ECONOMIC COST-BENEFIT ANALYSIS: PADMA BRIDGE PROJECT

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Benefits and Costs of Completing the Padma Bridge

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Bangladesh Priorities

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Introduction and Background

The construction of Padma Bridge will provide road and rail links between the relatively less-developed Southwest region (SWR) of the country and the more-developed eastern half that includes the capital of Dhaka and the port city of Chittagong. By facilitating transportation across the river, the bridge is expected to lead to a greater integration of regional markets within the Bangladeshi national economy. It is also expected that the Padma Bridge will have the most significant economic and poverty impacts in Khulna and Barisal Divisions – the southwest region of Bangladesh. Given its importance to the Bangladesh economy several studies were conducted to assess the project cost, expected benefit and finally the financial and economic feasibility applying conventional measures such as NPV, IRR and BCR.

One of such study was commissioned by the Bangladesh Bridge Authority in 2010 with financial assistance from the World Bank. In additional to the conventional benefit derived from a traffic model, the study assessed the economy wide benefit of the Padma Bridge and concluded on the basis of three measures of benefit-cost analysis that the Padma Bridger project would be financially viable. The donor consortium withdrew their funding of the project on corruption charges. Bangladesh government then decided to fund the project from their own funding. As a result of uncertainty over funding, the project could not be started and accordingly the completion of the project deadline has been shifted from 2015 to 2018. According to Bridges Division, the delay led to rise of the project cost by three times. This paper tries to reassess the feasibility of the Padma Bridge project against the backdrop of increasing project costs.

The rest of the paper is composed of five more sections. Section two provides an overview of the previous benefit cost analysis. Cost escalation has been discussed in section three. Data and methodology has been discussed in section four. Section five presents benefit-cost analysis. Final section provides concluding observations.

Overview of the Previous Economic Benefit Cost Analysis1

Raihan and Khondker (2010) used four different types of methodologies to quantify the economic as well as welfare implication of Padma Bridge. Although strict comparisons of the outcomes of these

1 Benefit cost analysis refers to a study conducted in 2010 by Raihan and Khondker. For details please see "Estimating the Economic Impacts of the Padma Bridge in Bangladesh". The study was commissioned by the Bangladesh Bridge Authority and the World Bank.

models are not usually advocated, they have been used in the study to examine the robustness of the project benefit outcomes[2].

a) Although, it is customary to use 'traffic' models to estimate the economic benefits of transport project (e.g. Padma Bridge), reliance only on the traffic model may underestimate full benefits of the project since such model can only capture primary or direct benefit in the form of efficiency gains arising out of cost and time saved.

b) The secondary benefits of a transportation project are also substantial. The secondary effects may be generated due to multi-sectoral productivity gain through structural change occurring in the economy from improved productivity made possible by the bridge. The well known models for capturing secondary benefits are SAM based fixed price and CGE models.

c) Hence in addition to adopting the traffic model, both SAM based fixed price and CGE models are employed to estimate full benefits of the Padma Bridge project. In this context the full benefits would thus compose of efficiency gains of traffic model and the economy wide benefits of the SAM and CGE models.

d) Because of its location in the South West region of Bangladesh, Padma Bridge is expected to have larger impacts on this regions compared to the other parts of Bangladesh. A regional CGE model, although not an impossibility, has not been possible because of lack of required region specific parameters and elasticity values. However a regional SAM model was formulated to assess the impacts of Padma Bridge on the SW region of Bangladesh.

Estimated Benefits

1. In the Traffic model, road users benefits are estimated based on the saving on vehicle operation costs (VOC) and savings in travel time cost (TTC). Total road user benefit is estimated to be about million 1,295,840 taka ($18,512 million) over the 31 year period[3]. The economic benefits are on top of the financial benefits estimated using the forecasted traffic volume and levying of toll (please see section 3).

[2] All these models are stand alone model and hence their outcomes should be considered independent of each other. Strict comparison is not advocated in the literature. However, in this exercise road user benefit of the traffic model is combined with the outcome of the SAM model (i.e. considering it as a measure of economy wide secondary impacts due to the implementation of the project) to derive total benefit of the project.

[3] The quantifiable cost and benefits of the Padma Bridge carried out by AECOM New Zealand Limited. For details please see "Padma Multipurpose Bridge Design Project: Detailed Economic and Financial Analysis- Revision 1", AECOM New Zealand Limited.

2. As for economy-wide (secondary) benefits, use of national SAM with injection of $2.1 billion into the economy (i.e. Simulation 1A) produced economy wide (secondary benefits) in terms of value added of taka 453,670 million ($6481 million) over a period of 31 years, which represents 10.6 percent growth. This would give an annualized growth rate of 0.33 percent of national base GDP. This is obtained by dividing the total economy wide benefits by 31 to get an average annual incremental flow of value and dividing that figure by base GDP figure, we get this (0.33 percent) annual figure. If the WEB figure is added to with direct (traffic) benefits, the annual size of the benefits of the bridge, in relation to GDP, would be larger, as noted later.

3. Compared to national GDP the average annual increase in SW regional base GDP because of WEB alone will be 2.3 percent. This is on the assumption that a 100 percent of the shock will occur within the regional economy. However, if we assume that only 70 percent of the shock would be operative in the region (and not full 100 percent), the equivalent of annual rate of growth regional GDP would be roughly 1.66 percent. The annual equivalent rate of growth was calculated keeping in view the 31 years as the time taken to fully realize the impact of the bridge. If we took a shorter time horizon for fully realizing the benefit of growth, then the annual equivalent rates could be larger. Given that SAM based model assume excess capacity (which may be a reasonable assumption in a country like Bangladesh with under-utilized resources), the size of impacts vary with the size of injection or shock.

4. To sum up, using the Traffic model, road users benefit has been found to be million 1,295,840 taka ($18512 million). We consider value added increase of million 453,670 taka ($6481 million) derived from the national SAM model (i.e. simulation 1A) as economy wide benefits of the project. Thus, total project benefit is estimated to be 1,749,510 million taka or $24993 million. The breakdown is: Total (1,749,510 million taka or $24993 million) = Road User Benefit (1,295,840 million taka or $18512 million) + WEB (453,670 million taka or $6481 million). This implies that total project benefit is 39 percent relative to the base national income (i.e. 4,468,549 million taka or $63836 million). Assuming the 31 year full realization timeframe, total project benefits per year is then 1.26 percent relative to the base national income. The base year GDP figure would not remain the same over 31 years. Assuming 5 percent GDP growth over (as experienced in recent years) the 31 period an alternative estimate of base year is arrived. The total project benefit (i.e. 1,749,510 million taka or $24993 million) is only 0.56 percent relative to the alternative base national income. Under certain assumptions, the relative size of annual increase of output for the SW region would be 1.66 percent considering the WEB alone. If the total benefits were taken into account, the relative size

of annual flow of benefits in comparison to regional GDP would, of course, be larger and, would depend on how much of the traffic benefits would accrue to the south-west region.

5. Further assessment of the total project benefits (explained above) in terms of conventional project appraisal measures suggests that the project is economically viable. More specifically, the project is viable with:

   - *a net present value[4] of US$ 1234 million;*
   - *a benefit-cost ratio (BCR) of 2.01;*
   - *an economic internal rate of return (EIRR) of 19 percent.*

6. The application of constrained optimization model such as CGE model outcomes also vindicates the findings of the traffic model and SAM based model. More specifically, 50 percent reduction in transport margins may lead to welfare increase by 0.78 percent compared to the base value. Furthermore, conventional project appraisal measures inclusive of CGE outcome suggest that the project is also economically viable. The conventional project appraisal measures with CGE outcome are:

   - *a net present value of US$ 851 million;*
   - *a benefit-cost ratio (BCR) of 1.72;*
   - *an economic internal rate of return (EIRR) of 17 percent.*

7. Under certain assumptions, the construction of the Padma Bridge would lead to an annualised reduction in head-count poverty at the national level by 0.84 percent and at the regional level by 1.01 percent. Other simulations also indicated reduction in poverty in different magnitudes.

[4] A discount rate of 12% was used in the BCR calculation.

Traffic and Revenue Forecasts5

A transport model was developed by AECOM to forecasts traffic volume and revenues on the Padma Bridge. The calibration of the model was done using detailed information on socio-economic and travel patterns. Some of the key parameters and variables include:

I. Changed land use patterns;
II. Changed population and number of households;
III. Regional and national economic growth;
IV. Growth in car ownership;
V. Increase in value of time; and

When the forecasting exercise was conducted it was projected that opening year traffic (2014) would be 12,000 vehicles per day, growing over 63,000 in thirty years at a growth rate of 6.3% per annum. AECOM argued that "initially, trucks and buses make up around 75% of vehicles on Padma Bridge, although light vehicles (cars and motorcycles) make up an increasing proportion of traffic as vehicle ownership in Bangladesh increases. Thus, the change in traffic mix results in a slightly lower long term growth rate of revenue around 5.8%".

They further stated that "by 2036, traffic volumes on Padma Bridge are assumed to be close to capacity, given current capacity assumptions and vehicle technology. The forecasts have therefore been capped at 75,000 vehicles per day. Further, as traffic using Padma Bridge will be additional to existing local traffic, capacity on the N8 to Dhaka will require upgrading to at least four lanes. This was assumed to occur from year of opening. Between the western end of the bridge and Bhanga junction, it was assumed that the N8 is widened by 2025 to four lanes".

[5] AECOM (2010), 'Padma Multipurpose Bridge Design Project: Detailed Economic and Financial Analysis', Revision 1 Bangladesh Bridge Authority, 11 February 2010. AECOM New Zealand Limited

Table 1: Traffic and Revenue Forecasts

	Traffic Volume					Revenue (BDT Million)				
Year	**Truck**	**Bus**	**Car**	**Motor cycle**	**Total**	**Truck**	**Bus**	**Car**	**Motor cycle**	**Total**
2014	3,477	5,693	2,658	228	12,056	1,187	1,652	388	3	3,229
2015	4,233	6,091	3,097	265	13,686	1,445	1,768	452	3	3,667
2016	5,154	6,518	3,607	308	15,587	1,759	1,891	527	3	4,180
2017	6,274	6,974	4,203	357	17,808	2,141	2,024	614	4	4,782
2018	7,638	7,462	4,896	415	20,411	2,607	2,165	715	5	5,491
2019	9,299	7,985	5,704	482	23,469	3,173	2,317	833	5	6,328
2020	11,320	8,544	6,645	559	27,068	3,863	2,479	970	6	7,319
2024	14,378	9,460	11,058	972	35,869	4,907	2,745	1,615	11	9,277
2034	22,449	11,348	27,641	2,617	64,055	7,661	3,293	4,036	29	15,018
2044	25,882	12,190	34,314	3,271	75,658	8,833	3,537	5,010	36	17,416

Source: AECOM

The tolling scenario has been based on 2010 tolls at Jamuna Bridge, which are BDT 30 for Motorcycle; BDT 400 for cars; BDT 795 for buses and BDT 935 for trucks. The table below summarises the traffic and revenue forecasts (in Million BDT at 2009 price level) for the base tolling scenarios (Please see Annex 1 for details).

Cost Escalation

Cost of Padma Bridge project has increased for the second time in January 2016. According to the latest estimate by the Bridges Division, the total cost of Padma Bridge project stand at Tk. 28,793 crore (or Billion USD 3.69[6]), implying almost 184 percent or 2.8 times increase over 2007 estimate. The project when first approved in 2007 has been estimated at Tk. 10,162 crore (or Billion USD 1.47). However, in 2011 the project cost was revised upward to Tk. 20,507 crore (or Billion USD 2.97) envisaging almost 104 percent or 2 times increase over 2007 estimate[7].

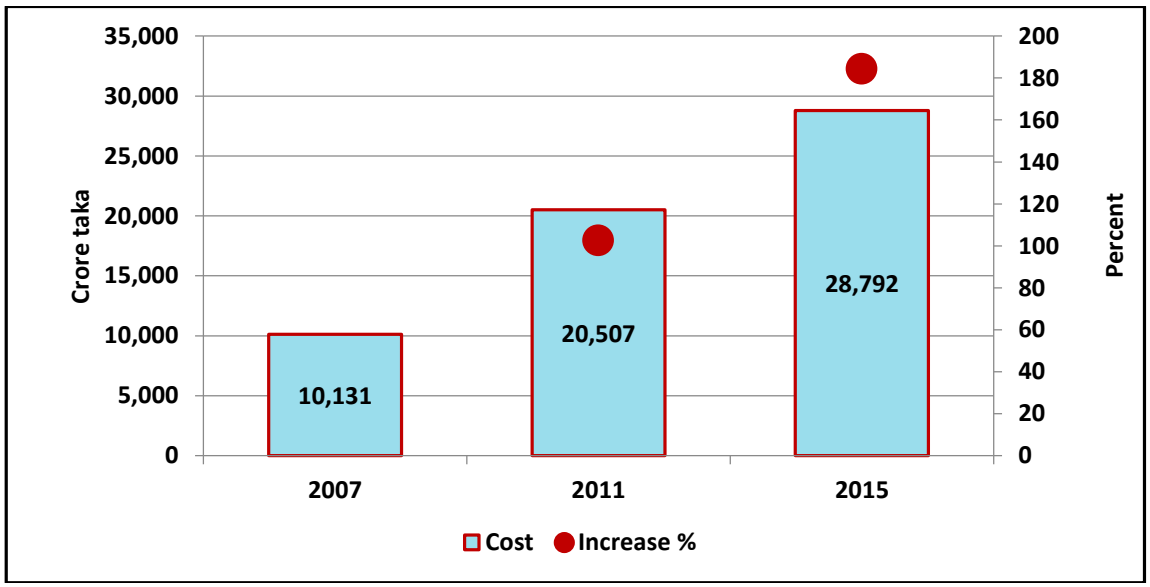
According to the Bridges Division, a feasibility study was conducted with assistance from JICA between 2003 and 2005. On the basis of the JICA feasibility study the original project cost was estimated at Tk. 10,162 crore (or Billion USD 1.47) in 2007. Later on with assistance from ADB, the work on preparing a detailed design of the bridge commenced in 2009. Based on the ADB study, the first revision of the project cost was estimated in 2011. In the first revision, the cost of rail was incorporated which led to doubling of the project cost. According to the first revision, the completion of project was scheduled

[6] The exchange rate was Tk. 69 per dollar during the first revision in 2011. The exchange rate ranged between Tk. 74.45 and 78.4 during the second revision. We used exchange rate of TK. 78 per dollar to derive dollar value of second revision.

[7] The effect of price inflation in Bangladesh between 2007 and 2015 (i.e. at around 6.6% per annum) should add about 78% to costs. Moreover, during the same period, currency depreciation reduced the Taka's value by about 13%. Together they accounted for 91% of the cost increase between 2007 and 2015.

for 2015. But recently the completion date has extended to 2018 which has also led to further escalation of cost.

Figure 1: Cost Comparison ((In Cores of Taka: Current Prices)



Source: Bridges Division

According to the latest estimate by the Bridges division cost has escalated between 2011 and 2016 by about 40% reflecting mainly the price increase during the five year period. A review of the inflation rate (i.e. Consumer Price Index) between 2011 and 2016 suggests that the impact of price inflation is about 41%. The reasoning of the price inflation effect of cost escalation by the Bridges division appears justifiable.

Table 1: Movements of Key Macroeconomic Indicators (%)

Key Macroeconomic Indicators	FY11	FY12	FY13	FY14	FY15	FY11
Real GDP growth	6.2	6.5	6.5	6.0	6.1	6.2
CPI Inflation	7.3	8.8	10.6	7.7	7.4	6.5
GDP Deflator	6.5	7.5	8.5	6.6	7.2	6.5
Nominal GDP growth	12.9	14.4	15.6	13.0	13.8	13.1

Source: BBS, Bangladesh Bank

Estimated cost by major components is shown in Table 1 below. Two major components are main bridge and river training. According to the second revision, the cost of construction of the main bridge has increased by 45 percent compared to the estimate of the first revision in 2011. The cost of another major component – river training has gone up by 114 percent compared to estimate of the first revision. More specifically, cost of river training has increased to Tk. 9,400 crore, as an additional 1.3 kilometers of work of river training work would need to be carried out at Mawa. Moreover, the cost of different approach roads has also escalated as an additional Tk. 408 crore would be needed for road

widening, shifting of jetties, and laying out the approach roads. On the other hand, amount allocated for miscellaneous component has been brought down. In 2011 it was estimated at Tk. 3,979 crore which has reduced to Tk. 2,538 crore.

Table2: Padma Bridge Cost by Major Components (In Cores of Taka)

Cost Components	2007		2011		2015	
	Cost	Share (%)	Cost	Share (%)	Cost	Share (%)
Main Bridge	3,633	35.9	8,361	40.8	12,133	42.1
River Training	2,613	25.8	4,388	21.4	9,400	32.6
Approach Road	360	3.6	1,270	6.2	1,908	6.6
Resettlement	528	5.2	1,423	6.9	1,515	5.3
Land Acquisition	306	3.0	1,086	5.3	1,298	4.5
Others	2,691	26.6	3,979	19.4	2,538	8.8
Total	10,131	100.0	20,507	100.0	28,792	100.0

Source: Bridges Division

Data and Methodology

In this exercise estimated benefits derived from the traffic model and indirect economy wide benefits generated from the economy wide model have been retained.

Estimated Road user's benefits are based on the saving on vehicle operation costs (VOC) and savings in travel time cost (TTC). Vehicle operating cost (VOC) is used to provide economic value in distance savings covering various factors such as fuel, tiers and maintenance etc. For economic valuation unit VOC was derived from the "Road Users Cost Report, 2004-05", RHD. Total VOC was disaggregated into fuel and non-fuel components, which were then escalated to 2009 values by the increase in average petroleum spot price (IMF, 2009b) and Consumer Price Index (BBS, 2009a). A measure of Value of Time (VOT) is used to convert travel time savings into a monetary value. Following two formulas have been used to estimate the VOC and TTC:

A. Savings in vehicle operating costs (VOC) = $(VKT_{without\ bridge} - VKT_{with\ bridge})$ x Unit VOC

B. Savings in travel time costs (TTC) = $(VHT_{without\ bridge} - VHT_{with\ bridge})$ x Unit TTC

Where,

VKT refers to vehicle kilometer of travel; VOC denotes vehicle operating cost; VHT stands for vehicle hours of travel; and TTC is a measure of Value of Time. Please see Annex 2 for VOC and TTC.

Savings in travel time costs account for 23% of total benefits estimated by Design Consultant. Unit travel time costs for passengers and crew were sourced from RHD (2005) and for freight in transit from STUP (2007). These were then escalated to 2009 using prices by estimated increase in General Wage Rate Index from BBS (2008) and ADB (2009). These constitute a major part of the quantifiable benefits. *Total road user benefit is estimated to be about million 1,295,840 taka over the 31 year period.*

Although economic benefits of road users have been retained, the economy wide benefits (WEB) has been re-estimated using national and regional social accounting matrices (SAM). Two scenarios have been considered: (i) in simulation one (SIM 1) the fifty (50%) of the total cost will be used in the domestic economy (e.g. foreign currency cost component is thus 50% - will be use outside implying a leakage from the domestic economy); (ii) in simulation two (SIM 2) the only thirty (30%) of the total cost will be used in the domestic economy (e.g. foreign currency cost is thus 70% - implying higher leakage).

The pace at which the Padma Bridge is expected to impact upon output and income would depend mainly on the extent to which the bridge's capacity will be used. In line with traffic model estimation, one may assume that it will take roughly 31 years for full realization of the estimated simulation results from SAM analysis. Accordingly, the total effects are converted into annual effects and the estimates are presented in Table 2. It is important to note that the simulation exercises were meant to trace the impacts of a particular intervention, assuming that all other things remained constant. Annual equivalent rates of growth were calculated keeping in view the 31 years as the time taken to fully realize the impact of the bridge.

The annualized equivalent rate would be 0.194 percent for national GDP (compared to the national base GDP) and 2.5 percent for SW region (compared to the SW base GDP) assuming 100 percent confinement of shock to the regional economy. If we assume that if 70 percent of the shock would be operative in the region, the equivalent of annual rate of growth regional GDP would be roughly 1.77 percent. Given that SAM based model assume excess capacity (which may be a reasonable assumption in a country like Bangladesh with under-utilized resources), the size of impacts vary with the size of injection or shock.

Table2: Total and Annualized Economy Wide Benefit of Simulations (% Change from Base Values)

	Simulation 1A: National SAM Based		Simulation 1B: Regional SAM Based				Simulation 2A: National SAM Based		Simulation 2B: Regional SAM Based	
Increase in:	Total (1)	Annualized (2)	Total (3)	Annualized (4)	Total* (5)	Annualized (6)	Total (7)	Annualized (8)	Total (9)	Annualized (10)
Gross Output	6.02	0.194	78.34	2.53	51.4	1.66	3.61	0.116	47.00	1.516
Commodity	5.85	0.188	78.23	2.51	51.3	1.66	3.51	0.113	46.94	1.514
Factor Return	5.79	0.187	76.16	2.46	49.9	1.61	3.48	0.112	45.68	1.474
Household Income	5.12	0.165	72.72	2.34	47.7	1.54	3.07	0.099	43.63	1.407

Note: Gross output = intermediate use + factor payments; Total commodity demand = commodity demanded by households; Value added = factor payments; Household income = Incomes of different household categories

In the benefits cost analysis (BCA) the revised cost estimates and revised EWB estimates have been replaced but previously estimated road users benefits have been retained. In the cost benefit analysis three discount rates[8] have been used – these are (i) 10%; (ii) 5% and (iii) 3%.

[8] In a note for the Planning Commission on social discount rate (SDR), a PRI study found that "ignoring the government real borrowing rate, the estimates for SDR for Bangladesh range from a low of 7.25% to a high of 10.8%. The higher end of SRTP (10%) is pretty close to the social opportunity cost of capital (SOCC) rate of 10.4% that uses a 10 year T-bill rate. It is therefore suggested that this 10% rate should be used as a central rate while sensitivity analysis should check for the responses to the end points (7 -11 %). What is clear is that the current practice of using 15% is way out of line and is not based on any reasonable assumptions. This must be replaced for all future investment decisions. For details please see PRI (2015), "A Policy Note on the Social Discount Rate for Bangladesh"

Benefit-Cost Analysis

As mentioned above standard measure such as benefit cost ratio (BCR) has been used to assess the feasibility of the Padma Bridge project. Assessment conducted in 2010 found benefit cost ratio of 2.01 for the Padma Bridge project.

In this exercise we have used to two estimated benefits (both direct and indirect). *Under simulation 1*, the total undiscounted benefits of the Padma Bridge have been estimated to be Tk. 1.8 trillion or $22.4 billion. The breakdown is: Total (1.5 trillion taka or $22.4 billion) = Road User Benefit (1.3 trillion taka or $18.5 billion) + WEB-SIM (0.3 trillion taka or $3.2 billion). On the other hand under *under simulation 2*, the total undiscounted benefits of the Padma Bridge have been estimated to be Tk. 1.6 trillion or $21.1 billion. The breakdown is: Total (1.6 trillion taka or $21.4 billion) = Road User Benefit (1.5 trillion taka or $18.5 billion) + WEB-SIM 2(0.1 trillion taka or $1.9 billion).

Road user's benefits estimation were based on the saving on vehicle operation costs (VOC) and savings in travel time cost (TTC). Vehicle operating cost (VOC) is used to provide economic value in distance savings covering various factors such as fuel, tiers and maintenance etc. For economic valuation unit VOC was derived from the "Road Users Cost Report, 2004-05", RHD. Compared to 2004-05 estimates, although cost of some of these components may be increased such as tiers and maintenance but the cost of fuel may have fallen leading a situation that economic valuation unit VOC more or less remained unchanged. A measure of Value of Time (VOT) is used to convert travel time savings into a monetary value. Savings in travel time costs account for 23% of total benefits estimated by Design Consultant. Since, savings in travel would likely to remain same and total benefit has also remained same (i.e. 2010 level), this component of Road user's benefits would also likely to remain unchanged.

The cost of Padma Bridge has gone up by almost three times. The latest cost of $ 3.7bn has been incorporated into the BCR framework to assess the feasibility of the Padma Bridge. It should be important to note since in the exercise, escalated cost has been incorporated but benefits more or less remained unchanged and hence may suggest an underestimation of BCR. The results of the feasibility exercise with escalated costs and unchanged benefits are provided below.

Table3: Benefit-Cost Ratios under Different Discount Rates (In $ Million)

Values	Total Cost (C)	Benefit (B)			Benefit-Cost Ratio (B/C-%)
		Road User's	Economy Wide	Total	
Simulation 1					
@ discount rate 10%[9]					
Nominal value	4,252	18,509	3,236	22,400	
Discounted value	2,528	1,579	360	2,217	0.877
@ discount rate 5%					
Nominal value	4,252	18,509	3,236	22,400	
Discounted value	3,204	4,906	984	6,312	1.970
@ discount rate 3%					
Nominal value	4,252	18,509	3,236	22,400	
Discounted value	3,572	8,145	1,545	10,192	2.853
Memorandum Item					
@ discount rate 8%					
Nominal value	4,252	18,509	3,236	22,400	
Discounted value	2,766	2,431	528	3,286	1.188
Simulation 2					
@ discount rate 10%					
Nominal value	4,252	18,509	1,941	21,105	
Discounted value	2,528	1,579	216	2,073	0.820
@ discount rate 5%					
Nominal value	4,252	18,509	1,941	21,105	
Discounted value	3,204	4,906	590	5,918	1.847
@ discount rate 3%					
Nominal value	4,252	18,509	1,941	21,105	
Discounted value	3,572	8,145	927	9,574	2.680
Memorandum Item					
@ discount rate 8%					
Nominal value	4,252	18,509	1,941	21,105	
Discounted value	2,766	2,431	317	3,075	1.112

[9] With falling market interest rate to less than double digit, an appropriate discount rate may line somewhere between 5% and 10%. A discount rate 8% suggests a BCR of 1.18 under simulation 1 and 1.11 under simulation 2.

Concluding Observations

By facilitating transportation across the river, the Padma Bridge is expected lead to the greater integration of regional markets within the Bangladeshi national economy. On the basis of their suitability of capture primary and secondary economic impacts of construction project, three different types of economy wide models are employed in addition to traditional traffic model to capture the total and economy wide impacts of Padma Bridge.

In this exercise we have used to two estimated benefits (both direct and indirect). *Under simulation 1*, the total benefits of the Padma Bridge have been estimated to be Tk. 1,554,672 million or $21,747 million. The breakdown is: Total (1,554,672 million taka or $21,747 million) = Road User Benefit (1,295,840 million taka or $18,512 million) + WEB-SIM 2(258,832 million taka or $3,235 million). On the other under *under simulation 2*, the total benefits of the Padma Bridge have been estimated to be Tk. 1,451,139 million or $20,453 million. The breakdown is: Total (1,451,139 million taka or $20,453 million) = Road User Benefit (1,295,840 million taka or $18,512 million) + WEB-SIM 2(155,298 million taka or $1,941 million). The latest project cost (i.e. 2016) has been incorporated into the benefit-cost framework.

Three alternative discount rates (i.e. 10%; 5% and 3%) were used to assess to robustness of the economic viability of the project.

Despite cost escalation by almost 3 times over the original estimate in 2007, the project would remain viable according to the most of the revised BCR estimates. More specifically, BCR values of 0.887; 1.970; and 2.853 respectively have been found for three alternative discount rates of 10%; 5% and 3% under simulation 1. Upward adjustment of road users' benefits would surely provide higher BCR values. For instance, upward adjustment of unit VOC and TTT at 2015 prices would increase the BCR values to 1.127 and 1.070 respectively under SIM 1 and SIM 2 at 10 percent discount rate. Moreover, given the falling market interest rate as an appropriate discount in Bangladesh now may lie somewhere between 5% and 10%. Accordingly, use of discount rate 8% suggests a BCR of 1.18.

Annex 1: Traffic and Revenue Forecasts

	Traffic (AADT)					Toll (Taka)				Annual toll revenue (Taka million)				
Year	Truck	Bus	Car	Motor cycle	Total	Truck	Bus	Car	Motor cycle	Truck	Bus	Car	Motor cycle	Total
2014	3,477	5,693	2,658	228	12,056	935	795	400	30	1,187	1,652	388	3	3,229
2015	4,233	6,091	3,097	265	13,686	935	795	400	30	1,445	1,768	452	3	3,667
2016	5,154	6,518	3,607	308	15,587	935	795	400	30	1,759	1,891	527	3	4,180
2017	6,274	6,974	4,203	357	17,808	935	795	400	30	2,141	2,024	614	4	4,782
2018	7,638	7,462	4,896	415	20,411	935	795	400	30	2,607	2,165	715	5	5,491
2019	9,299	7,985	5,704	482	23,469	935	795	400	30	3,173	2,317	833	5	6,328
2020	11,320	8,544	6,645	559	27,068	935	795	400	30	3,863	2,479	970	6	7,319
2021	12,018	8,764	7,547	642	28,971	935	795	400	30	4,101	2,543	1,102	7	7,753
2022	12,758	8,990	8,572	737	31,058	935	795	400	30	4,354	2,609	1,252	8	8,222
2023	13,544	9,222	9,736	846	33,349	935	795	400	30	4,622	2,676	1,421	9	8,729
2024	14,378	9,460	11,058	972	35,869	935	795	400	30	4,907	2,745	1,615	11	9,277
2025	15,264	9,704	12,560	1,116	38,644	935	795	400	30	5,209	2,816	1,834	12	9,871
2026	16,178	9,918	14,289	1,284	41,669	935	795	400	30	5,521	2,878	2,086	14	10,499
2027	17,147	10,136	16,255	1,479	45,016	935	795	400	30	5,852	2,941	2,373	16	11,182
2028	18,174	10,359	18,491	1,702	48,727	935	795	400	30	6,202	3,006	2,700	19	11,927
2029	19,263	10,587	21,036	1,959	52,845	935	795	400	30	6,574	3,072	3,071	21	12,739
2030	20,417	10,820	23,930	2,255	57,422	935	795	400	30	6,968	3,140	3,494	25	13,626
2031	20,907	10,949	24,808	2,341	59,005	935	795	400	30	7,135	3,177	3,622	26	13,960
2032	21,409	11,081	25,719	2,429	60,638	935	795	400	30	7,306	3,215	3,755	27	14,303
2033	21,923	11,214	26,663	2,521	62,321	935	795	400	30	7,482	3,254	3,893	28	14,656
2034	22,449	11,348	27,641	2,617	64,055	935	795	400	30	7,661	3,293	4,036	29	15,018
2035	22,987	11,485	28,656	2,716	65,844	935	795	400	30	7,845	3,333	4,184	30	15,391
2036	23,539	11,622	29,707	2,819	67,688	935	795	400	30	8,033	3,373	4,337	31	15,774
2037	24,104	11,762	30,798	2,926	69,590	935	795	400	30	8,226	3,413	4,496	32	16,168
2038	24,683	11,903	31,928	3,037	71,550	935	795	400	30	8,424	3,454	4,661	33	16,572
2039	25,275	12,046	33,100	3,152	73,572	935	795	400	30	8,626	3,495	4,833	35	16,988
2040	25,882	12,190	34,314	3,271	75,658	935	795	400	30	8,833	3,537	5,010	36	17,416
2041	25,882	12,190	34,314	3,271	75,658	935	795	400	30	8,833	3,537	5,010	36	17,416
2042	25,882	12,190	34,314	3,271	75,658	935	795	400	30	8,833	3,537	5,010	36	17,416
2043	25,882	12,190	34,314	3,271	75,658	935	795	400	30	8,833	3,537	5,010	36	17,416
2044	25,882	12,190	34,314	3,271	75,658	935	795	400	30	8,833	3,537	5,010	36	17,416
2045	25,882	12,190	34,314	3,271	75,658	935	795	400	30	8,833	3,537	5,010	36	17,416
2046	25,882	12,190	34,314	3,271	75,658	935	795	400	30	8,833	3,537	5,010	36	17,416
2047	25,882	12,190	34,314	3,271	75,658	935	795	400	30	8,833	3,537	5,010	36	17,416
2048	25,882	12,190	34,314	3,271	75,658	935	795	400	30	8,833	3,537	5,010	36	17,416
2049	25,882	12,190	34,314	3,271	75,658	935	795	400	30	8,833	3,537	5,010	36	17,416
2050	25,882	12,190	34,314	3,271	75,658	935	795	400	30	8,833	3,537	5,010	36	17,416

Annex 2: Vehicle Operating Costs and Travel Time Costs

VOC Assumptions (Taka per vehicle-kilometre)

		Unit VOC (2008/09)		
Vehicle Type	VOC (2004/05)	Fuel	Non-Fuel	Total
Medium Truck	12.9	7.20	10.03	17.23
Small Truck	9.56	2.88	9.44	12.32
Large Bus	13.72	5.59	12.36	17.95
Mini Bus	11.40	6.02	9.15	15.16
Micro Bus	11.36	3.94	10.80	14.74
Utility	9.26	4.19	8.00	12.19
Car	9.32	4.08	8.17	12.24

Source: "Road User Cost Annual Report for 2004-05", Roads and Highways Department

VOT Assumptions (Taka per vehicle-hour)

	2004/05				2008/09
Vehicle Type	Passengers	Crew	Freight	Total	Total
Medium Truck	0	24	16	40	54
Small Truck	0	15	13	28	38
Large Bus	641	34	0	675	907
Mini Bus	797	25	0	822	1,104
Micro Bus	149	18	0	168	225
Utility	93	12	0	105	141
Car	93	12	0	105	141

Source: "Road User Cost Annual Report for 2004-05", Roads and Highways Department

Annex 3: Estimated Road Users Benefit – Traffic Model[10]

Road users benefits, estimated based on the saving on vehicle operation costs (VOC) and savings in travel time cost (TTC). Vehicle operating cost (VOC) is used to provide economic value in distance savings covering various factors such as fuel, tiers and maintenance etc. For economic valuation unit VOC was derived from the "Road Users Cost Report, 2004-05", RHD. Total VOC was disaggregated into fuel and non-fuel components, which were then escalated to 2009 values by the increase in average petroleum spot price (IMF, 2009b) and Consumer Price Index (BBS, 2009a). A measure of Value of Time (VOT) is used to convert travel time savings into a monetary value. Savings in travel time costs account for 23% of total benefits estimated by Design Consultant. Unit travel time costs for passengers and crew were sourced from RHD (2005) and for freight in transit from STUP (2007). These were then escalated to 2009 using prices by estimated increase in General Wage Rate Index from BBS (2008) and ADB (2009). These constitute a major part of the quantifiable benefits. Total road user benefit is estimated to be about million 1,295,840 taka over the 31 year period.

Table A1: Road User Benefit from the Traffic Model

Year End June	VOC	TTC	Sub-total
2011			0
2012			0
2013			0
2014			0
2015	19	31	50
2016	37	50	88
2017	61	75	137
2018	74	87	161
2019	84	97	182
2020	93	106	199
2021	111	124	235
2022	131	145	276
2023	153	168	321
2024	176	193	369
2025	202	221	423
2026	231	243	473
2027	260	266	526
2028	290	291	581
2029	322	316	637
2030	354	342	696
2031	370	351	721
2032	386	360	746
2033	401	370	771

[10] The traffic benefits were estimated by Design Consultants and revised by the World Bank team.

Year End June	VOC	TTC	Sub-total
2034	417	378	795
2035	431	388	820
2036	447	397	844
2037	462	407	869
2038	477	417	895
2039	493	427	919
2040	508	437	945
2041	513	438	951
2042	518	439	957
2043	521	440	962
2044	525	441	966
2045	542	455	997
Total (Mill USD)	9609	8900	18512
Total (Mill Taka)	672630	623000	1295840

Annex 4: Description of the SAM Model and Estimated Economy Wide Benefit

Description of the SAM Model

The shift from a 'data' SAM structure to a SAM Multiplier Module requires the introduction of assumptions and the separation of the SAM accounts into 'exogenous' and 'endogenous' components[11].

Table A1: General SAM Modular Structure

		1a-PA	1b-CM	2-FP	3a-HH-OI	4-KHH-OI	5-ROW	TDD
1a	PA		$T_{1a, 1b}$		0			$\mathbf{Y_{1a}}$
1b	CM	$T_{1b, 1a}$			$T_{1b, 3}$	$T_{1b, 4}$	$T_{1b, 5}$	$\mathbf{Y_{1b}}$
2	FP	$T_{2, 1a}$					$T_{2, 5}$	$\mathbf{Y_2}$
3	HH-IO	$T_{3, 1a}$	$T_{3, 1b}$	$T_{3, 2}$	$T_{3, 3}$		$T_{3, 5}$	$\mathbf{Y_3}$
4	KHH-OI	$T_{4, 1a}$			$T_{4, 3a}$		$T_{4, 5}$	$\mathbf{Y_4}$
5	ROW		$T_{5, 1b}$	$T_{5\,2}$	$T_{5, 3}$	0	0	$\mathbf{Y_5}$
	TSS	$\mathbf{E_{1a}}$	$\mathbf{E_{1b}}$	$\mathbf{E_2}$	$\mathbf{E_3}$	$\mathbf{E_4}$	$\mathbf{E_5}$	

Where: by definition $Y_i = E_j$ and 1 Production (1a PA = Production Activities and 1b CM = Commodities); 2 FP = Factors of Production; 3 HH-IO = Households and Other Institutions (incl. Government); 4 KHH-OI = Capital Account Households and Other Institutions (incl. government); 5 ROW = Rest of the World (Current and capital account). Blank entries indicate that there are no transactions by definition.

The separation is needed to gain entry into the system, allowing some variables within the SAM structure to be manipulated exogenously (via injection instruments) to assess the subsequent impacts on the endogenous accounts as well as on the exogenous accounts. Generally, accounts intended to be used as policy instruments are classified as exogenous and accounts specified *a priory* as objectives (or targets) are classified as endogenous.

Three accounts are designated as endogenous accounts: *(1) Production (Production Activities and Commodities) account, (2) Factors of Production* account*, (3a) Households and Other Institutions (excl. the Government)*. The exogenous accounts comprises *3a Government (expenditure, transfer, remittances); 4 Capital account of institutions (savings and demand for houses, investment demand, infrastructure and machinery and equipment); and* 5 ROW *transfers, remittances, export demand and capital.* The SAM Flows and the categorization into endogenous and exogenous accounts are shown below.

Table A2: Endogenous and Exogenous Accounts

		1a-PA	1b-CM	2-FP	3a-HH-OI	3b-Gov	4-KHH-OI	5-ROW	TDD
1a	PA		$T_{1a, 1b}$		0				$\mathbf{Y_{1a}}$
1b	CM	$T_{1b, 1a}$			$T_{1b, 3a}$	$T_{1b, 3b}$	$T_{1b, 4}$	$T_{1b,5}$	$\mathbf{Y_{1b}}$
2	FP	$T_{2, 1a}$						$T_{2, 5}$	$\mathbf{Y_2}$
3a	HH-OI			$T_{3a, 2}$	$T_{3a, 3a}$	$T_{3a, 3b}$		$T_{2, 5}$	$\mathbf{Y_3}$
3b	Gov	$T_{3b, 1a}$	$T_{3b, 1b}$		$T_{3b, 3a}$	$T_{3b, 3b}$		$T_{3a, 5}$	
4	KHH-OI	$T_{4, 1a}$			$T_{4, 3}$			$T_{4, 5}$	$\mathbf{Y_4}$
5	ROW		$T_{5, 1b}$	$T_{5, 2}$	$T_{5, 3a}$	$T_{5, 3b}$	$T_{5, 4}$	0	$\mathbf{Y_5}$
	TSS	$\mathbf{E_{1a}}$	$\mathbf{E_{1b}}$	$\mathbf{E_2}$	$\mathbf{E_{3a}}$	$\mathbf{E_{3b}}$	$\mathbf{E_4}$	$\mathbf{E_5}$	

Where Endogenous: 1 Production (1a PA = Production Activities and 1b CM = Commodities); 2 FP = Factors of Production; 3a HH = Households and Other Institutions (excl. Government); Where Exogenous: 3b Government; 4 KHH-OI = Capital

[11] The methodology and symbology follows Pyatt, G. and Jeffrey Round, (1977) Pyatt, G. and Jeffrey Round, (1979) and Pyatt, G. and Roe, A. (1987) (eds), while the lay out follows Alarcón, J. V., E. Delabastida and R. Vos, (1984), Alarcon, J. V., S. Keuning, J. van Heemst, W. de Ruyter and R. Vos, (1991).

Account of Households and of Other Institutions (incl. government); 5 ROW = Rest of the World (Current and capital account). Blank entries indicate that there are no transactions by definition.

Table A3: Endogenous and Components of Exogenous Accounts

	PA	CM	FP	3a HH&OI	EXO	INCOME	Exogenous Accounts (EXO) used as injections Column Vectors
1a PA		$T_{1a\ 1b}$		0	X_{1a}	$\mathbf{Y_{1a}}$	$X_{1a} = 0$
1b CM	$T_{1b\ 1a}$			$T_{1b\ 3a}$	X_{1b}	$\mathbf{Y_{1b}}$	X_{1b} = Government Consumption Subsidies -Taxes + Exports + Gov. Investment (capital formation in infrastructure and machinery and equipment) + Gross Capital Stock formation
2 FP	$T_{2\ 1a}$				X_2	$\mathbf{Y_2}$	X_2 =Factor Remittances from ROW
3a HH&OI			$T_{3a\ 2}$	$T_{3a\ 3a}$	X_{3a}	$\mathbf{Y_{3a}}$	X_{3a} = Factor Remittances from ROW
3b-5 Leaks	L_{1a}	L_{1b}	L_2	L_{3a}	$L_{3b\text{-}5} = X_{3b\text{-}5}$	$Y_{3b\text{-}5}$	3b =Aid to Government from ROW
EXPN	$\mathbf{E_{1a}}$	$\mathbf{E_{1b}}$	$\mathbf{E_2}$	$\mathbf{E_{3a}}$	$\mathbf{E_{3b\text{-}5}}$		Where $\mathbf{E_i = Y_j}$
L_{1a} = Activity Tax					L_{3a} = Income Tax + Household Savings + Corporate Savings		
L_{1b} = Commodity Tax + Import Duty + Imports					$L_{3b\text{-}5}$ $X_{3b\text{-}5}$ and $Y_{3b\text{-}5}$ falls out of the model		
L_2 = Factor Remittances to ROW					Blank entries indicate that there are no transactions by definition.		

<u>Note on Injection</u>: For any given injection into the exogenous accounts X_i (i.e. instruments) of the SAM, influence is transmitted through the interdependent SAM system among the endogenous accounts. The interwoven nature of the system implies that the incomes of factors, institutions and production are all derived from exogenous injections into the economy via a multiplier process. Multiplier models may also be built on the input-output frameworks. The main shortcoming of the IO model is that the feedback between factor income generation (value added) and demand by private institutions (households) does not exist. In this case the circular economic flow is truncated. The problem can be partly tackled by endogenising household consumption within the I-O framework; this is typically referred to as a 'closed I-O model'. In this case, the circular economic flow is only partially truncated. A better solution is to extend the I-O to a SAM framework which captures the full circular economic flow.

SAM coefficient (Aij) are derived from payments flows by endogenous accounts to themselves (Tij) and other endogenous accounts as to the corresponding outlays (Ei = Yj); similarly, the leak coefficients (Bij) derived from flows reflecting payments from endogenous accounts to exogenous accounts. They are derived below.

Table A4: Coefficient Matrices and Vectors of the SAM Model

Account	1a - PA	1b – CM	2 – FP	3a - HH&OI	3b … 5 EXO	Income
1a – PA		$A_{1a,1b} = T_{1a,1b} / \mathbf{Y_{1b}}$			X_{1a}	$\mathbf{Y_{1a}}$
1b – CM	$A_{1b,1a} = T_{1b,1a} / \mathbf{Y_{1a}}$			$A_{1b,3a} = T_{1b,3a} / \mathbf{Y_{3a}}$	X_{1b}	$\mathbf{Y_{1b}}$
2 – FP	$A_{2,1a} = T_{2,1a} / \mathbf{Y_{1a}}$				X_2	$\mathbf{Y_2}$
3a - HH&OI			$A_{3a,2} = T_{3a,2} / \mathbf{Y_2}$	$A_{3a,3a} = T_{3a,3a} / \mathbf{Y_{3a}}$	X_{3a}	$\mathbf{Y_{3a}}$
3b … 5 Leaks	$B_{1a} = L_{1a} / \mathbf{Y_{1a}}$	$B_{1b} = L_{1b} / \mathbf{Y_{1b}}$	$B_2 = L_2 / \mathbf{Y_2}$	$B_{3a} = L_{3a} / \mathbf{Y_{3a}}$		
Expenditure	$\mathbf{E_{1a} = Y_{1a}}$	$\mathbf{E_{1b} = Y_{1b}}$	$\mathbf{E_2 = Y_2}$	$\mathbf{E_3 = Y_{3a}}$		

The multiplier analysis using the SAM framework helps to understand the linkages between the different sectors and the institutional agents at work within the economy. Accounting multipliers have been calculated according to the standard formula for accounting (impact) multipliers, as follows:

$\mathbf{Y} = A\,Y + \mathbf{X} = (I - A)^{-1}\mathbf{X} = M_a\,\mathbf{X}$

Where:

Y is a vector of incomes of endogenous variables

X is a vector of expenditures of exogenous variables

A is the matrix of average expenditure propensities for endogenous accounts

$M_a = (I - A)^{-1}$ is a matrix of aggregate accounting multipliers (generalized Leontief inverse).

Variations in any one of the exogenous account (i.e. in this case ΔX) will produce total impacts (ΔY) of endogenous entries via the multipliers. The total impact will be decomposed by direct and induced impacts for capturing the strengths of the transmission channel.

Table A6: Description of the Endogenous and Exogenous Accounts and Multiplier Affects

Endogenous (y)	Exogenous (x)
The activity (gross output multipliers), indicates the total effect on the sectoral gross output of a unit-income increase in a given account *i* in the SAM, and is obtained via the association with the commodity production activity account *i*.	
The consumption commodity multipliers, which indicates the total effect on the sectoral commodity output of a unit-income increase in a given account *i* in the SAM, is obtained by adding the associated commodity elements in the matrix along the column for account *i*.	Intervention into through activities (x = i + g + e), where i= GFC + ST (GFCF) Exports (e) Government Expenditure (g) Investment Demand (i) Inventory Demand (i)
The value added or GDP multiplier, giving the total increase in GDP resulting from the same unit-income injection, is derived by summing up the factor-payment elements along account *i*'s column.	Factor Income Remittances from RoW.
Household income shows the total effect on household and enterprise income, and is obtained by adding the elements for the household groups along the account i column.	Intervention via households (x = r + gt + ct), where Remittance (r) Government Transfers (gt) Corporation Transfers (ct)

The economy-wide impacts of infrastructure investments are examined by changing the total exogenous injection vector (especially Government Expenditure (g), Government Investment (expenditures on infrastructure, machinery and equipment) and Investment Demand (i). More specifically, the total exogenous account is manipulated to estimate their effects on output (through an output multiplier), value-added or GDP, (through the GDP multiplier), and household income (through household income multiplier).

Estimated Economy Wide Benefit

Four simulations were carried out to assess the economy wide benefits using national as well as regional SAM based models. Table below shows the simulation set up.

Table A7: Simulation Set Up

Simulation	National SAM	Regional SAM
1A	Total cost was $2.9 billion, out of which $2.1 billion is estimated as the amount that would be injected into the economy. It is further assumed that $2.1 would be injected into the economy in the following way: Construction sector $1.4 billion, utility $0.1 billion, trade $0.1 billion, transport and communication $0.15 billion, different kinds of services (professional, financial, public administration, social etc) $0.3 billion and food $0.05 billion. This total injection excludes foreign imports, contingencies, IDC etc from total cost. All other exogenous elements remain unaltered.	
1B		Within the Regional SW SAM model, we performed similar injection of $2.1 billion into the regional economy. All other regional exogenous elements remain unaffected. In tracing the impact on the regional economy, two alternatives were reviewed. First, it was assumed that the entire injection would accrue to the region. Second, it was assumed that 70 percent of injection would accrue to the region.
Operation of Jamuna Bridge suggests that additional demand may arise for consumer goods, energy and utility services and as well as transport services. These demand effects are in addition to impacts generated due to bridge construction and associated services activities. Therefore, in line with the Jamuna Bridge impact analysis exercise, further simulations were carried out (i.e. 2A and 2B) to capture economic impacts of demand. The simulation set ups are explained below:		
2A	Increase in sectoral demand at the national level: Other crops by 10 %, Fisheries by 10 %, Utility by 5 % and Transport by 20 %.	
2B		Increase in sectoral demand at the regional level: Other crops by 20 %, Fisheries by 20 %, Utility by 10 % and Transport by 50 %.

Simulation Results

Impacts of simulations using the 'National' and the 'Regional' SAM models are reported in terms of gross output, commodity demand, value added by factors and household consumption.

Table A8: Simulation 1A: Economic Wide Benefit of Intervention using National SAM Model

(In million taka unless otherwise specified)

	Endogenous SAM Accounts	Base Value	Simulation	% Change over Base
1	Cereal Crops	614209	55060	8.97
2	Commercial Crops	199811	13050	6.53
3	Livestock-Poultry-fishing	764211	62889	8.23
4	Forestry	210295	40473	19.24
5	Other Agriculture	159683	14046	8.80
6	Other Food	1156780	103912	8.98
7	Leather Products	64680	2574	3.97
8	Cloth	274245	12582	4.58
9	Readymade Garments	734635	7323	0.99
10	Chemical-Fertilizer	96050	10558	11.00
11	Machinery	338400	45821	13.54
12	Petroleum Products	45849	4312	9.41
13	Other Industries	318938	44561	13.98
14	Construction	895119	260071	29.06
15	Transport	556137	46726	8.40
16	Utility	200010	34176	17.08
17	Other Services	2746118	231270	8.43
	Gross Output	**9375170**	**989400**	**10.56**
1	Cereal Crops	647473	58089	8.97
2	Commercial Crops	281463	18706	6.64
3	Livestock-Poultry-fishing	769744	63383	8.23
4	Forestry	210295	40473	19.24
5	Other Agriculture	178805	15733	8.80
6	Other Food	1302387	116817	8.97
7	Leather Products	65167	2594	3.97
8	Cloth	357348	16784	4.70
9	Readymade Garments	748044	7456	0.99
10	Chemical-Fertilizer	220509	23653	10.73
11	Machinery	676932	71475	10.56
12	Petroleum Products	247631	23289	9.41
13	Other Industries	539253	64169	11.90
14	Construction	895119	260071	29.06
15	Transport	654329	54976	8.40
16	Utility	208034	35547	17.08
17	Other Services	2790890	234088	8.39
	Total Commodity Demand	**10793425**	**1107304**	**10.26**
18	VA Labour Unskilled	1107767	116069	10.47
19	VA Labour Skilled	1130936	97308	8.60
20	VA Capital	1941427	216344	11.14
21	VA Land	288419	23950	8.30
	Value added	**4468549**	**453670**	**10.16**
22	Rural Landless	300256	27482	9.15
23	Rural Marginal Farmers	283097	25634	9.05
24	Rural Small Farmers	549961	47406	8.63
25	Rural Large Farmers	341538	28974	8.49
26	Rural Non Farm Poor	433473	35822	8.26
27	Rural Non Farm Non Poor	1156862	114049	9.86
28	Urban Low Education	490267	42807	8.73
29	Urban High Education	1168683	101617	8.70
	Household income	**4724136**	**423793**	**8.97**
	National (Output + Commodity + Factor + Household)	**29361280**	**2974168**	**10.13**

Note: Gross output = intermediate use + factor payments; Total commodity demand = commodity demanded by households; Value added = factor payments; Household income = Incomes of different household categories

Table A9: Simulation 1B: Economy Wide Benefit of Intervention Using the Regional SAM Model

(In million taka unless otherwise specified)

	Endogenous SAM Accounts	Base Value	Simulation	% Change
1	Cereal Crops	82010	49316	60.13
2	Commercial Crops	43145	23194	53.76
3	Livestock-Poultry-fishing	193480	68146	35.22
4	Forestry	36272	38976	107.45
5	Other Agriculture	26570	16262	61.21
6	Other Food	165149	105160	63.68
7	Leather Products	3129	1785	57.03
8	Cloth	20522	14198	69.19
9	Readymade Garments	14024	8976	64.01
10	Chemical-Fertilizer	23363	9678	41.43
11	Machinery	76982	69954	90.87
12	Petroleum Products	6613	6536	98.83
13	Other Industries	62503	85623	136.98
14	Construction	87508	139738	159.69
15	Transport	78228	56557	72.29
16	Utility	27155	27751	102.19
17	Other Services	386929	257047	66.43
	Gross Output	**1333583**	**978900**	**73.40**
1	Cereal Crops	82119	49384	60.13
2	Commercial Crops	44943	24290	54.05
3	Livestock-Poultry-fishing	193508	68165	35.23
4	Forestry	36272	38976	107.45
5	Other Agriculture	26786	16393	61.20
6	Other Food	165628	105478	63.68
7	Leather Products	3130	1785	57.03
8	Cloth	20943	14503	69.24
9	Readymade Garments	14282	9141	64.01
10	Chemical-Fertilizer	23424	9704	41.43
11	Machinery	80617	71807	89.07
12	Petroleum Products	6626	6548	98.83
13	Other Industries	63590	86446	135.95
14	Construction	87508	139738	159.69
15	Transport	78382	56667	72.29
16	Utility	27206	27804	102.19
17	Other Services	387554	257368	66.41
	Total Commodity Demand	**1342515**	**984197**	**73.32**
18	VA Labour Unskilled	132408	98133	74.11
19	VA Labour Skilled	152721	105493	69.07
20	VA Capital	293265	216977	73.98
21	VA Land	64424	37961	58.93
	Value added	**642818**	**458562**	**71.34**
22	Rural Landless	41451	28922	69.78
23	Rural Marginal Farmers	41598	27468	66.04
24	Rural Small Farmers	75323	50692	67.30
25	Rural Large Farmers	96441	65962	68.39
26	Rural Non Farm Poor	62621	42482	67.84
27	Rural Non Farm Non Poor	204405	140637	68.80
28	Urban Low Education	56472	39021	69.10
29	Urban High Education	61593	40813	66.26
	Household Income	**639904**	**435997**	**68.14**
	South West Bangladesh (Output + Commodity + Factor + Household)	**3958820.9**	**2857658**	**72.18**

Table A10: Simulation 2A: Economy Wide Benefit of Intervention Using the National SAM Model

(In million taka unless otherwise specified)

	Endogenous SAM Accounts (Intermediate Classification)	Base Value	Simulation	% Change over Base
1	Cereal Crops	614209	49260	8.02
2	Commercial Crops	199811	28973	14.5
3	Livestock-Poultry-fishing	764211	139316	18.23
4	Forestry	210295	19389	9.22
5	Other Agriculture	159683	23601	14.78
6	Other Food	1156780	127477	11.02
7	Leather Products	64680	3247	5.02
8	Cloth	274245	11902	4.34
9	Readymade Garments	734635	6832	0.93
10	Chemical-Fertilizer	96050	7895	8.22
11	Machinery	338400	12013	3.55
12	Petroleum Products	45849	3838	8.37
13	Other Industries	318938	15819	4.96
14	Construction	895119	23989	2.68
15	Transport	556137	152660	27.45
16	Utility	200010	33362	16.68
17	Other Services	2746118	202664	7.38
	Gross Output	**9375170**	**862236**	**9.20**
1	Cereal Crops	647473	51927	8.02
2	Commercial Crops	281463	40812	14.50
3	Livestock-Poultry-fishing	769744	138043	17.93
4	Forestry	210295	19389	9.22
5	Other Agriculture	178805	26427	14.78
6	Other Food	1302387	143523	11.02
7	Leather Products	65167	3271	5.02
8	Cloth	357348	15509	4.34
9	Readymade Garments	748044	6957	0.93
10	Chemical-Fertilizer	220509	18126	8.22
11	Machinery	676932	24031	3.55
12	Petroleum Products	247631	20727	8.37
13	Other Industries	539253	26747	4.96
14	Construction	895119	23989	2.68
15	Transport	654329	179613	27.45
16	Utility	208034	34700	16.68
17	Other Services	2790890	205968	7.38
	Total Commodity Demand	**10793425**	**979760**	**9.08**
18	VA Labour Unskilled	1107767	92659	8.37
19	VA Labour Skilled	1130936	95604	8.37
20	VA Capital	1941427	192510	9.92
21	VA Land	288419	23560	8.06
	Value added	**4468549**	**404333**	**8.99**
22	Rural Landless	300256	23994	8.06
23	Rural Marginal Farmers	283097	22506	8.06
24	Rural Small Farmers	549961	41881	7.75
25	Rural Large Farmers	341538	25947	7.75
26	Rural Non Farm Poor	433473	31403	7.44
27	Rural Non Farm Non Poor	1156862	101122	8.68
28	Urban Low Education	490267	35836	7.44
29	Urban High Education	1168683	95015	8.06
	Household Income	**4724136**	**377766**	**8.06**
	National (Output + Commodity + Factor + Household)	**29361280**	**2542155**	**8.68**

Table A11: Simulation 2B: Economy Wide Benefit of Intervention Using the Regional SAM Model

(In million taka unless otherwise specified)

	Endogenous SAM Accounts (Intermediate Classification)	Base Value	Simulation	% Change over Base
1	Cereal Crops	82010	44117	8.02
2	Commercial Crops	43145	41963	97.26
3	Livestock-Poultry-fishing	193480	236587	122.28
4	Forestry	36272	22432	61.84
5	Other Agriculture	26570	26341	99.14
6	Other Food	165149	122075	73.92
7	Leather Products	3129	1054	33.67
8	Cloth	20522	5974	29.11
9	Readymade Garments	14024	875	6.24
10	Chemical-Fertilizer	23363	12882	55.14
11	Machinery	76982	18331	23.81
12	Petroleum Products	6613	3713	56.14
13	Other Industries	62503	20795	33.27
14	Construction	87508	15731	17.98
15	Transport	78228	144036	184.12
16	Utility	27155	30382	111.88
17	Other Services	386929	191538	49.50
	Gross Output	**1333583**	**938825**	**70.40**
1	Cereal Crops	82119	6586	8.02
2	Commercial Crops	44943	43712	97.26
3	Livestock-Poultry-fishing	193508	236621	122.28
4	Forestry	36272	22432	61.84
5	Other Agriculture	26786	26555	99.14
6	Other Food	165628	122429	73.92
7	Leather Products	3130	1054	33.67
8	Cloth	20943	6097	29.11
9	Readymade Garments	14282	891	6.24
10	Chemical-Fertilizer	23424	12915	55.14
11	Machinery	80617	19197	23.81
12	Petroleum Products	6626	3720	56.14
13	Other Industries	63590	21156	33.27
14	Construction	87508	2345	2.68
15	Transport	78382	144320	184.12
16	Utility	27206	30439	111.88
17	Other Services	387554	191848	49.50
	Total Commodity Demand	**1342515**	**892316**	**66.47**
18	VA Labour Unskilled	132408	92659	63.24
19	VA Labour Skilled	152721	95604	65.41
20	VA Capital	293265	192510	62
21	VA Land	64424	23560	51.77
	Value added	**642818**	**404333**	**62**
22	Rural Landless	41451	23994	60.76
23	Rural Marginal Farmers	41598	22506	57.04
24	Rural Small Farmers	75323	41881	58.28
25	Rural Large Farmers	96441	25947	58.59
26	Rural Non Farm Poor	62621	31403	60.14
27	Rural Non Farm Non Poor	204405	101122	59.83
28	Urban Low Education	56472	35836	60.14
29	Urban High Education	61593	95015	59.21
	Household Income	**639904**	**377766**	**59.52**
	South West Bangladesh (Output + Commodity + Factor + Household)	**3958820.9**	**2542155**	**61.07**

Annex 5: Estimated Benefit Cost Ratio

Table A12: Estimated BCR @10% Discount Rate (SIM 1)

	Cost			Project Benefits								Net
Year	Capital	O&M	Total	Road User Benefits			Non Road User Benefits				Total	Economic
End June	Cost		Cost	VOC	TTC	Sub-total	Ferry	Land	Utilities	WEB	Benefits	Benefits
2011	60	0	60	0	0	0	0	0	0	0	0	-60
2012	500	0	500	0	0	0	0	0	0	0	0	-500
2013	500	0	500	0	0	0	0	0	0	0	0	-500
2014	500	0	500	0	0	0	0	0	0	0	0	-500
2015	600	0	600	0	0	0	0	0	0	0	0	-600
2016	600	13	613	0	0	0	0	0	0	0	0	-613
2017	600	25	625	0	0	0	0	0	0	0	0	-625
2018	324	25	349	0	0	0	0	0	0	0	0	-349
2019	0	25	25	19	31	50	0	384	271	0	705	680
2020	0	25	25	37	50	87	0	0	0	0	87	62
2021	0	25	25	61	75	136	0	0	0	45.5	181.5	156.5
2022	0	25	25	74	87	161	0	0	0	50	211	186
2023	0	15	15	84	97	181	0	0	0	80	261	246
2024	0	15	15	93	106	199	0	0	0	100	299	284
2025	0	15	15	111	124	235	0	0	0	110	345	330
2026	0	15	15	131	145	276	0	0	0	110	386	371
2027	0	15	15	153	168	321	0	0	0	110	431	416
2028	0	15	15	176	193	369	0	0	0	110	479	464
2029	0	15	15	202	221	423	0	0	0	120	543	528
2030	0	15	15	231	243	474	0	0	0	120	594	579
2031	0	15	15	260	266	526	0	0	0	120	646	631
2032	0	15	15	290	291	581	0	0	0	120	701	686
2033	0	15	15	322	316	638	0	0	0	120	758	743
2034	0	15	15	354	342	696	0	0	0	120	816	801
2035	0	15	15	370	351	721	0	0	0	120	841	826
2036	0	15	15	386	360	746	0	0	0	120	866	851
2037	0	15	15	401	370	771	0	0	0	120	891	876
2038	0	15	15	417	378	795	0	0	0	120	915	900
2039	0	15	15	431	388	819	0	0	0	120	939	924
2040	0	15	15	447	397	844	0	0	0	120	964	949
2041	0	15	15	462	407	869	0	0	0	120	989	974
2042	0	15	15	477	417	894	0	0	0	120	1014	999
2043	0	15	15	493	427	920	0	0	0	120	1040	1025
2044	0	15	15	508	437	945	0	0	0	120	1065	1050
2045	0	15	15	513	438	951	0	0	0	120	1071	1056
2046	0	15	15	518	439	957	0	0	0	120	1077	1062
2047	0	15	15	521	440	961	0	0	0	120	1081	1066
2048	0	15	15	525	441	966	0	0	0	120	1086	1071
2049	0	15	15	542	455	997	0	0	0	120	1117	1102
Total	3684	568	4252	9609	8900	18509	0	384	271	3236	22400	
	2,415	113	2,528	787	792	1,579	0	163	115	360	2,217	

Table A13: Estimated BCR @10% Discount Rate (SIM 2)

	Cost			Project Benefits								Net
Year	Capital	O&M	Total	Road User Benefits			Non Road User Benefits				Total	Economic
End June	Cost		Cost	VOC	TTC	Sub-total	Ferry	Land	Utilities	WEB	Benefits	Benefits
2011	60	0	60	0	0	0	0	0	0	0	0	-60
2012	500	0	500	0	0	0	0	0	0	0	0	-500
2013	500	0	500	0	0	0	0	0	0	0	0	-500
2014	500	0	500	0	0	0	0	0	0	0	0	-500
2015	600	0	600	0	0	0	0	0	0	0	0	-600
2016	600	13	613	0	0	0	0	0	0	0	0	-613
2017	600	25	625	0	0	0	0	0	0	0	0	-625
2018	324	25	349	0	0	0	0	0	0	0	0	-349
2019	0	25	25	19	31	50	0	384	271	0	705	680
2020	0	25	25	37	50	87	0	0	0	0	87	62
2021	0	25	25	61	75	136	0	0	0	27.3	163.3	138.3
2022	0	25	25	74	87	161	0	0	0	30	191	166
2023	0	15	15	84	97	181	0	0	0	48	229	214
2024	0	15	15	93	106	199	0	0	0	60	259	244
2025	0	15	15	111	124	235	0	0	0	66	301	286
2026	0	15	15	131	145	276	0	0	0	66	342	327
2027	0	15	15	153	168	321	0	0	0	66	387	372
2028	0	15	15	176	193	369	0	0	0	66	435	420
2029	0	15	15	202	221	423	0	0	0	72	495	480
2030	0	15	15	231	243	474	0	0	0	72	546	531
2031	0	15	15	260	266	526	0	0	0	72	598	583
2032	0	15	15	290	291	581	0	0	0	72	653	638
2033	0	15	15	322	316	638	0	0	0	72	710	695
2034	0	15	15	354	342	696	0	0	0	72	768	753
2035	0	15	15	370	351	721	0	0	0	72	793	778
2036	0	15	15	386	360	746	0	0	0	72	818	803
2037	0	15	15	401	370	771	0	0	0	72	843	828
2038	0	15	15	417	378	795	0	0	0	72	867	852
2039	0	15	15	431	388	819	0	0	0	72	891	876
2040	0	15	15	447	397	844	0	0	0	72	916	901
2041	0	15	15	462	407	869	0	0	0	72	941	926
2042	0	15	15	477	417	894	0	0	0	72	966	951
2043	0	15	15	493	427	920	0	0	0	72	992	977
2044	0	15	15	508	437	945	0	0	0	72	1017	1002
2045	0	15	15	513	438	951	0	0	0	72	1023	1008
2046	0	15	15	518	439	957	0	0	0	72	1029	1014
2047	0	15	15	521	440	961	0	0	0	72	1033	1018
2048	0	15	15	525	441	966	0	0	0	72	1038	1023
2049	0	15	15	542	455	997	0	0	0	72	1069	1054
Total	3684	568	4252	9609	8900	18509	0	384	271	1941	21105	
	2,415	113	2,528	787	792	1,579	0	163	115	216	2,073	

Table A14: Estimated BCR @5% Discount Rate (SIM 1)

	Cost			Project Benefits								Net
Year	Capital	O&M	Total	Road User Benefits			Non Road User Benefits				Total	Economic
End June	Cost		Cost	VOC	TTC	Sub-total	Ferry	Land	Utilities	WEB	Benefits	Benefits
2011	60	0	60	0	0	0	0	0	0	0	0	-60
2012	500	0	500	0	0	0	0	0	0	0	0	-500
2013	500	0	500	0	0	0	0	0	0	0	0	-500
2014	500	0	500	0	0	0	0	0	0	0	0	-500
2015	600	0	600	0	0	0	0	0	0	0	0	-600
2016	600	13	613	0	0	0	0	0	0	0	0	-613
2017	600	25	625	0	0	0	0	0	0	0	0	-625
2018	324	25	349	0	0	0	0	0	0	0	0	-349
2019	0	25	25	19	31	50	0	384	271	0	705	680
2020	0	25	25	37	50	87	0	0	0	0	87	62
2021	0	25	25	61	75	136	0	0	0	45.5	181.5	156.5
2022	0	25	25	74	87	161	0	0	0	50	211	186
2023	0	15	15	84	97	181	0	0	0	80	261	246
2024	0	15	15	93	106	199	0	0	0	100	299	284
2025	0	15	15	111	124	235	0	0	0	110	345	330
2026	0	15	15	131	145	276	0	0	0	110	386	371
2027	0	15	15	153	168	321	0	0	0	110	431	416
2028	0	15	15	176	193	369	0	0	0	110	479	464
2029	0	15	15	202	221	423	0	0	0	120	543	528
2030	0	15	15	231	243	474	0	0	0	120	594	579
2031	0	15	15	260	266	526	0	0	0	120	646	631
2032	0	15	15	290	291	581	0	0	0	120	701	686
2033	0	15	15	322	316	638	0	0	0	120	758	743
2034	0	15	15	354	342	696	0	0	0	120	816	801
2035	0	15	15	370	351	721	0	0	0	120	841	826
2036	0	15	15	386	360	746	0	0	0	120	866	851
2037	0	15	15	401	370	771	0	0	0	120	891	876
2038	0	15	15	417	378	795	0	0	0	120	915	900
2039	0	15	15	431	388	819	0	0	0	120	939	924
2040	0	15	15	447	397	844	0	0	0	120	964	949
2041	0	15	15	462	407	869	0	0	0	120	989	974
2042	0	15	15	477	417	894	0	0	0	120	1014	999
2043	0	15	15	493	427	920	0	0	0	120	1040	1025
2044	0	15	15	508	437	945	0	0	0	120	1065	1050
2045	0	15	15	513	438	951	0	0	0	120	1071	1056
2046	0	15	15	518	439	957	0	0	0	120	1077	1062
2047	0	15	15	521	440	961	0	0	0	120	1081	1066
2048	0	15	15	525	441	966	0	0	0	120	1086	1071
2049	0	15	15	542	455	997	0	0	0	120	1117	1102
Total	3684	568	4252	9609	8900	18509	0	384	271	3236	22400	
	2,977	227	3,204	2,499	2,407	4,906	0	248	175	984	6,312	

