ECONOMIC ANALYSIS

A. Introduction

1. Bangladesh is rapidly urbanizing. The urban population is growing at 3.5% annually, double the national average of 1.37%.[1] If this growth continues, the country's urban population is expected to reach 74 million by 2025, or 41.6% of the total population.[2] However, Bangladesh's rapid growth in economic activities has been centered in Dhaka, the capital, and its peripheries, which has resulted in uneven development across the country. Recognizing the importance of urbanization to economic growth, the government has emphasized urban development in *pourashavas* (municipalities). Responding to Bangladesh's need to improve basic infrastructure and services, the Asian Development Bank (ADB) approved the Third Urban Governance Infrastructure Improvement Project in 2014.[3] The additional financing will expand the current project by supporting (i) additional priority infrastructure and governance improvements in *pourashavas* covered by the current project, and (ii) infrastructure and governance improvements in five more *pourashavas*.[4]

2. The additional financing, with a total investment of $268.1 million, will increase economic potential through the development of basic infrastructure and governance improvements in *pourashavas*. The overall project (current project with additional financing), which adopts the sector lending modality, is being implemented in three phases and will have two outputs: (i) municipal infrastructure improved and made gender and climate responsive; and (ii) capacity of *pourashavas* in urban service delivery, planning, and financial management improved. The five new *pourashavas* will enter the project in phase 2. Subprojects to be implemented and operated by *pourashavas* will be stand-alone to avoid the risk of *pourashavas* not proceeding to the next phase. An economic analysis for the additional financing was carried out for two sample subprojects,[5] for which detailed engineering designs have been completed.

B. Project Rationale

3. **Rationale for government involvement**. The government's intervention under the additional financing is limited to basic urban services where (i) there is a natural monopoly in a sector, (ii) the services provided are public goods, and (iii) integrated and coordinated management by the government is required because of the externality and interdependence of these sectors. The government's involvement in basic urban services is also in line with the urban sector development plans and programs the government is pursuing.

4. **Sector development plan**. The additional financing will cover part of the 10-year financing requirements in *pourashavas* where infrastructure gaps have been identified in their development plans. It will prioritize options to close development gaps of *pourashavas* by proposing subprojects in each urban subsector and recommending institutional reforms to sustain improved service delivery.

5. **Associated economic policies**. Promoting urban development is a national policy of Bangladesh. Under the national urban agenda, the government has advanced priority projects

[1] Bangladesh Bureau of Statistics. 2016. *Statistical Packet Book Bangladesh 2015*. Dhaka.
[2] United Nations. 2015. *World Urbanization Prospects: The 2014 Revision.* New York.
[3] ADB. 2014. *Report and Recommendations of the President to the Board of Directors: Proposed Loan to the People's Republic of Bangladesh for the Third Urban Governance and Infrastructure Improvement (Sector) Project.* Manila.
[4] Cox's Bazar, Faridpur, Gopalganj, Kushtia, and Mymensingh.
[5] Drainage subproject in Kushtia, and water supply subproject in Faridpur.

and governance reforms. Some *pourashavas* are implementing volumetric water tariffs in selected areas with piped water supply, a critical step to achieve financial sustainability.

6. **Government capacity**. The government, through its Local Government Engineering Department (LGED), the executing agency, and the Department of Public Health Engineering (DPHE), the co-executing agency for water supply and sanitation components, is capable of implementing the additional financing. LGED and DPHE have implemented several externally aided projects, including ones funded by ADB, the World Bank, and the Japan International Cooperation Agency. This experience demonstrates the government's capacity to implement the additional financing.

7. **Least-cost analysis**. Subprojects have been designed on a least-cost option basis. For drainage subprojects, preliminary designs were based on a least-cost analysis of different types and shapes of drains, as well as the composition of material mixes (stone chips, sand, and cement), which relate to drainage water quality or toxicity, resilience to climate change, and ease of regular drain cleaning. For road subprojects, preliminary designs were based on a least-cost analysis of different materials (bitumen carpeting or reinforced cement concrete) that refer to frequency of flooding and the ease of maintenance. Preliminary designs of water supply subprojects were based on a least-cost analysis of different raw water sources (groundwater or surface water), raw water quality, intake options, water demand projections for water treatment plant capacity, and pipe materials (such as mild steel and polyvinyl chloride, that relate to the ease of operation and maintenance (O&M).

8. **Economic risks**. Financial sustainability of subprojects is an identified risk, as required revisions to tariffs and taxes may be delayed. Existing cross-subsidies among user groups and subprojects will help mitigate financial sustainability risks. The overall project will also provide capacity building support for urban service delivery, planning, financial management, and public awareness campaigns to mitigate this risk.

9. **Government commitment**. The government's commitment is indicated by its willingness to provide grant financing to *pourashavas* to improve their basic infrastructure.

C. Economic Analysis of Sample Subprojects

10. An economic analysis of the additional financing was conducted in accordance with the ADB guidelines, including the *Guidelines for the Economic Analysis of Projects* and the *Guidelines for the Economic Analysis of Water Supply Projects*.[6] The economic analysis assessed economic viability in terms of the economic internal rate of return (EIRR) and economic net present value (ENPV) for two sample subprojects with the following assumptions:

(i) All costs are based on 2017 prices and converted at $1 = Tk78.4;
(ii) Economic costs of capital works and annual O&M are calculated from project cost estimates. Price contingencies, financial charges, and taxes and duties are excluded in the analysis, but physical contingencies are included;
(iii) The analysis was conducted from 2017 to 2041, including 5 years of construction and 20 years of O&M upon completion of construction;
(iv) Economic opportunity cost of capital (EOCC) is assumed at 9% in real terms;
(v) All costs are valued using domestic numeraire. Tradable inputs are adjusted by a

[6] ADB. 2017. *Guidelines for the Economic Analysis of Projects. Manila*; ADB. 1998. *Guidelines for the Economic Analysis of Water Supply Projects*. Manila.

shadow exchange rate factor of 1.07,[7] while unskilled labor is adjusted by a conversion factor of 0.78[8] of the market wage rate to estimate shadow wage rate; and

(vi) The project network and related infrastructure are designed to cater to 20 years of demand, but the capacity for treatment and water supply is for 10 years.

Table 1: Details of Project Costs
($ million)

Subproject	Capital Costs		Operation and Maintenance Costs		Project Period	
	Project costs	Economic costs[a]	Project costs	Economic costs[a]	Implementation	Operation
Drainage in Kushtia	13.2	10.6	10.5	8.5	2017–2021	2022–2041
Water supply in Faridpur	7.4	6.3	7.2	6.1		

O&M = operation and maintenance
[a] Excludes taxes and duties, price contingencies, and financing charges.
Source: Asian Development Bank estimates.

D. Drainage Subproject in Kushtia

11. Insufficient open drains to address the needs of a growing population and the lack of drainage system capacity to handle flooding risks are considered the main challenges of Kushtia. The proposed subproject will enable the *pourashava* to address flooding by constructing 45.8 kilometers of drainage. This will benefit (i) 81 properties by reducing damage, (ii) 25,896 households by reducing lost income and saving on medical costs, and (iii) 21.5 kilometers of roads by reducing damage and repair.

Table 2: Benefits of Drainage Subproject in Kushtia
($ million)

Particulars	Details	Annual Benefits
A. Reduced property damage cost	(i) Construction cost: $0.17 million 1,287.4 m^3 (damaged areas) x $263.4 (average cost) x 50% (ii) Repair cost: $0.02 million 2,746.7 m^3 (damaged areas) x $15.5 (average cost) x 50% (iii) Clean-up cost: $0.01 million 84 (No. of damaged properties) x $86.9 (average cost)	0.2
B. Reduced income loss	25,896 (No. of HHs affected) x $90.8 (average income loss per household)	2.4
C. Reduced medical cost	25,896 (No. of HHs affected) x $6.7 (average expenditure of health per HH) x 52% (average expenditure of health due to flooding)	0.1
D. Reduced road damage cost	21.5 km (length of roads affected) x $7,653.1 (road repair cost per km)	0.2

HHs = households, km = kilometer, m^3 = cubic meter.
Source: Social and Economic Willingness to Pay Survey 2016 estimates.

[7] Standard Exchange Rate Factor

Details	FY2016	FY2015	FY2014	Average
Exports[a]	22,124	31,209	30,187	27,840
Imports[a]	24,361	40,704	40,732	35,266
Customs Duties[a]	3,707	4,871	4,314	4,297
Shadow Conversion Factor	0.93	0.94	0.94	0.94
Shadow Exchange Rate Factor	**1.08**	**1.07**	**1.06**	**1.07**

[a] In $ million

[8] 0.78 (Shadow wage factor) = $4.5 per day (unskilled labor cost, using practiced labor wage rate paid by contractors to unskilled laborers) / $5.7 per day (official minimum wages as per the *pourashava*).

12. The economic analysis shows that the proposed subproject is economically viable, with a calculated EIRR exceeding the EOCC of 9%. The results of the sensitivity analysis are also satisfactory against all downside risks (Table 3).

Table 3: Economic Internal Rate of Return and Sensitivity Analysis

Particulars	Economic Internal Rate of Return (%)	Economic Net Present Value ($ million)	Switching Value (%)
Base case	**18.2**	**8.3**	
Capital Costs (+20%)	15.5	6.7	103.3
Operation and Maintenance Costs (+20%)	17.8	7.8	367.5
Benefits (–20%)	14.5	4.6	44.6
Delay in operation by 1 year	18.1	8.0	
All combined	11.6	2.3	

Source: Asian Development Bank estimates.

Table 4: Costs and Benefits Streams of Drainage Subproject in Kushtia

($ million)

Year	Benefits					Costs			Net Benefits
	Property damage	Income loss	Medical cost	Road damage	**Total**	Capital	Operation and Maintenance	**Total**	
2017	0	0	0	0	**0**	0.1	0	**0.1**	**(0.1)**
2018	0	0	0	0	**0**	3.0	0	**3.0**	**(3.0)**
2019	0	0	0	0	**0**	3.2	0	**3.2**	**(3.2)**
2020	0	0	0	0	**0**	3.0	0	**3.0**	**(3.0)**
2021	0	0	0	0	**0**	1.4	0	**1.4**	**(1.4)**
2023	0.2	2.4	0.1	0.2	**2.9**	**0**	0.3	**0.3**	**2.5**
2025	0.2	2.5	0.1	0.2	**3.0**	**0**	0.3	**0.3**	**2.7**
2027	0.2	2.6	0.1	0.2	**3.1**	**0**	0.3	**0.3**	**2.8**
2029	0.2	2.7	0.1	0.2	**3.2**	**0**	0.3	**0.3**	**2.9**
2031	0.2	2.8	0.1	0.2	**3.4**	**0**	0.3	**0.3**	**3.0**
2033	0.2	2.8	0.1	0.2	**3.4**	**0**	0.5	**0.5**	**2.8**
2035	0.2	2.8	0.1	0.2	**3.4**	**0**	0.5	**0.5**	**2.8**
2037	0.2	2.8	0.1	0.2	**3.4**	**0**	0.5	**0.5**	**2.8**
2039	0.2	2.8	0.1	0.2	**3.4**	**0**	0.5	**0.5**	**2.8**
2041	0.2	2.8	0.1	0.2	**3.4**	**0**	0.5	**0.5**	**2.8**
Total	4.5	53.8	2.1	3.8	**64.2**	10.6	8.5	**19.1**	**45.2**
ENPV	1.3	15.5	0.6	1.1	**18.5**	8.0	2.3	**8.0**	**8.3**
EIRR									**18.2%**

( ) = negative, EIRR = economic internal rate of return, ENPV = economic net present value.
Source: Asian Development Bank estimates.

E. Water Supply Subproject in Faridpur

13. The proposed subproject aims to increase the capacity of water treatment from 22,600 cubic meters (m^3) to 34,000 m^3 per day to achieve 95% coverage (from existing coverage of 65%). The piped water supply will increase up to 100 liters per capita per day (lpcd) by 2022 (the first year of O&M), benefitting 33,677 households. Current water consumption is 85 lpcd, of which 64 lpcd is from piped water. Thus, 21 lpcd of water is supplemented from other sources. The resource cost for the supplemental water from other sources in the "without project" scenario is treated as a non-incremental benefit. The additional water above current consumption is treated as an incremental benefit. Economic benefits are presented in Table 5.

