This means there will be demand for sanitation services, through the provision of pit emptying/disposal services, ongoing hygiene promotion, waste management etc. These services may form part of the direct support expenditure from institutional bodies or be incorporated into services already purchased by households.

Planning ahead for asset management will be important to ensure that ultra-poor households are able to cover the costs of repairs, replacement or pit emptying. Benchmark costs for other upazilas can be collected for higher regional accuracy if required for programmatic purposes.

Annex 1 Life-Cycle Cost Approach - Household Questionnaire

I. General information

Date:

Name of the District:	Name of the respondent:
Name of Uzapilas:	Mobile No of the respondent:
Name of the Village:	Occupation:
Name of VWC:	Annual Income:
Household Number:	Land in decimal (Living):
Name of the HHs Owner:	Land in decimal (Arable land):

II. Availability of latrines and its costs

1. Household Status: (Tick please) Hard core Poor=1; Poor=2; Non poor=3	Please write the code=
2. Type of toilet: Septic Tank + Offset=1 Twin-pit offset=2 Single-pit offset=3 Twin pit=4 Single pit=5 Unhygienic toilet=6 Any other (specify)=7	Please write the code=
3. Use of Latrine All time all the family members (including infant – if applicable)=1 Some family members=2 No one uses=3	Please write the code=
4. When was the Latrine constructed? (Year)	

Section A: Capital expenditure

(in case household cannot give the exact amount fill the range with minimum and maximum amounts)

Type of Cost	Amount	Minimum	Maximum
5. How much did you spend on constructing the latrine?			
a. Super structure and materials			
b. Transportation			
c. Mason			
d. Any other expenditure (specify)			

Section B: Operational expenditure

6. Do you or a member of your family clean the latrine?	[1] yes [2] no		
7. How often do you clean your latrine?			
[1] Every day [2] Once in 5 days [3] Once in a week [4] Once in 10 days [5] Once in 15 days [6] Once in a month [7] Others (specify)	Please write the code=		
8. What equipments do you use to clean your latrine regularly?	Amount spent (as applicable)		
Type of equipment	Per week	Per month	Per year
a. Brush			
b. Broom			

c. Cleaning powder (Bleaching/Washing powder)			
d. Cleaning liquid			
e. Mug/scoop			
f. Vessel			
g. Bucket/pot/drum//Pitcher			
h. Soap			
i. Others (specify)			
j.			
k.			
l.			
9. Did you spend on minor repairs and maintenance?	Amount spent (as applicable)		
	Per week	Per month	Per year
a. Change of siphon or water seal?			
b. Replacing the taps/locks			
c. Repairing of leakages			
d. Latches			
e. Pan Change (Plastic)			
f. Others (specify)			
g.			
h.			
i.			
Environmental Protection			
10. Does it ever filled up with faecal sludge after installation? Status Yes=1; No=2	Go to section 3 if your answer is No		
11. How was the faecal matter disposed of last time (Kept minimum of 12 months – if applicable) a. Composted and re-used=1 b. Disposed safely into a pit outside area=2 c. Disposed in an open area, surface water, jungle, field, tank outside the house premises, etc.=3 d. Others (Specify)=4			
12. What will you do when pit is full with the faecal matter? (If applicable) a. Will compost and re use=1 b. Will dispose safely into a pit outside area=2 c. Will dispose in an open area, surface water, jungle, field, tank outside the house premises, etc.=3 d. Others (Specify)=4			
Section 3 Capital Maintenance			
13. Was there any substantial damage happened due to floods/storms/other calamities (Tick please)	[1] yes [2] no		

14. Did you change the superstructure (bara)/latrine rings/slabs/ring cover after construction of the latrine? (Tick please) (Including labour cost)	[1] yes [2] no	
	Year	Amount (Taka)
a. Super structure		
b. Ring slab		
c. Rings		
d. Roof repair/change		
e. Pit emptying		
f. Colour		
g. Pan (Ceramic) change		
h. Changing pipe		
i. Up gradation Cost		
j. Others		
k.		
l.		
m.		
n.		
o.		
Observation notes after visiting the latrine.		

Name and mobile of the data collector:

