Study on Lifecycle Cost of Water Points and Affordability of the Poor People to Access in Safe Water in Urban and Rural Areas in Bangladesh

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Introduction

During past five fiscal years (FY 2007/08 – FY 2011/12), Government of Bangladesh has spent in Water Sub-sector Tk. 44,020 million (in FY 2011/12 market price) of which the rural areas, irrespective of locations (disadvantaged, hard-to-reach, etc.), have received Tk. 7,835 million (i.e. 17.8% of total spending for 75% population). In this back drop, WaterAid Bangladesh has sponsored a study to explore cost of water supply for various types of water points in different disadvantaged, hard-to-reach and difficult areas in terms of safe drinking water availability using lifecycle cost approach (LCCA) framework and examine the affordability of the poor people to access safe water in the urban and rural areas in Bangladesh.

The **objective** of the study is to analyze and explore LCCA cost of water supply and affordability of the poor to access safe water in selected urban and rural areas.

Methodology

The study for exploring lifecycle cost has followed the methodological recommendation made under the WashCost project of International Resource Centre (IRC) on water supply, sanitation and hygiene. Secondary and primary data on various heads of expenditure have been elicited from respective government and NGO sources as well as from applicable households. In total 220 various types water points in 87 habitations being spread over 8 disadvantaged and hard-to-reach areas in terms of safe drinking water availability has served as object for collecting relevant information. In the process, 1259 households have also been interviewed to address the objective. For estimating lifecycle cost of water point relevant definitions and approaches formulated by the WashCost project has been used.

Findings

About 51% of the respondents are living below the upper poverty line and 31% are below the lower poverty line (nationally 31% households are poor). It reflects that the study has appropriately reached the poor households and the water points used by them.

Only 13.4% of all sample households have access to piped water (with hand pumps in Dhaka slum), while 77% households depends on either deep or shallow tube-wells with hand pumps. About 22% households own water points and nearly 77% households have to collect water from shared points. Across the locations the average amount of daily use of drinking water is 16.8 litres per household.

The households in some locations have regularly spent money as water bill, water expenditure or water purification/treating purpose. In Dhaka Slum, an average household has to pay annually Tk. 1,510 (USD 19) as expenditure on water. Households in Paikgacha (small town) and Koira (high salinity prone coastal belt area) respectively pay Tk. 921 (USD 11) and Tk. 1072 (USD 13) per year for collecting drinking water. Households in the rest of the locations do not pay for water or its collection. In Dhaka slum, Paikgacha and Koira, an average household spent around 2% of their net income as routine expenditure for water.

The lifecycle cost (current cost of water point) of any water point across the location is substantially higher compared to capital expenditure. For example, per water point current cost (lifecycle cost) of piped water supply with hand pump is Tk. 147,670 (USD 1,816)**.** The capital expenditure comprises 26% of the total cost, while operational expenditure and capital maintenance expenditure cost are 35% and 39% respectively.

In Ajmiriganj, the respective shares of capital, operational and capital-maintenance components is 75%, 8% and 17% of current cost of an average deep tube-well.

Irrespective of water point type, the operational and maintenance cost comprises a substantial amount of the lifecycle cost.

Conclusion

Regardless of water point type, location and number of user households, the operational expenditure and capital-maintenance expenditure taken together are immensely significant in reckoning the lifecycle cost of any water point.

Often, government and development partners narrowly focus on capital expenditure. During the study it has been revealed that many water points by different types have become dysfunctional due to lack of operational and capital-maintenance expenditure. In many instances the users of the water points installed under public schemes perceive that such expenditure will be borne from the public resources. On the other hand, the installation agencies usually do not have any built-in provision for inclusion of operational and capital-maintenance expenditure. Due to lack of operational and capital-maintenance expenditure, substantial amount of water sector expenditure are being mis-used and/or underutilized.

A massive motivational campaign needs to be undertaken to develop adequate sense of the water point users installed by government and/or development agency, which in turn, will contribute to the sustainability of the investment.

Recommendations

Policy makers and planners may consider the following recommendations for enhancing sustainability of the non-individual household owned water points as well as better utilization of the public resources spent in water sector.

- Undertake properly designed interventions to develop a sense of ownership among the users of water points installed utilizing public resources.
- Government may facilitate creation of a fund for meeting the operation and maintenance expenditure involving the water point users. The users also need to contribute in this fund on regular basis. A differentiated approach of user contribution based on household income can be introduced.
- Introduction of a safety-net approach (subsidy policy) will be highly important for water point user households living below the lower poverty line.
- Local government institutions may be provided with lump some amount of resources for participating in the major maintenance/repairing work of the public funded water points along with the users.
- Cost rationalization may be introduced for water points constructed under the public fund.

CHAPTER 1
INTRODUCTION, OBJECTIVE AND METHODOLOGY

1.1 Introduction

WaterAid Bangladesh has undertaken an initiative to explore cost of water supply for various types of water points in different disadvantaged, hard-to-reach and difficult areas in terms of safe domestic[1] water availability using lifecycle cost approach (LCCA) framework and examine the affordability of the poor people to access safe water in the urban and rural areas in Bangladesh. It is worth mentioning that water supply in Bangladesh is of a mixed approach comprising of government managed large piped water supply systems, government sponsored/funded community water points and individually installed water points. During past couple of decades some Non Government Organizations (both national and international) have undertaken some community based initiatives on limited scale that enable access of poor people to safe water.

In cities like Dhaka, Chittagong, Rajshahi and Khulna specialized autonomous entities: Water and Sewerage Authority (WASA) have been established to provide safe water to its residents through piped water supplies. However, it is to note that in urban slums in cities WASA operates whereas in most of the instances low-income settlements in pourashavas are normally kept out of piped water supply coverage. In larger pourashavas (municipalities) which is mainly comprised of district headquarters (towns) piped water supply is considered as the basic solution for safe water supply. Although, each Pourashava has its own mechanism for provisioning of water supply, Department of Public Health Engineering (DPHE)[2] provides necessary technical assistance to pourashavas. Nevertheless, in district towns the piped water supply coverage is not provided to all habitations (housing settlements), and thus shallow and deep tube-wells with hand and/or electric pumps serves as the common solution for getting safe water. Most of the tube-well options except a very few are owned and managed by the respective households.

By and large, small towns and rural areas are dependent of shallow and deep tube-wells mostly owned by the respective households. In these areas, a small proportion of tube-wells have been installed by DPHE and handed over to community/group for management. Some NGOs also installed a limited number of tube-wells under user community/group ownership initiatives programme.

The coastal belt of Bangladesh is salinity prone, where the people have to depend mainly on rainwater. In some coastal belt areas there are some few instances of deep tube-wells providing salinity-free potable water. These deep tube-wells have become lone sources for drinking water for a greater proportion of households in coastal belt areas. As a result, an unique profession of supplying households with potable drinking water on commercial terms has emerged in the area. In some costal belt habitations few pond sand filters and a limited number of rainwater harvesting plants have also been installed.

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1 The accompanying study has concentrated its focus on safe drinking water options

2 Specialized department under Ministry of Local Government, Rural Development and Cooperatives (MoLGRD&C) for water, sanitation and hygiene activities

In hill tracts, still people has to depend on springs and unpolluted (perceived) streams. Considering the specific geo-physical conditions, government, international development agencies and NGOs have set up a limited number of safe water solutions in the form of deep tube-wells, gravitational flow systems and infiltration galleries.

During past five fiscal years (FY 2007/08 – FY 2011/12), Government of Bangladesh has spent Tk. 44,020 million (in FY 2011/12 market price) in Water Sub-sector. Of this amount the rural areas irrespective of locations (disadvantaged, hard-to-reach, etc.) have received Tk. 7,835 million (in FY 2011/12 market price)[3]. The per capita average per annum public expenditure in water sub-sector for rural areas is as low as Tk. 13.88 (USD 0.17).

However, it is worth noting that provisioning of water supply is widely considered as a public good. On the other hand, most of the households in rural areas and small towns belonging water points have been installed and maintained through individual investment. The similar scenario is found in very many of the pourashavas where a substantial part of the areas are not covered by municipal piped water supply systems. Due to non-availability of data the study has not explored the size of investment made for individually installed water points in the area. It is mentionable that delving into the number of drinking water points installed and managed by individual households as well as per annum out of pocket water expenditure made by individual households are not covered under public water supply system. This can be treated as an area for separate comprehensive nationally representative study.

Government expenditure on non-piped water supply is mostly capital expenditure on infrastructure while other important cost components like planning and designing, capital maintenance, source sustainability, water quality, etc., receive little or no allocation. This results in ad hoc investments in capital maintenance expenditure and poor service levels. On the other hand, appropriate cost sharing aspects of various relevant stakeholders are not realistic.

The study has explored lifecycle cost, cost drivers and cost sharing aspects of drinking water supply in the following location categories: (i) Low income settlement in big cities, (ii) Low income settlements in small towns, (iii) Low water table areas, (iv) Climate vulnerable areas, (v) coastal areas, (vi) Hill tracts, (vii) Arsenic prone areas, and (viii) Haor. The following water options[4] have been explored: (i) piped water supply to slums, (ii) shallow tube-well, (iii) deep tube-well, (iv) rainwater harvesting systems, (v) pond sand filter, (vi) gravitational flow systems, and (vii) infiltration gallery.

1.2 Objective, Methodology and Implementation

The **objective** of the study is to analyze and explore LCCA cost of water supply, and affordability of the poor to access safe water in selected urban and rural areas.

Methodology and Implementation: The study has purposively selected areas in each location categories. The study areas include both rural and urban areas. Dhaka slums and Paikgacha Pourashava represents urban, while the rest of the locations belongs to rural. Each of the location categories in rural areas has been represented by an upazila (sub-district). In each selected upazila 20% unions and in each union 3 to 4 villages have been selected.

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[3] *Barkat A., Poddar A., Abdullah M., (2012) Analysis of the National Budget for Water and Sanitation Sector in Bangladesh: FY 2007/8-FY 2011/12, conducted by Human Development Research Centre (HDRC) sponsored by WaterAid Bangladesh, Dhaka, 2012.*

[4] In this report the words: water options, water point types, sources of water have been used interchangeably.

Table 1.1: Sample areas by location categories

Location categories	**Sample areas**
Low income settlement in big cities	Dhaka Slums
Low income settlements in small towns	Paikgacha Pouroshava
Low water table areas	Bagmara
Climate vulnerable areas	Hymchar
Coastal areas	Koira
Hill tracts	Bandarban Sadar
Arsenic prone areas	Sitakunda
Haor	Ajmirigonj

Altogether 87 sample habitations and 220 water points have been selected from among 8 location categories. From each sample water points about 1 to 7 user households have been interviewed to draw information on water point cost, and affordability of the poor to access safe water. A total of 1259 households have participated in the study as respondents and/or key informants.

Table 1.2: Sample habitations and Water point by location

District	Upazila	Sample habitation (village/Wards/Slums	Water point	Sample Water points
Khulna	Koira	16	Deep Tubewell	14
			Shallow Tubewell	14
			PSF	10
			RWH	10
	Paikgacha	5	Shallow Tubewell	14
			RWH	5
Chandpur	Hymchar	9	Shallow Tubewell	14
			Deep Tubewell	14
Chittagong	Sitakundu	10	Shallow Tubewell	16
			Deep Tubewell	16
			RWH	4
Habiganj	Ajmiriganj	11	Shallow Tubewell	9
			Deep Tubewell	14
Rajshahi	Bagmara	17	Deep Tubewell	13
			Tara deep	20
Bandarban	Bandarban sadar	15	IFG	5
			GFS	5
			Deep Tubewell	6
Dhaka	Dhaka Slum	4	Piped water supply delivery using hand-pump	17
Total Water Points		87		220

The study has been conducted in 3 phases. At the first phase, water point mapping has been made for each of the lowest tire of the study areas. The working definition for water points used in the study was the points from where people commonly collect drinking water. The mapping exercise besides identification of points of all the water options, sample water-points has been selected and GPS coordinates of the sample water points have been collected.

At the second phase a questionnaire survey has been administered among the users of the selected sample points.

At the third phase LCC cost related data has been congregated from several secondary and primary sources. The secondary sources include DPHE Head Office and Upazila Office, pourashava, NGOs working in WASH sector, whole sale/retail shops trading with water supply equipments and spares, technicians involved in installing and repairing of water points. The water point users and owners of individual water points provided primary information. All cost information has been gathered in Tk. and converted into current year market price.

1.3 Definitions and Approaches Used in the Study

Lifecycle Cost Approach usually includes the following broader heads of expenditure as components: (i) Capital Expenditure (CapEx), (ii) Operational Expenditure (OpEx), (iii) Capital Maintenance Expenditure (CapManEx), (iv) Expenditure on Direct Support (ExDS), (v) Expenditure on Indirect Support (ExIDS), (vi) Cost of Capital[5]. These components in real life are segregated into different sub-components.

Capital Expenditure (CapEx) is divided in to 2 sub-components, namely (a) hardware capital expenditure (CapExHrd) and (b) software capital expenditure (CapExSft). By definition CapExHrd is the establishment/instalation cost of water infrastructure, water extracting equipment/elements, purification equipment, storage reservoirs, distribution systems, etc. CapExSft is the cost of planning and designing the drinking water points. Hence, CapEx (including hardware and software) is one-time cost. The accompanying study has considered investments for installation of currently functioning drinking water points. For a sample water point[6] all the CapEx related expenditure is collected since its installation using current market price irrespective of its year of installation. The present value of these expenditures for sample water points have been obtained from different sources (like local DPHE engineers, NGO experts, individual households who installed the point, local retail outlets dealing with materials water points) and cross checked before considering the information in current market price of parts/equipments/elements.

OpEx is the operational expenditure spent on the regular maintenance (day to day maintenance of water point for keeping it functional). In context of Bangladesh, for non-piped system water points OpEx is the responsibility of users of the water points. It is to note that, in case of water point being installed by an individual household it is the responsibility of that household, although it may also be used by other households. For piped water connections in the urban slums OpEx (amount for maintenance of their water outlets and storage systems) is borne by the dwellers. In most of the cases slum owners mount OpEx in the house rent along with water bill.

OpEx information has been collected for the current year only. The same amount has been included in the cost of each year's expenditure estimates.

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5 *Fonseca C., Franceys R., Batchelor C., McIntyre P., Klutse A., Komives K., Moriarty P., Naafs A., Nyarko K., Pezon C, Potter A., Reddy R. and Snehalatha M., (2011) Life-cycle costs approach: Costing sustainable services, WashCost, Briefing Note 1a International Water and Sanitation Centre(IRC).*

6 Hereinafter, unless clarified otherwise the word water point denotes currently functioning drinking water points.

CapManEx is expenditure related to renewal and/or rehabilitation of water point (e.g. replacement of major equipment/elements like boreholes, pump set or plant equipment, etc. CapManEx (likewise CapEx) during functioning period has been collected in current market price, crosschecked in the manner stated above and cumulated over the years.

ExDS is defined as the expenditure on support during post implementation of the WASH systems (like IEC activities). However, for sample water points such activities (as well as expenditure under this head) have not been reported. Cross checking with the public organization (DPHE, Pourashavas, union parishads) and NGOs have not yielded any information that could be used in the costing exercise.

ExIDS is expenditure associated with macro planning and policy making at the national level. Expenditure on this particular head is available in planning and budgetary documents of the concerned public agencies at a very broad level under different budget and planning heads applicable for public water supply. It has been found very cumbersome and/or unrealistic to apportion the relevant expenditure for a particular water point. Therefore, the information under this head has not been explored.

CoC is the interest payments on any borrowed money. Investigation on this issue through key informant interviews with policy level officials of DPHE reveals that this component is applicable in large scale water supply projects (mostly piped water supply projects). Hence such projects have not been considered under the purview of the current study, and this component is not applicable in the costing exercise.

The following formulas have been used for estimating lifecycle cost.

Current Cost of Water Point using LCCA = CapExHrd + CapExSft + (OpEx x time span) +
(Sum of CapManEx for time span) …….. (I)

Where ,
Time span of a water point is defined as total duration of functioning of the respective water point

Current Cost of Water Point per Household using LCCA = Current Cost of Water Point ÷
Number of user households …… (II)

Current Cost of Water Point per person using LCCA = Current Cost of Water Point per HH ÷
Average number of HH Members …… (III)

1.4 Example of Lifecycle Cost Estimation

For better understanding of estimation procedure an example of an average piped water supply using hand pump in Dhaka slums is presented below in a tabular form.

Estimation of Lifecycle Cost for an average Water point in Dhaka Slum

Item	Quantity	Expenditure
Dhaka WASA office		
1. Water connection fee		Tk. 2500
2. Meter		Tk. 6000
3. Conveyance bill (return trips for approving water connection)	5 days (Tk. 80×5)	Tk. 400
4. Imputed Wage (5 days)	Tk. 400×5	Tk. 2000
5. Speed money in WASA office	Tk. 200 ×5	Tk. 1000
Dhaka City corporation office		
6. City corporation fee (using road for underground pipe connection from the WASA distribution point)		Tk. 4000
7. Speed money in city corporation		Tk. 1000
8. Conveyance bill (return trips for getting approval for making underground pipe line)	Tk. 80×3	Tk. 240
9. Imputed Wage (3 days)	Tk. 400×3	Tk. 1200
10. Cost of pipe (400 ft)	Tk. 15 ×400	Tk. 6000
11. Labour cost (for digging pipe connection trench and before laying pipe and filling the same after laying connection) (@Tk. 350 per labour) (3 labour x 1 day)	Tk. 350 ×3	Tk. 1050
12. Labour cost (Tk. 550+Tk.350: wage of 1 technician + 1 assitant)		Tk. 900
13. Cost of hand pump set		Tk. 3000
Sub-total= Tk. 29,290		
Construction of platform and drain:		
14. Cement (3 bags)	Tk. 500×3	Tk. 1500
15. Brick cheaps materials (1 bag)		Tk. 100
16. Sand (9 bags)		Tk. 300
17. Labour cost (Tk. 550+Tk.350: wage of 1 mason + 1 assistant)		Tk. 900
18. Bricks (200 pieces)	Tk. 8000 per thousand	Tk. 1600
Sub-total= Tk. 4400		
Capital Expenditure Hardware Cost :	**Tk. 33,690**	
Capital Expenditure Software Cost : ***CapExSft includes apportioned (on the basis of *prorata* time involvement) salary of directly involved staff, managerial and supervision staff, rent of office space, utility bills, front line IEC expenditure, etc. (Data source: KII)**	**Tk. 4,500**	
Operational cost:		
19. Rod (4 pieces per year)	Tk. 50×4	Tk. 200
20. Screw (12 pieces per year)	Tk. 20×12	Tk. 240
21. Plunger (1 pieces per year)		Tk. 200
22. Washer (4 pieces per year)	Tk. 70×4	Tk. 280
23. Value (2 pieces per year)	Tk. 50×2	Tk. 100
24. Conveyance bill (return trip for buying spare parts)	Tk. 40 ×23	Tk. 920
25. Imputed wage (4 days)	Tk. 350 ×4	Tk. 1400
26. Payment of caretaker for operating (@ Tk. 1800 per month)		Tk. 1800
Operational Cost for time span (10 years) @ Tk. 5140 per month	**Tk. 51,400**	
Capital Maintenance cost:		
27. Handle (2 pieces in 3 years)	Tk. 340×2	Tk. 680
28. Removal of iron or other materials from pipe (cleaning pipe)	(once in 3 year)	Tk. 9000
29. Replacement of damaged pipe	(once in 5 years)	Tk. 13000
Total capital maintenance cost for time span (10 years)	**Tk. 58,080**	
Average Current Cost[7] of water point (based on LCCA) having piped water supply (with legal connection) using hand pump per point in Dhaka Slum = Tk. 147,670 (USD 1,816)		
Average Current Cost of water point (based on LCCA) having piped water supply (with legal connection) using hand pump per household in Dhaka Slum (average # of HH 32 households in the sample slum) = Tk. 4,651 (USD 57.2)		
Average Current Cost of water point (based on LCCA) having piped water supply (with legal connection) using hand pump per person in Dhaka Slum (average HH size 4.64) = Tk. 995 (USD 12.2)		

Note: Tk. 1.00 = USD 0.0123vide www.fx-rate.net entered on October 15, 2012

1.5 Limitations

In some instances, the technical details of the water points could not be easily retrieved. For these instances expert opinion has been solicited from the knowledgeable persons in the locality and current market price by each of the parts and/or elements have been cross checked with the local markets and suppliers. Operation and maintenance related information

[7] To compare water points with different time span of functioning, the term current cost of water point based on LCCA has been introduced.

has to be collected from either the individual owner or the knowledgeable users depending on their memory recall. Therefore, though several cross checks have been made and expert opinion has been solicited, some degree of biasness is unavoidable. Moreover, apportionment of expenditure associated with macro planning and policy making at the national level and relate it with a particular water point has not been made to avoid complications.

CHAPTER 2: POOR PEOPLE'S ACCESS TO WATER

2.1. Introduction

It is revealed that about 51% of the respondents are living below upper poverty line (national corresponding figure is 31.5% vide BBS, HIES 2010) while 31% of the respondents are below lower poverty line. Therefore, the study acceptably represents the poor households. Across the location, however, the share of households living below the poverty line varies between 85% in Ajmiriganj and 23% in Sitakunda. Deep and/or shallow tube-wells with hand pumps have been found as most common water source for drinking water across the locations.

In the sample Dhaka slums, the dwellers have to depend on piped water connections using hand pumps as water delivery devise. Not all of these water connections are legal (according to Dhaka WASA). The slum owners somehow managed to get the connections. In Koira, there are few unions that depend on pond sand filter or rainwater harvesting systems for drinking water. Similarly, in Bandarban Sadar a number of paras (village equivalent habitations in Chittagong Hill Tracts) depend on infiltration gallery (IFG), gravitational flow systems (GFS) and rain water harvesting systems (RWHS). Rain water harvesting for drinking water has also been found in a few villages in Sitakunda and Paikgacha. A substantial proportion of households have to buy drinking water in Paikgacha and Koira. The accompanying chapter delineates basic information on poor people's access to water supply.

2.2. Water sources, Quality of Water and Ownership

Drinking Water Source: The study indicates that for drinking water about 47% and 27% of the total households have round the year access to deep and shallow tube-wells with hand pumps respectively. This shows that a majority of the households depends on deep and shallow tube-well round the year. Only 13.4% of all sample households have access to piped water with hand pumps. The later is the explicit case of Dhaka slum dwellers (Annex-1, Table-1).

The study has also snooped into the seasonal variation of drinking water sources. It is revealed that out of the remaining households, 40% have access to deep and 22% to shallow tube-wells[8] in winter (Annex-1, Table-4). Similarly, 50% households reportedly have access to deep and 12% to shallow tube-wells in summer (Annex-1, Table-7).

Quality of water

An absolute majority of households (79%) has reported that round the year the quality of drinking water is good (Annex-1, Table-13). Out of the remaining households, 27% has mentioned that the quality of drinking water is good in rainy season, while 19 % has stated that the quality of drinking water they use in winter is good (Annex-1, Table-14, & Table-16). About 19% of similar category of households has reported that quality of water for drinking used in summer is good (Annex-1, Table-15).

[8] The word tube-well in the study denotes tube-well with hand pumps.

Ownership of water source

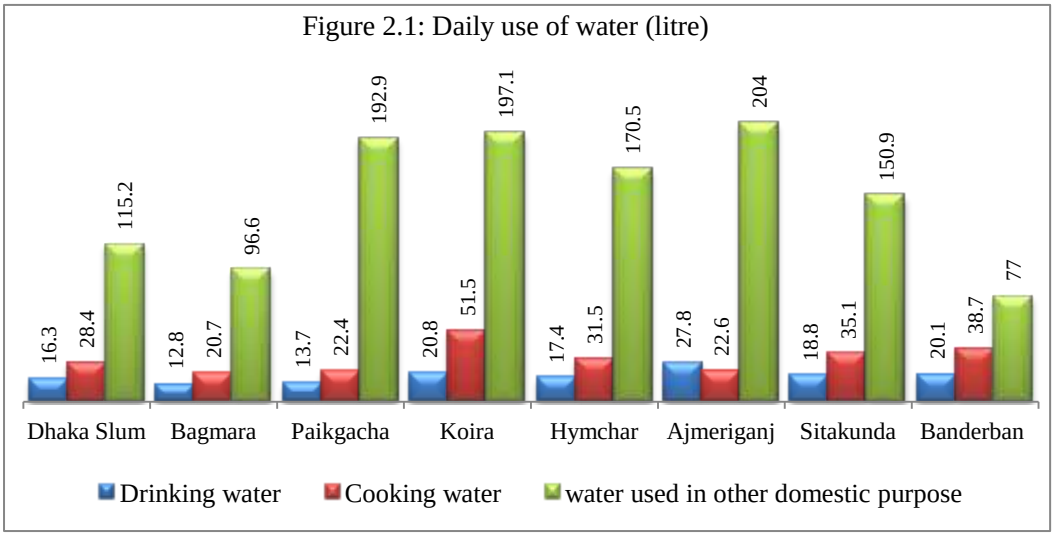
Analysis shows that 46% households have collected drinking water round the year from water points installed by organizations working in water sector (mostly DPHE and in some limited instances NGOs). Only 22% households have their own water sources and 31% households use to collect drinking water from sources owned by other individual households. It implies that about 77% households have to collect water from shared sources (Annex-1, Table-17).

However, for those households whose drinking water source varies by seasons, the picture is different. About 48% of such households in winter, 52% in summer and 17% in rainy season collect drinking water from sources belonging to other households.

2.3. Daily use of water

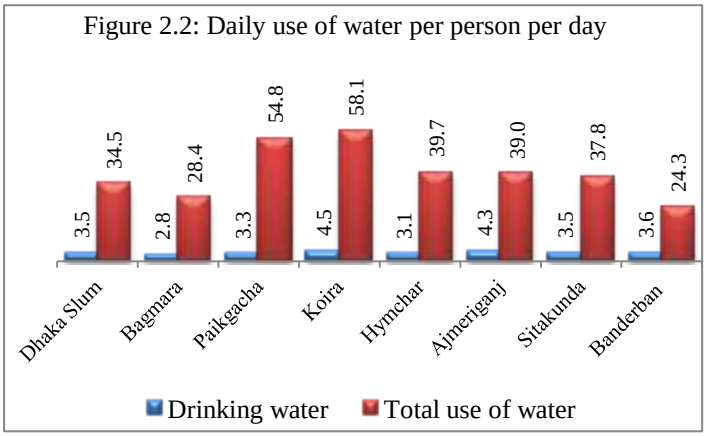
In terms of daily household water as well as drinking water consumption in litres, the total amount of daily use of water varies from location to location. The average amount of daily use of drinking water among the sample is 16.8 litres per household. In Dhaka slum, the amount of daily use of domestic water is 159.9 litres of which 16.3 litres are used for drinking purpose (Annex-1, Table-21A).

Figure 2.1: Daily use of water (litre)



Daily consumption of domestic water per household in Bagmara is 129 litres (12.8 litres for drinking purpose). Figures 2.1 and 2.2 presents location-wise daily consumption of domestic and drinking water per household and per person.

Figure 2.2: Daily use of water per person per day



2.4. User's Cost of water

In Dhaka Slum, an average household has to pay yearly Tk. 1,510 (USD19) as cost of water of which Tk. 1011(USD12) is paid by the households as water bill. The situation is different in Paikgacha and Koira upazilas. The annual cost for collecting drinking and cooking water for an average household in Paikgacha is Tk. 921 (USD 11) and Tk. 612 (USD 8)

respectively. Similarly, Tk. 1072 (USD13) is paid by an average household in Koira for collecting drinking water (Annex-1, Table-22).

A 33% households in Paikgacha have monthly paid Tk.234 (USD 2.9) to collect drinking water and Tk. 284 (USD 3.5) to collect cooking water. About 30% households in Koira have paid Tk. 295(USD 3.6) to collect drinking water. It is also found that 55% households in Koira and 43% households in Hymchar spends some amount of money for water purification.

However, 43.1% households had to pay on average Tk. 3,563 (USD 43.8) for installation of the water point provided by organizations involved in water sector. Across the locations a substantial proportion of households reportedly shared some amount of money for installing water point provided by such organizations.

2.5. Household's Income -Expenditure Pattern

In this study, the yearly net income of an average household is Tk. 122,508 (USD 1,507). An average household in Sitakunda have the highest yearly net income Tk. 193,504 (USD 2,380). On average, yearly net income of a household in Bandarban is the lowest Tk. 85,997 (USD 1,058).

The average yearly expenditure of a household is Tk. 82,303(USD 1,012). An average household in Sitakunda have spent maximum amount of money [Tk. 133,105 (USD 1, 637)] while the yearly expenditure often average household in Bandarban is the lowest amounting Tk. 38,744 (USD 477).

It is to note that yearly net income of an average household in Dhaka slum is Tk. 98,683 ($1,213), while the yearly household expenditure is Tk. 81,308 (USD 1,000).

CHAPTER 3
LIFECYCLE COST AND SUSTAINABILITY

3.1. Introduction

The current chapter presents various aspects of cost of water points estimated using lifecycle cost approach, and also delineates sustainability aspects of different types of water points. The time span (i.e. time between installation and data collection) varies by water points. It also varies by type of water points and by location categories. The time span of sample water points vary between 4 years and 10 years. Therefore, to compare water points with different time span of functioning, the concept of current cost of water point based on LCCA has been introduced. The capital expenditure (CapEx), operational expenditure (OpEx) and capital maintenance expenditure (CapManEx) has also been found to vary depending on location of the water point. For deep and shallow tube-wells it also varies depending on the depth of the well. The cost estimation is presented in Taka (Tk. 1.00 = USD 0.0123)[9].

3.2. Lifecycle Cost by Water Point Types

Capital Expenditure (CapEx)

As discussed above, CapEx consists of two sub-components: (i) CapExHrd and (ii) CapExSft. Tables 3.1, 3.2 and 3.3 provides location and water point type wise estimates of CapExHrd, CapExSft and CapEx.

It is revealed that the average CapExHrd for a deep tube-well varies between Tk 15 thousand (USD 187) in Bagmara and Tk. 40 thousand (USD 496) in Hymchar (Table 3.1). The same in Koira and Bandarban is around 85% of that in Hymchar. Similarly, CapExHrd for other water point types available in various locations varies from location to location. For example, the same for Shallow tube-well in Koira costs around Tk. 12 thousand (USD 148) while in Hymchar it is around Tk. 30 thousand (USD 369). It is to note that the definition of shallow and deep tube-well also varies by location depending upon the depth of aquafare. For example in Bagmara, tube-well lifting water from the depth upto 50 feet is considered as shallow tube-well and the depth of deep tube-well ranges between 90 feet and 115 feet. While, in Ajmirigangj the depth of shallow tube-wells ranges between 50 feet and 200 feet and the depth for deep tube-well ranges between 250 feet and 1000 feet.

The estimation of CapExSft considering apportionment (on the basis of *prorata* time involvement) of salary of directly involved staff, managerial and supervision staff, rent of office space, utility bills, front line IEC expenditure, etc. also reveals that CapExSft varies by location and water point type (Table 3.2).

Therefore, the CapEx being functionally dependent of its sub-components varies by type of water point and by location (Table 3.3). It implies that during estimation of capital cost of a water point, the type of water point and location needs to be duly considered instead of current practice of using an average normative amount common for all location (irrespective of geographical diversity).

Table 3.1: **Capital Expenditure Hardware (**CapExHrd) cost by Water Point Types and by Location (in Tk.)

[9] www.fx-rate.net entered on October 15, 2012

Water point type	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Bandarban
Shallow Tubewell	-	-	17,654 (44)	11,608 (47)	30,116 (387)	16,898 (195)	18,261 (38)	-
Deep Tubewell	-	15,177 (96)	-	33,845 (608)	40,368 (566)	26,886 (606)	29,682 (358)	32,796 (460)
Tara deep	-	27,826	-	-	-	-	-	-
GFS	-	-	-	-	-	-	-	665,697
IFG	-	-	-	-	-	-	-	25,985
PSF	-	-	-	145,023	-	-	-	-
RWH	-	-	22,807	28,290	-	-	21,275	-
Piped water supply with hand pump	33,690							

***Note:** *Figures in parenthesis denotes average depth of tubewells*

Table 3.2: **Capital Expenditure Software** (CapExSft) cost by Water Point Types and by Location (in Tk.)

Water point type	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban
Shallow Tubewell	-	-	940	941	875	880	950	-
Deep Tubewell	-	1535	-	1412	1350	1400	1378	1500
Tara deep	-	1428	-	-	-	-	-	-
GFS	-	-	-	-	-	-	-	3665
IFG	-	-	-	-	-	-	-	1715
PSF	-	-	-	2850	-	-	-	-
RWH	-	-	1715	1882	-	-	1700	-
Piped water supply with hand pump	4500							

Table 3.3: **Capital Expenditure (**CapEx) cost by Water Point Types and by Location (in Tk.)Cap ex

Water point type	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban
Shallow Tubewell			18594	12549	30991	17778	19211	
Deep Tubewell		16712		35257	41718	28286	31060	34296
Tara Deep		29254						
GFS								669362
IFG								27700
PSF				147873				
RWH			24522	30172			22975	
Piped water supply with hand pump	38190							

Operational Expenditure (OpEx) Cost

The costing exercise reveals that the yearly average operational expenditure (OpEx) also varies by location and type of water point. For example, average annual OpEx of Shalow and Deep tube-well in Ajmiriganj is Tk 499 (USD 6.13) and Tk. 404 (USD 4.97) respectively. Again, annual average Opex of deep tube-well ranges between Tk. 169 (USD 2.09) in Bagmara and Tk. 541 (USD 6.65) in Hymchar. The same for an average GFS in Bandarban is Tk. 223 (USD 2.74) and PSF in Koira is Tk. 356 (USD 3.38). Highest annual average Opex is Tk. 5,140 (USD 63.22) found for piped water supply with hand pump in Dhaka Slum. Comparing Opex with CapEx, it appears that annual average OpEx is independent of CapEx.

Table 3.4: Yearly Operational Expenditure Cost **(Op**Ex) cost by Water Point Types and by Location (in Tk.)

Water point types	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban
Shallow Tubewell	-	-	173	351	504	499	274	-
Deep Tubewell	-	169	-	208	541	404	246	251
Tara Deep	-	90	-	-	-	-	-	-
GFS	-	-	-	-	-	-	-	223
IFG	-	-	-	-	-	-	-	216
PSF	-	-	-	356	-	-	-	-
RWH	-	-	170	203	-	-	130	-
Piped water supply with hand pump	5140							

Analysis of capital maintenance expenditure data across the location over the time span of functioning shows that generally the trend follows the principle: the more is the duration of functioning of the water point, the higher is the expenditure. For a shallow tubewell in Paikgacha, the CapManEx in the first year of functioning is Tk. 178 (USD 2.18), in the fifth year Tk. 461 (USD 5.67) and in the tenth year it is Tk 589 (USD 5.24). Similar pattern has been observed in other locations. For other types of water points across the locations, the trend for the component is same.

Table 3.5: Capital Maintenance Expenditure (CapManEx) Cost by Type of Water Points by Year of Functioning and by Location (in Tk.)

	Yr_1	Yr_2	Yr_3	Yr_4	Yr_5	Yr_6	Yr_7	Yr_8	Yr_9	Yr_10
Shallow Tubewell										
Paikgacha	178	169	214	311	461	338	405	341	437	589
Koira	418	446	593	623	691	666	689	778	1049	1064
Hymchar	505	976	1016	1195	1207	1146				
Ajmiriganj	278	650	848	1187	1390	1457	1168			
Sitakunda	375	383	400	463	595	529	651	662	668	746
Deep Tubewell										
Bagmara	175	231	224	211	244	335	319	345	402	888
Koira	140	147	139	157	296	332	563	580	1384	
Hymchar	727	992	993	1172	1268	1344				
Ajmiriganj	257	419	588	737	944	1431	1053	1034		
Sitakunda	366	318	335	391	451	490	546	683	690	653
Bandarban	439	474	460	631	-	-	-	-	-	-
Tara Deep										
Bagmara	104	137	192	174	137	223	130	346		
Rain water harvesting system										
Paikgacha	174	148	208	500	671					
Koira	334	375	385	456	480					
Sitakunda	63	150	161	158	200	574	520			
PSF										
Koira	386	543	502	547	676	1143	1189			
GFS										
Bandarban	145	131	241	241	666	678	664	800		
IFG										
Bandarban	134	294	478	446	563	681				
Piped water supply with hand pump										
Dhaka slum	1,010	1,645	2,015	9,230	2,200	13,080	2,630	9,420	2,825	14,025

The current cost of water point, as explained in previous chapter, has been estimated as summation of components: CapEx, cumulative OpEx (as applicable for the entire time span of functioning) and cumulative CapManEx (as applicable for the entire time span of functioning).

It is exposed that regardless of type of water points the current cost of any water point across the location is substantially higher compared to CapExHrd or even CapEx. As evident from the study, the current cost of piped water supply with hand pump constitutes almost 3.9 times higher compared to that of capital expenditure (CapEx). Another instance can also be cited in this context: current cost of an average deep tubewell in Hymchar is about 1.6 times higher than the initial capital expenditure. Details about current cost of water points by types and locations are presented in Table 3.6.

Table 3.6: **Current Cost of water point (based on LCCA)** by Water Point Types and by Location (in Tk.)

Water point type	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban
Shallow Tubewell			23,767	23,076	40,060	28,249	27,423	
Deep Tubewell		21,776		40,867	51,460	37,981	38,443	37,304
Tara deep		31,417						
GFS								674,712
IFG								31,592
PSF				155,352				
RWH			27,074	33,217			25,711	
Piped water supply with hand pump	147,670							

Current Cost of water point per household

Current cost of water points per household by type and by location is presented in Table 3.7. It shows that the current cost of a water point per household depends on water point type, geographical characteristics of location and number of user households. The current cost of an average deep tube-well in Bandarban, Sitakunda and Ajmiriganj is almost similar (around Tk. 38 thousand i.e. USD 467). However, the number of deep tube-well user households is 7, 7 and 43 respectively. Therefore, the respective current cost per household of an average deep tube-well in Ajmiriganj and Sitakunda is close (around Tk. 5500 i.e. USD 67.65), while it is much lower in Bandarban (Tk 868 i.e. USD 10.68).

It is also worth mentioning that although the current cost of an average GFS in Bandarban is highest among of all types of water points considered in the study across the locations (over Tk. 674 thousand i.e. USD8,270) still due to substantial number of user households per point (40), cost per household has been found to be remarkably lower (around Tk. 17 thousand i.e USD 203).

Similar is the scenario in Dhaka slum. In this location an average water point having piped water supply with hand tube-well is used by 32 households, and the current cost per household has reduced to the level of Tk. 4,615 (USD 56.76).

Table 3.7: **Current Cost of water point (based on LCCA)** by Water Point Type per Household Types and by Location (in Tk.)

Water point type	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban
Shallow Tubewell	-	-	3,961 (6)	4,615 (5)	6,677 (6)	5,650 (5)	4,571 (6)	-
Deep Tubewell	-	3,629 (6)	-	6,811 (6)	8,577 (6)	5,426 (7)	5,492 (7)	868 (43)
Tara deep	-	5,236 (6)	-	-	-	-	-	-
GFS	-	-	-	-	-	-	-	16,868 (40)
IFG	-	-	-	-	-	-	-	735 (43)
PSF	-	-	-	3,237 (48)	-	-	-	-
RWH	-	-	27,074 (1)	8,304 (4)	-	-	25,711 (1)	-
Piped water supply with hand pump	4,615 (32)	-	-	-	-	-	-	-

Current cost of water points can be estimated also in terms of person. Table 3.8 presents the detailed estimates of current cost of water point per person by locations and by types.

Table 3.8: **Current Cost of water point (based on LCCA)** by Water Point per person Types and by Location (in Tk.)

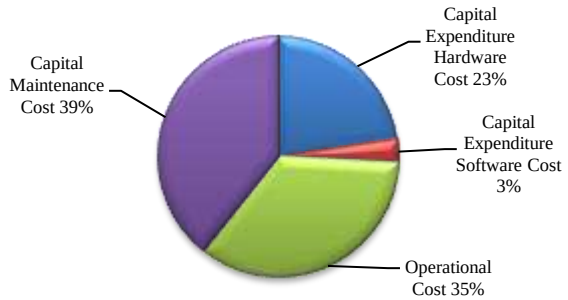
Water point type	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban
Shallow Tubewell			948	997	1,207	865	843	
Deep Tubewell		798		1,471	1,551	831	1,013	155
Tara deep		1,151						
GFS								3,017
IFG								131
PSF				699				
RWH			6,477	1,794			4,744	
Piped water supply with hand pump	995							
Household size (persons)	4.64	4.55	4.18	4.63	5.53	6.53	5.42	5.59

3.3. Lifecycle Cost Component Analysis

A brief analysis of the share of components used in lifecycle cost approach for two types of water points in two locations: Dhaka slum and Ajmiriganj is presented below. It depicts two different scenarios providing a common message for the planners and programme managers.

In the case of Dhaka slum with piped water supply using hand pump the aggregated share of capital expenditure (including CapExHrd and CapExSft) is only 26% of total current cost. The respective share of operational expenditure cost and capital maintenance expenditure cost is 35% and 39%.

Figure 3.1: Composition of current cost of piped water supply using hand pump in Dhaka slum by cost component (%)



On the contrary, in Ajmiriganj the water point type is different, the location is in geographically disadvantaged condition and the number of water user households is also around 4.6 times less than that in Dhaka slum. The percentage composition of components shows a different picture. The respective share of capital, operational and capital-maintenance components is 75%, 8% and 17% of current cost of an average deep tube-well.

Figure 3.2: Composition of current cost of deep tube well in Ajmiriganj by cost component (%)

3.4. Sustainability of Water Points

The above analysis indicates that irrespective of water point type, location and number of user households, the operational expenditure and capital-maintenance expenditure lumped together carries a mounting significance in the lifecycle of any water point. Most often government and development partners are narrowly focusing on capital expenditure. During the study it has been revealed that different types of many water points installed by organizations involved in the water sector became dysfunctional due to lack of operational and capital-maintenance expenditure. These are neither taken care of by the users nor the installation agency. One common perception deeply ingrained among a large number of users is that it is the responsibility of the concerned organization to undertake repairing and/or maintenance of the water point. As a result, a substantial amount of expenditure in the water sector is being mis-used and/or underutilized. It is to note that water points funded by the organization/agency usually remained functional, because the user household has taken the initiative and/or responsibility of repairing and maintenance. On the contrary, the water points owned and installed by individual households seldom found dysfunctional due to same reasons as mentioned above.

It is not necessary that government and/or development partners have to bear the operational and capital-maintenance expenditure. Moreover, massive motivational campaign needs to be undertaken to develop adequate sense of responsibility among the water point users installed by government and/or development agency, which in turn, shall contribute to the sustainability of the investment as well as water points.

CHAPTER 4
RECOMMENDATIONS

On the backdrop of the study findings, the policy makers and planners may consider the following recommendations for enhancing the sustainability of the non-individual household owned water points as well as better utilization of the public resources spent in water sector.

(a) Undertake properly designed interventions for developing sense of ownership among the users of water points installed by utilizing public resources.

(b) Government may facilitate creation of a fund for meeting the operation and maintenance expenditure involving the water point users. The users should contribute on regular basis, but based on household income, a differentiated approach as appropriate is also needed to be introduced.

(c) Introduction of a safety-net approach (subsidy policy) will be highly important for water point user households living below lower poverty line.

(d) Local government institutions (union parishad and upazila parishad) may be provided with some lump amount of resources for participating in the major maintenance/repairing work of the public funded water points along with the users. Local government institutions may utilize LGSP fund or provisions for such participation may be created under block grant.

(e) Cost rationalization may be introduced for water points constructed under the public fund.

Annex 1: Tables

Table 1: Source of drinking water round the year

Source	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Through pipe in residence	0.5							2.2	0.2
Through pipe in yard/plot	67.9								13.4
Public point (stand point)	0.5				0.4				0.2
Deep tubewell		73.0	41.2	100.0	98.7	2.1	21.0	4.3	46.7
Shallow tubewell		17.6	54.9		0.8	95.7	76.9	4.3	26.8
Protected ringwell		9.5						21.7	2.5
Unprotected ringwell							0.5		0.1
Rain water (protected)							1.5		0.3
Submergible pump	31.0								6.1
Gravity flow system (GFS)								67.4	3.3
Protected pond			3.9						0.2
Surface water						2.1			0.1
N	187	148	51	34	237	47	195	46	945

Table 2: Source of cooking water round the year

Source	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Through pipe in residence	0.5							2.2	0.2
Through pipe in yard/plot	68.8								15.4
Public point (stand point)	0.5								0.1
Deep tubewell		59.9	2.1	76.6	66.5	2.1	5.3	2.2	31.0
Shallow tubewell		8.0	52.1		1.5	44.7	29.3	4.3	11.8
Protected ringwell		6.6						21.7	2.2
Unprotected ringwell		1.5							0.2
Rain water (protected)							3.0		0.5
Submergible pump	30.2								6.8
Gravity flow system (GFS)								69.6	3.7
Protected pond		19.0	33.3						4.9
Surface water		5.1	12.5	23.4	32.0	53.2	62.4		23.1
N	192	137	48	47	206	47	133	46	856