Table 5: Economic Benefits of the Water Supply Project

Category	Details	Benefits ($ million)
A. Non-incremental Benefits		
a. Savings in water purification cost	$35.5 household/year[a]	22.1
b. Savings in time to collect water	$2.9 household/year[b]	2.5

Category	Details	Benefits ($ million)
c. Savings in purchasing water cost	$5.5 household/year[c]	4.7
d. Savings in earning loss	$17.7 household/year[d]	11.0
B. Incremental Benefits		
Average unit cost for incremental benefit	$0.1 kiloliter/month[e]	7.1

a. Tk608.6/month (household water purification cost) x 12 months x 38.2% (households involved in water purification) = Tk2,786.0 household/year ($35.5 household/year)
b. 3.5 minutes (average household daily time savings) x 365 days x Tk21.9/hour (time value) / 60 minutes x 50% = Tk230.9 household /year ($2.9 household /year).
c. 14.5 kiloliters (monthly household water consumption) x 12 months x Tk217.8/kl (purchasing costs) x 1.14% (households involved in water purchasing) = Tk432.6 household /year ($5.5 household /year)
d. Tk449 household /year (slum households' savings) x 10.4% (rate of slum households) + Tk1,497 household /year (non-slum households' savings) x 89.6% (rate of non-slum households) = Tk1,387.6 household /year ($17.7 household /year)
e. Tk127.1 kiloliter/month (willingness to pay) / 14.5 kiloliters/month (households water supply consumption) = 8.7 kiloliters/month ($0.1 kiloliter/month)
Source: Social and Economic Willingness to Pay Survey 2016 estimates.

14. The economic analysis finds the proposed subproject economically viable, with the calculated EIRR values exceeding the EOCC of 9%. The sensitivity analysis results are also satisfactory against all downside risks (Table 6).

Table 6: Economic Internal Rate of Return and Sensitivity Analysis

Particulars	Economic Internal Rate of Return (%)	Economic Net Present Value ($ million)	Switching Value (%)
Base case	**19.5**	**6.6**	
Capital Costs (+20%)	17.0	5.7	138.1
Operation and Maintenance Costs (+20%)	19.1	6.3	364.1
Benefits (–20%)	15.9	4.0	50.0
Delay in operation by 1 year	19.4	5.8	
All combined	13.0	2.3	

Source: Asian Development Bank estimates.

Table 7: Costs and Benefits Streams of Water Supply Subproject in Faridpur
($ million)

Year	Benefits						Costs			
	Non-incremental				Incremental	Total	Capital	Operation and Maintenance	Total	Net Benefits
	Purification	Time savings	Vendors	Health						
2017	0	0	0	0	0	0	0.4	0	**0.4**	**(0.6)**
2018	0	0	0	0	0	0	1.8	0	**1.8**	**(1.9)**
2019	0	0	0	0	0	0	1.6	0	**1.6**	**(1.9)**
2020	0	0	0	0	0	0	1.7	0	**1.7**	**(1.3)**
2021	0	0	0	0	0	0	0.9	0	**0.9**	**(0.6)**
2023	0.8	0.1	0.2	0.4	0.3	**1.8**	0	0.3	**0.3**	**1.5**
2025	0.9	0.1	0.2	0.5	0.3	**2.0**	0	0.3	**0.3**	**1.7**
2027	1.0	0.1	0.2	0.5	0.3	**2.2**	0	0.3	**0.3**	**1.9**
2029	1.1	0.1	0.2	0.6	0.4	**2.4**	0	0.3	**0.3**	**2.1**
2031	1.2	0.1	0.3	0.6	0.4	**2.6**	0	0.3	**0.3**	**2.3**
2033	1.2	0.1	0.3	0.6	0.4	**2.6**	0	0.3	**0.3**	**2.3**
2035	1.2	0.1	0.3	0.6	0.4	**2.6**	0	0.3	**0.3**	**2.3**
2037	1.2	0.1	0.3	0.6	0.4	**2.6**	0	0.3	**0.3**	**2.3**
2039	1.2	0.1	0.3	0.6	0.4	**2.6**	0	0.3	**0.3**	**2.3**
2041	1.2	0.1	0.3	0.6	0.4	**2.6**	0	0.3	**0.3**	**2.3**
Total	22.1	2.5	4.7	11.0	7.1	**47.4**	6.3	6.1	**12.4**	**35.0**
ENPV	6.1	0.7	1.3	3.1	2.0	**13.2**	4.8	1.8	**6.6**	**6.6**
EIRR										**19.5%**

( ) = negative, EIRR = economic internal rate of return, ENPV = economic net present value.
Source: Asian Development Bank estimates.