Table 3: Source of other domestic use water round the year

Source	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Through pipe in residence								2.3	0.1
Through pipe in yard/plot	55.6			1.3			0.5		10.1
Deep tubewell		57.9		6.5	6.2			2.3	9.3
Shallow tubewell		14.5	31.3		6.2		27.5	4.5	13.5
Protected ringwell		4.1	0.5					20.5	1.4
Unprotected ringwell	16.2								2.9
Submergible pump	28.3								5.1
Gravity flow system (GFS)								54.5	2.2
Protected pond		14.5							1.9
Surface water		9.0	68.2	92.2	87.6	100.0	72.0	15.9	53.5
N	198	145	195	77	209	47	193	44	1108

Table 4: Source of drinking water in winter

Source	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Through pipe in yard/plot	98.0								15.5
Deep tubewell		31.6	55.6	46.8					40.1
Shallow tubewell		66.7	18.1	8.1			66.7		22.4
Rain water (protected)			1.4	8.1					2.2
Submergible pump	2.0								.3
Tanker tank			.7						.3
Protected pond		1.8	24.3						11.4
Surface water				37.1	100.0		33.3		7.9
N	50	57	144	62	1		3		317

Table 5: Source of cooking water in winter

Source	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Through pipe in yard/plot	97.8								10.9
Public point (stand point)			2.7						1.0
Deep tubewell		30.9	23.1	51.0	10.0		3.1		21.1
Shallow tubewell		55.9	8.8	2.0			29.7		17.6
Protected ringwell		1.5							0.2
Rain water (protected)			1.4				3.1		1.0
Rain water (unprotected)							4.7		0.7
Submergible pump	2.2								0.2
Protected pond		10.3	59.9						23.6
Surface water		1.5	3.4	46.9	90.0		59.4		23.3
106			0.7						0.2
N	45	68	147	49	30		64		403

Table 6: Source of other domestic use of water in winter

Source	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Through pipe in yard/plot	81.1								20.8
Deep tubewell		20.3		15.8					10.4
Shallow tubewell		66.1			4.2		66.7		29.2
Unprotected ringwell	16.2								4.2
Submergible pump	2.7								0.7
Gravity flow system (GFS)								100.0	1.4
Protected pond		3.4							1.4
Surface water		10.2		84.2	95.8		33.3		31.9
N	37	59		19	24		3	2	144

Table 7: Source of drinking water in summer

Source	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Through pipe in yard/plot	82.0								12.9
Public point (stand point)	16.0	1.8							2.8
Deep tubewell		80.7	52.8	58.1	100.0				50.2
Shallow tubewell		1.8	18.1	14.5			66.7		12.0
Protected ringwell		3.5							0.6
Rain water (protected)			4.9						2.2
Submergible pump	2.0								0.3
Tanker tank		1.8							0.3
Protected pond			24.3						11.0
Surface water		10.5		27.4			33.3		7.6
N	50	57	144	62	1		3		317

Table 8: Source of cooking water in summer

Source	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Through pipe in yard/plot	80.0								8.9
Public point (stand point)	17.8		2.7						3.0
Deep tubewell		70.6	19.0	55.1	50.0		3.1		29.8
Shallow tubewell		4.4	8.2	2.0			26.6		8.2
Protected ringwell		4.4							0.7
Rain water (protected)			4.8				1.6		2.0
Rain water (unprotected)							1.6		0.2
Submergible pump	2.2								0.2
Tanker tank		1.5							0.2
Protected pond		10.3	61.9						24.3
Surface water		8.8	3.4	42.9	50.0		67.2		22.3
N	45	68	147	49	30		64		403

Table 9: Source of other domestic use water in summer

Source	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Through pipe in residence	2.7								0.7
Through pipe in yard/plot	75.7								19.6
Public point (stand point)	16.2								4.2
Deep tubewell		60.3		42.1	4.2				30.8
Shallow tubewell		3.4			12.5				3.5
Protected ringwell		3.4							1.4
Submergible pump	2.7								0.7
Gravity flow system (GFS)								100.0	1.4
Protected pond		10.3							4.2
Surface water	2.7	22.4		57.9	83.3		100.0		33.6
N	37	58		19	24		3	2	143

Table 10: Source of drinking water in rainy season

Source	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Through pipe in yard/plot	82.0								12.8
Public point (stand point)	16.0								2.5
Deep tube well		15.8	1.4						3.4
Shallow tube well		78.9		1.6			33.3		14.6
Protected ring well		3.5							0.6
Rain water (protected)			84.7	62.9				100.0	51.4
Rain water (unprotected)				35.5			66.7		7.5
Submergible pump	2.0								0.3
Gravity flow system (GFS)			13.9						6.2
Protected pond		1.8							0.3
Surface water					100.0				0.3
N	50	57	144	62	1		3	4	321

Table 11: Source of cooking water in rainy season

Source	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Through pipe in yard/plot	80.0								8.9
Public point (stand point)	17.8								2.0
Deep tubewell		13.4					1.6		2.5
Shallow tubewell		62.7		2.0					10.6
Protected ringwell		1.5							.2
Rain water (protected)		7.5	93.2	73.5			1.6	100.0	45.1
Rain water (unprotected)				24.5			90.6		17.2
Submergible pump	2.2								.2
Gravity flow system (GFS)			6.8						2.5
Protected pond		14.9							2.5
Surface water					100.0		6.3		8.4
N	45	67	147	49	30		64	4	406

Table 12: Source of other domestic use of water in rainy season

Source	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Through pipe in yard/plot	62.2								16.1
Public point (stand point)	16.2								4.2
Deep tubewell		15.8							6.3
Shallow tubewell		73.7							29.4
Unprotected ringwell	16.2								4.2
Rain water (protected)				10.5				100.0	3.5
Protected pond		10.5							4.2
Surface water	5.4			89.5	100.0		100.0		32.2
N	37	57		19	24		3	3	143

Table 13: Quality of water round the year

	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Drinking water:									
Good	58.3	95.5	59.2	100.0	95.4	91.5	60.0	95.7	79.0
Moderately usable	34.2	3.8	38.8		3.8	8.5	28.7	2.2	16.7
Bad	7.5	0.6	2.0		0.8		11.3	2.2	4.3
n	187	157	49	33	237	47	195	46	951
Cooking water:									
Good	57.8	82.1	25.5	76.6	64.9	44.7	38.5	95.7	61.2
Moderately usable	34.4	17.2	70.2	21.3	34.1	53.2	33.1	2.2	31.8
Bad	7.8	0.7	4.3	2.1	1.0	2.1	28.5	2.2	7.0
n	192	145	47	47	205	47	130	46	859
washing (utensils) water:									
Good	45.4	75.0	7.3	22.8	7.8	19.1	33.9	86.4	32.7
Somehow usable	40.5	25.0	19.2	70.9	89.8	76.6	41.5	11.4	46.6
Bad	14.1		73.6	6.3	2.4	4.3	24.6	2.3	20.7
n	205	148	193	79	206	47	183	44	1105
Bath water:									
Good	36.6	62.0	1.0	20.8	5.8		31.7	84.1	26.0
Somehow usable	46.5	38.0	19.2	71.4	93.2	80.9	44.1	13.6	51.0
Bad	16.9		79.8	7.8	1.0	19.1	24.2	2.3	23.1
n	172	142	193	77	206	47	186	44	1067
Toilet andHand wash (personal hygiene) water:									
Good	43.0	79.6	6.7	22.8	8.7		33.3	86.4	32.1
Somehow usable	42.5	19.7	22.3	69.6	87.5	78.7	43.2	11.4	46.6
Bad	14.5	.7	71.0	7.6	3.8	21.3	23.4	2.3	21.3
n	200	152	193	79	208	47	192	44	1115
Other domestic use water:									
Good	43.0	77.2	6.2	20.8	8.2		33.2	84.1	31.2
Somehow usable	42.5	22.8	15.5	71.4	89.9	85.1	44.0	13.6	47.0
Bad	14.5		78.2	7.8	1.9	14.9	22.8	2.3	21.8
n	200	149	193	77	208	47	193	44	1111

Table 14: Quality of water in winter

	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Drinking water:									
Good	30.0	100.0	53.4	69.8			100.0		60.2
Somehow usable	68.0		45.9	28.6	100.0				38.8
Bad	2.0		.7	1.6					1.0
n	50	48	146	63	1		1		309
Cooking water:									
Good	31.1	85.0	23.6	67.3	6.1		42.4		40.6
Somehow usable	68.9	13.3	73.0	32.7	93.9		42.4		55.4
Bad		1.7	3.4				15.2		4.0
n	45	60	148	49	33		66		401
washing (utensils) water:									
Good	37.5	82.5		23.5	3.2		46.2	100.0	47.1
Somehow usable	62.5	15.8		76.5	96.8		30.8		49.7
Bad		1.8	100.0				23.1		3.3
n	32	57	1	17	31		13	2	153
Bath water:									
Good	52.3	77.8		31.6	3.2		60.0	100.0	51.3
Somehow usable	44.6	14.3	100.0	68.4	96.8		30.0		44.5
Bad	3.1	7.9					10.0		4.2
n	65	63	1	19	31		10	2	191
Toilet andHand wash (personal hygiene) water:									
Good	29.7	84.9		23.5	3.4		75.0	100.0	46.2
Somehow usable	64.9	13.2		76.5	93.1		25.0		50.3
Bad	5.4	1.9	100.0		3.4				3.5
n	37	53	1	17	29		4	2	143
Other domestic use water:									
Good	29.7	83.9		31.6	3.4		33.3	100.0	46.3
Somehow usable	64.9	14.3		68.4	93.1		33.3		49.7
Bad	5.4	1.8	100.0		3.4		33.3		4.1
n	37	56	1	19	29		3	2	147

Table 15: Quality of water in summer

	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Drinking water:									
Good	40.8	95.8	54.1	60.3			100.0		59.7
Somehow usable	51.0	4.2	45.2	28.6	100.0				36.4
Bad	8.2		.7	11.1					3.9
n	49	48	146	63	1		1		308
Cooking water:									
Good	45.5	83.3	24.3	55.1	45.5		59.1		46.8
Somehow usable	52.3	15.0	72.3	34.7	42.4		31.8		47.8
Bad	2.3	1.7	3.4	10.2	12.1		9.1		5.5
n	44	60	148	49	33		66		400
washing (utensils) water:									
Good	53.1	78.9		31.3	7.1		46.2	100.0	51.7
Somehow usable	43.8	19.3		43.8	50.0		53.8		35.6
Bad	3.1	1.8	100.0	25.0	42.9				12.8
n	32	57	1	16	28		13	2	149
Bath water:									
Good	66.2	58.1		38.9	10.3		70.0	100.0	52.4
Somehow usable	29.2	21.0	100.0	38.9	48.3		30.0		30.5
Bad	4.6	21.0		22.2	41.4				17.1
n	65	62	1	18	29		10	2	187
Toilet andHand wash (personal hygiene) water:									
Good	54.1	77.4		31.3			50.0	100.0	49.6
Somehow usable	40.5	22.6		43.8	53.6		50.0		36.2
Bad	5.4		100.0	25.0	46.4				14.2
n	37	53	1	16	28		4	2	141
Other domestic use water:									
Good	54.1	76.4		38.9			66.7	100.0	50.7
Somehow usable	40.5	23.6		38.9	53.6		33.3		35.4
Bad	5.4		100.0	22.2	46.4				13.9
n	37	55	1	18	28		3	2	144

Table 16: Quality of water in rainy season

	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Drinking water:									
Good	36.0	93.8	95.9	100.0			100.0	75.0	86.3
Somehow usable	48.0	4.2	4.1		100.0			25.0	10.9
Bad	16.0	2.1							2.9
n	50	48	146	63	1		1	4	313
Cooking water:									
Good	40.0	76.7	96.6	100.0	6.1		97.0	75.0	80.1
Somehow usable	48.9	20.0	2.7		90.9		1.5	25.0	17.4
Bad	11.1	3.3	.7		3.0		1.5		2.5
n	45	60	146	49	33		66	4	403
washing (utensils) water:									
Good	46.9	80.7		62.5	7.1		83.3	33.3	56.4
Somehow usable	37.5	14.0		37.5	89.3		16.7	66.7	36.9
Bad	15.6	5.3	100.0		3.6				6.7
n	32	57	1	16	28		12	3	149
Bath water:									
Good	32.3	57.1		66.7	6.9		100.0	33.3	43.4
Somehow usable	44.6	14.3	100.0	33.3	89.7			66.7	38.6
Bad	23.1	28.6			3.4				18.0
n	65	63	1	18	29		10	3	189
Toilet andHand wash (personal hygiene) water:									
Good	40.5	86.8		62.5	7.1		75.0	33.3	54.2
Somehow usable	35.1	7.5		37.5	85.7		25.0	66.7	35.2
Bad	24.3	5.7	100.0		7.1				10.6
n	37	53	1	16	28		4	3	142
Other domestic use water:									
Good	40.5	83.6		66.7	7.1		66.7	33.3	53.8
Somehow usable	35.1	10.9		33.3	85.7		33.3	66.7	35.9
Bad	24.3	5.5	100.0		7.1				10.3
n	37	55	1	18	28		3	3	145

Table 17: Ownership of water source round the year

	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Drinking water:									
Self	11.8	45.8	30.6		3.0	10.6	47.2	6.5	22.5
Community	46.0	3.9		94.7	91.1	48.9	17.4	82.6	46.1
Others	42.2	50.3	69.4	5.3	5.9	40.4	35.4	10.9	31.4
n	187	153	49	38	237	47	195	46	952
Cooking water:									
Self	14.1	41.1	40.8	2.0	25.2	10.9	40.5	6.5	25.4
Community	45.3	2.8		74.0	61.2	54.3	8.4	82.6	38.1
Others	40.6	56.0	59.2	24.0	13.6	34.8	51.1	10.9	36.5
n	192	141	49	50	206	46	131	46	861
washing (utensils) water:									
Self	20.0	46.3	39.0	4.9	79.5	10.9	56.8	7.3	42.2
Community	51.7	2.7	15.4	48.1	5.2	56.5	5.5	82.9	23.5
Others	28.3	51.0	45.6	46.9	15.2	32.6	37.7	9.8	34.3
n	205	147	195	81	210	46	183	41	1108
Bath, toilet and hand wash (personal hygiene) water:									
Self	23.1	42.7	30.9	5.0	80.9	4.3	60.6	7.5	42.3
Community	44.5	1.4	23.2	46.3	3.3	56.5	5.2	82.5	22.0
Others	32.4	55.9	45.9	48.8	15.8	39.1	34.2	10.0	35.7
n	173	143	194	80	209	46	193	40	1078
Other domestic use water:									
Self	20.5	44.6	36.4	5.0	78.6	4.3	61.1	7.5	42.3
Community	51.5	3.4	12.8	46.3	5.7	56.5	4.7	82.5	22.5
Others	28.0	52.0	50.8	48.8	15.7	39.1	34.2	10.0	35.3
n	200	148	195	80	210	46	193	40	1112

Table 18: Ownership of water source during winter

	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Drinking water:									
Self	84.0	50.0	11.6	3.4					28.2
Community	2.0	1.9	1.4	44.1					9.7
Others	14.0	48.1	87.0	52.5			100.0		62.0
n	50	52	146	59			1		308
Cooking water:									
Self	82.2	45.3	7.5		54.8		58.5		33.2
Community	2.2	1.6	3.4	54.3	12.9		3.1		9.6
Others	15.6	53.1	89.0	45.7	32.3		38.5		57.2
n	45	64	146	46	31		65		397
washing (utensils) water:									
Self	90.6	49.1		26.7	61.5		76.9		60.0
Community	6.3	1.8		53.3	3.8			100.0	9.7
Others	3.1	49.1		20.0	34.6		23.1		30.3
n	32	57		15	26		13	2	145
Bath, toilet and hand wash (personal hygiene) water:									
Self	46.2	46.9		25.0	55.2		66.7		45.6
Community	46.2	1.6		56.3	6.9			100.0	24.4
Others	7.7	51.6	100.0	18.8	37.9		33.3		30.0
n	65	64	1	16	29		3	2	180
Other domestic use water:									
Self	78.9	50.0		25.0	59.3		66.7		56.3
Community	10.5			56.3	3.7			100.0	11.3
Others	10.5	50.0		18.8	37.0		33.3		32.4
n	38	56		16	27		3	2	142

Table 19: Ownership of water source during summer

	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Drinking water:									
Self	22.0	7.7	10.3	3.4					10.4
Community	20.0	51.9	6.2	42.4					23.1
Others	58.0	40.4	83.6	54.2			100.0		66.6
n	50	52	146	59			1		308
Cooking water:									
Self	20.0	15.6	6.9	2.2	6.5		61.5		18.2
Community	20.0	42.2	8.3	52.2	32.3		3.1		21.2
Others	60.0	42.2	84.8	45.7	61.3		35.4		60.6
n	45	64	145	46	31		65		396
washing (utensils) water:									
Self	9.4	15.8		6.7	18.5		76.9		19.2
Community	25.0	47.4		60.0	3.7			100.0	32.2
Others	65.6	36.8		33.3	77.8		23.1		48.6
n	32	57		15	27		13	2	146
Bath, toilet and hand wash (personal hygiene) water:									
Self	4.6	19.4		6.3	20.7		66.7		13.6
Community	53.8	37.1		62.5	6.9			100.0	40.7
Others	41.5	43.5		31.3	72.4		33.3		45.8
n	65	62		16	29		3	2	177
Other domestic use water:									
Self	7.9	14.3		6.3	18.5		66.7		13.4
Community	26.3	46.4		62.5	3.7			100.0	34.5
Others	65.8	39.3		31.3	77.8		33.3		52.1
n	38	56		16	27		3	2	142

Table 20: Quality of water in rainy season

	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Drinking water:									
Self	10.0	51.9	61.0	86.4				66.7	55.9
Community	18.0	1.9	37.0	6.8				33.3	22.2
Others	72.0	46.2	2.1	6.8			100.0		21.9
n	50	52	146	59			1	3	311
Cooking water:									
Self	11.1	51.6	70.7	87.0	90.3		92.3	66.7	67.8
Community	17.8	1.6	28.6	6.5	3.2			33.3	14.0
Others	71.1	46.9	.7	6.5	6.5		7.7		18.2
n	45	64	147	46	31		65	3	401
washing (utensils) water:									
Self		52.6		53.3	96.3		92.3	66.7	53.1
Community	18.8			33.3				33.3	8.2
Others	81.3	47.4		13.3	3.7		7.7		38.8
n	32	57		15	27		13	3	147
Bath, toilet and hand wash (personal hygiene) water:									
Self		41.9		50.0	92.9		66.7	66.7	36.2
Community	18.5	1.6		31.3				33.3	10.7
Others	81.5	56.5		18.8	7.1		33.3		53.1
n	65	62		16	28		3	3	177
Other domestic use water:									
Self		51.8		50.0	96.3		66.7	66.7	46.9
Community	23.7			31.3				33.3	10.5
Others	76.3	48.2		18.8	3.7		33.3		42.7
n	38	56		16	27		3	3	143

Table 21A: Amount of daily use of water

	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Drinking water	16.3	12.8	13.7	20.8	17.4	27.8	18.8	20.1	16.8
Cooking water	28.4	20.7	22.4	51.5	31.5	22.6	35.1	38.7	29.8
Others use of water	115.2	96.6	192.9	197.1	170.5	204.0	150.9	77.0	148.3
Total	159.9	129.0	229.0	269.0	219.4	254.4	204.8	135.9	194.7
n	237	205	195	96	237	47	196	46	1259

Table 21B: Amount of daily use of water per person

	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Drinking water	3.5	2.8	3.3	4.5	3.1	4.3	3.5	3.6	3.4
Cooking water	6.1	4.5	5.4	11.1	5.7	3.5	6.5	6.9	6.0
Others use of water	24.8	21.2	46.1	42.6	30.8	31.2	27.8	13.8	30.0
Total	34.5	28.4	54.8	58.1	39.7	39.0	37.8	24.3	39.3
n	237	205	195	96	237	47	196	46	1259

Table 22: Cost of water per year

Cost head	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Water bill	1011.9	0.0	0.0	0.0	1.2	0.0	0.0	0.0	190.7
collecting water bill	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
water bill payment	24.6	0.0	18.5	0.0	0.0	0.0	0.0	0.0	7.5
Collecting drinking water	94.8	0.0	921.8	1072.5	0.0	0.0	18.4	0.0	245.3
Collecting cooking water	124.9	0.0	612.9	0.0	0.0	0.0	0.0	0.0	118.4
Collecting water for other purposes	160.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.3
boiling water	75.0	0.1	0.1	0.0	33.4	0.0	0.0	0.0	20.5
chemical for purification	2.5	0.1	7.9	132.4	125.5	0.0	9.8	0.0	37.0
Others	15.7	14.6	0.0	0.1	1.5	0.0	0.0	0.0	5.6
Total	1510.3	14.9	1561.3	1205.0	161.6	0.0	28.2	0.0	655.2
N	237	205	195	96	237	47	196	46	1259

Table 23: Percentage distribution of respondents whether they had to pay any amount for using water source/point

	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Whether they pay any amount:									
Yes	25.3	47.3	41.5	42.7	46.4	23.4	71.9	2.2	43.1
No	74.7	52.7	58.5	57.3	53.6	76.6	28.1	97.8	56.9
N	237	205	195	96	237	47	196	46	1259
Average amount of paid up money for installation:									
Cost of drinking water for installation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cost of cooking water for installation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cost of water for other purpose for installation	0.0	0.0	4914.8	597.6	0.0	0.0	0.0	0.0	779.7
Total amount of cost for installation	2430.0	5897.0	5713.6	231.7	1566.5	727.3	3962.9	2000.0	3563.1
N (q209a=1)	60	97	81	41	110	11	141	1	542
Average amount of paid up money for operation:									
Cost of drinking water for operation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cost of cooking water for operation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cost of water for other purpose for operation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total amount of cost for operation	34.3	92.8	0.0	6.6	0.0	0.0	0.0	0.0	20.9
N (q209a=1)	60	97	81	41	110	11	141	1	542
Average amount of paid up money for maintenance:									
Cost of drinking water for maintenance	0.2	0.0	0.0	39.8	0.0	829.1	0.0	0.0	19.9
Cost of cooking water for maintenance	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cost of water for other purpose for maintenance	0.5	0.0	50.4	0.0	0.0	0.0	0.0	0.0	7.6
Total amount of cost for maintenance	143.1	200.9	40.6	82.4	112.5	1641.8	311.0	1000.0	203.0
N (q209a=1)	60	97	81	41	110	11	141	1	542

Table 24: Average gross income, cost incurred to earn gross income and net income of the household

Indicators	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Gross income:									
Income from agriculture	4.2	49214.9	15120.5	10830.2	37591.8	94212.8	23273.1	89934.8	28684.7
Wage labor	38572.7	14341.5	48886.3	35010.4	28263.7	9829.8	27518.1	7843.5	30095.6
Petty trading/shops	57029.1	32589.3	56482.1	40239.6	225265.8	46404.3	204692.6	37000.0	105214.0
Salaried employment	41015.2	12879.0	10596.9	5812.5	49818.6	2042.6	47814.8	10717.4	29192.1
Transport business	13934.3	3453.7	205.1	3408.3	2230.0	14042.6	3964.6	652.2	5062.1
Social safety allowance	139.2	175.6	1483.1	565.6	1706.5	0.0	384.3	187.0	715.5
Sources not mentioned above	3282.7	8770.7	9292.3	4796.9	22639.2	2978.7	27764.8	8641.3	12862.1
Others	1162.4	8117.1	2410.8	1187.5	3123.2	0.0	421.2	2000.0	2731.0
Total income (gross)	155139.9	129541.7	144477.0	101851.0	370638.7	169510.6	335833.5	156976.1	214557.2
Amount of cost incurred to earn gross income:									
Agriculture	0.8	21026.8	7064.9	3833.3	14387.4	13489.4	9408.5	44091.3	11098.0
Wage labor	6229.8	1940.0	3429.7	6072.9	1563.7	1808.5	5520.0	1391.3	3755.0
Petty trading/shops	41850.3	16243.9	36339.0	15041.7	184206.8	11072.3	119830.2	18630.4	71723.4
Salaried employment	4444.2	826.3	844.1	729.2	5113.8	212.8	6532.7	3104.3	3258.5
Transport business	3304.2	481.0	51.3	1083.3	417.8	1808.5	623.5	0.0	1034.1
Social safety allowance	2.9	0.0	14.3	74.0	34.9	0.0	3.1	0.0	15.5
Sources not mentioned above	300.0	1243.9	74.1	0.0	293.4	319.1	251.3	3760.9	514.2
Others	323.8	2692.7	623.6	312.5	29.1	0.0	159.9	0.0	650.2
Total cost incurred	56456.1	44454.6	48440.9	27146.9	206047.0	28710.6	142329.1	70978.3	92048.8
Amount of net income:									
Agriculture	3.4	28188.0	8055.6	6996.9	23204.3	80723.4	13864.6	45843.5	17586.6
Wage labor	32342.9	12401.5	45456.5	28937.5	26700.0	8021.3	21998.1	6452.2	26340.7
Petty trading/shops	15178.9	16345.4	20143.1	25197.9	41059.1	35331.9	84862.3	18369.6	33490.6
Salaried employment	36571.0	12052.7	9752.8	5083.3	44704.7	1829.8	41282.1	7613.0	25933.6
Transport business	10630.0	2972.7	153.8	2325.0	1812.1	12234.0	3341.2	652.2	4028.0
Social safety allowance	136.4	175.6	1468.7	491.7	1671.6	0.0	381.2	187.0	700.1
Sources not mentioned above	2982.7	7526.8	9218.3	4796.9	22345.7	2659.6	27513.5	4880.4	12347.9
Others	838.6	5424.4	1787.2	875.0	3094.1	0.0	261.2	2000.0	2080.8
Total net income	**98683.8**	**85087.1**	**96036.1**	**74704.2**	**164591.6**	**140800.0**	**193504.3**	**85997.8**	**122508.4**
N	237	205	195	96	237	47	196	46	1259

Table 25: Average yearly expenditure of the household

Indicators	Dhaka Slum	Bagmara	Paikgacha	Koira	Hymchar	Ajmiriganj	Sitakunda	Banderban	Total
Yearly expenditure on food	74500.0	54663.2	55341.5	46087.5	79582.8	56553.2	83562.2	74191.3	67822.5
Yearly expenditure on clothing	5187.3	6231.2	4079.5	4671.9	6597.4	3095.7	8909.7	10445.7	6105.4
Yearly expenditure on housing	18743.2	2980.5	7983.1	4697.9	15054.9	11072.3	22639.1	4773.5	12554.5
Yearly expenditure on education	3029.0	5638.0	6266.7	4253.1	9080.8	4368.1	12456.7	25108.7	7512.3
Yearly expenditure on health	7440.8	9583.8	6565.7	4360.0	19783.8	3131.9	15641.0	12143.0	11030.3
yearly expenditure on others	2040.5	1463.4	7574.4	0.0	6745.7	85.1	18886.1	652.2	6032.6
Total yearly expenditure of the household	81308.8	58764.5	61090.2	50772.5	107060.9	48329.8	133105.6	38744.8	82303.1
N	237	205	195	96	237	47	196	46	1259