Table A15: Estimated BCR @5% Discount Rate (SIM 2)

	Cost			Project Benefits								Net
Year	Capital	O&M	Total	Road User Benefits			Non Road User Benefits				Total	Economic
End June	Cost		Cost	VOC	TTC	Sub-total	Ferry	Land	Utilities	WEB	Benefits	Benefits
2011	60	0	60	0	0	0	0	0	0	0	0	-60
2012	500	0	500	0	0	0	0	0	0	0	0	-500
2013	500	0	500	0	0	0	0	0	0	0	0	-500
2014	500	0	500	0	0	0	0	0	0	0	0	-500
2015	600	0	600	0	0	0	0	0	0	0	0	-600
2016	600	13	613	0	0	0	0	0	0	0	0	-613
2017	600	25	625	0	0	0	0	0	0	0	0	-625
2018	324	25	349	0	0	0	0	0	0	0	0	-349
2019	0	25	25	19	31	50	0	384	271	0	705	680
2020	0	25	25	37	50	87	0	0	0	0	87	62
2021	0	25	25	61	75	136	0	0	0	27.3	163.3	138.3
2022	0	25	25	74	87	161	0	0	0	30	191	166
2023	0	15	15	84	97	181	0	0	0	48	229	214
2024	0	15	15	93	106	199	0	0	0	60	259	244
2025	0	15	15	111	124	235	0	0	0	66	301	286
2026	0	15	15	131	145	276	0	0	0	66	342	327
2027	0	15	15	153	168	321	0	0	0	66	387	372
2028	0	15	15	176	193	369	0	0	0	66	435	420
2029	0	15	15	202	221	423	0	0	0	72	495	480
2030	0	15	15	231	243	474	0	0	0	72	546	531
2031	0	15	15	260	266	526	0	0	0	72	598	583
2032	0	15	15	290	291	581	0	0	0	72	653	638
2033	0	15	15	322	316	638	0	0	0	72	710	695
2034	0	15	15	354	342	696	0	0	0	72	768	753
2035	0	15	15	370	351	721	0	0	0	72	793	778
2036	0	15	15	386	360	746	0	0	0	72	818	803
2037	0	15	15	401	370	771	0	0	0	72	843	828
2038	0	15	15	417	378	795	0	0	0	72	867	852
2039	0	15	15	431	388	819	0	0	0	72	891	876
2040	0	15	15	447	397	844	0	0	0	72	916	901
2041	0	15	15	462	407	869	0	0	0	72	941	926
2042	0	15	15	477	417	894	0	0	0	72	966	951
2043	0	15	15	493	427	920	0	0	0	72	992	977
2044	0	15	15	508	437	945	0	0	0	72	1017	1002
2045	0	15	15	513	438	951	0	0	0	72	1023	1008
2046	0	15	15	518	439	957	0	0	0	72	1029	1014
2047	0	15	15	521	440	961	0	0	0	72	1033	1018
2048	0	15	15	525	441	966	0	0	0	72	1038	1023
2049	0	15	15	542	455	997	0	0	0	72	1069	1054
Total	3684	568	4252	9609	8900	18509	0	384	271	1941	21105	
	2,977	227	3,204	2,499	2,407	4,906	0	248	175	590	5,918	

Table A16: Estimated BCR @ 3% Discount Rate (SIM 1)

	Cost			Project Benefits								Net
Year	Capital	O&M	Total	Road User Benefits			Non Road User Benefits				Total	Economic
End June	Cost		Cost	VOC	TTC	Sub-total	Ferry	Land	Utilities	WEB	Benefits	Benefits
2011	60	0	60	0	0	0	0	0	0	0	0	-60
2012	500	0	500	0	0	0	0	0	0	0	0	-500
2013	500	0	500	0	0	0	0	0	0	0	0	-500
2014	500	0	500	0	0	0	0	0	0	0	0	-500
2015	600	0	600	0	0	0	0	0	0	0	0	-600
2016	600	13	613	0	0	0	0	0	0	0	0	-613
2017	600	25	625	0	0	0	0	0	0	0	0	-625
2018	324	25	349	0	0	0	0	0	0	0	0	-349
2019	0	25	25	19	31	50	0	384	271	0	705	680
2020	0	25	25	37	50	87	0	0	0	0	87	62
2021	0	25	25	61	75	136	0	0	0	45.5	181.5	156.5
2022	0	25	25	74	87	161	0	0	0	50	211	186
2023	0	15	15	84	97	181	0	0	0	80	261	246
2024	0	15	15	93	106	199	0	0	0	100	299	284
2025	0	15	15	111	124	235	0	0	0	110	345	330
2026	0	15	15	131	145	276	0	0	0	110	386	371
2027	0	15	15	153	168	321	0	0	0	110	431	416
2028	0	15	15	176	193	369	0	0	0	110	479	464
2029	0	15	15	202	221	423	0	0	0	120	543	528
2030	0	15	15	231	243	474	0	0	0	120	594	579
2031	0	15	15	260	266	526	0	0	0	120	646	631
2032	0	15	15	290	291	581	0	0	0	120	701	686
2033	0	15	15	322	316	638	0	0	0	120	758	743
2034	0	15	15	354	342	696	0	0	0	120	816	801
2035	0	15	15	370	351	721	0	0	0	120	841	826
2036	0	15	15	386	360	746	0	0	0	120	866	851
2037	0	15	15	401	370	771	0	0	0	120	891	876
2038	0	15	15	417	378	795	0	0	0	120	915	900
2039	0	15	15	431	388	819	0	0	0	120	939	924
2040	0	15	15	447	397	844	0	0	0	120	964	949
2041	0	15	15	462	407	869	0	0	0	120	989	974
2042	0	15	15	477	417	894	0	0	0	120	1014	999
2043	0	15	15	493	427	920	0	0	0	120	1040	1025
2044	0	15	15	508	437	945	0	0	0	120	1065	1050
2045	0	15	15	513	438	951	0	0	0	120	1071	1056
2046	0	15	15	518	439	957	0	0	0	120	1077	1062
2047	0	15	15	521	440	961	0	0	0	120	1081	1066
2048	0	15	15	525	441	966	0	0	0	120	1086	1071
2049	0	15	15	542	455	997	0	0	0	120	1117	1102
Total	3684	568	4252	9609	8900	18509	0	384	271	3236	22400	
	3,255	317	3,572	4,182	3,963	8,145	0	294	208	1,545	10,192	

Table A17: Estimated BCR @ 3% Discount Rate (SIM 2)

	Cost			Project Benefits								Net
Year	Capital	O&M	Total	Road User Benefits			Non Road User Benefits				Total	Economic
End June	Cost		Cost	VOC	TTC	Sub-total	Ferry	Land	Utilities	WEB	Benefits	Benefits
2011	60	0	60	0	0	0	0	0	0	0	0	-60
2012	500	0	500	0	0	0	0	0	0	0	0	-500
2013	500	0	500	0	0	0	0	0	0	0	0	-500
2014	500	0	500	0	0	0	0	0	0	0	0	-500
2015	600	0	600	0	0	0	0	0	0	0	0	-600
2016	600	13	613	0	0	0	0	0	0	0	0	-613
2017	600	25	625	0	0	0	0	0	0	0	0	-625
2018	324	25	349	0	0	0	0	0	0	0	0	-349
2019	0	25	25	19	31	50	0	384	271	0	705	680
2020	0	25	25	37	50	87	0	0	0	0	87	62
2021	0	25	25	61	75	136	0	0	0	27.3	163.3	138.3
2022	0	25	25	74	87	161	0	0	0	30	191	166
2023	0	15	15	84	97	181	0	0	0	48	229	214
2024	0	15	15	93	106	199	0	0	0	60	259	244
2025	0	15	15	111	124	235	0	0	0	66	301	286
2026	0	15	15	131	145	276	0	0	0	66	342	327
2027	0	15	15	153	168	321	0	0	0	66	387	372
2028	0	15	15	176	193	369	0	0	0	66	435	420
2029	0	15	15	202	221	423	0	0	0	72	495	480
2030	0	15	15	231	243	474	0	0	0	72	546	531
2031	0	15	15	260	266	526	0	0	0	72	598	583
2032	0	15	15	290	291	581	0	0	0	72	653	638
2033	0	15	15	322	316	638	0	0	0	72	710	695
2034	0	15	15	354	342	696	0	0	0	72	768	753
2035	0	15	15	370	351	721	0	0	0	72	793	778
2036	0	15	15	386	360	746	0	0	0	72	818	803
2037	0	15	15	401	370	771	0	0	0	72	843	828
2038	0	15	15	417	378	795	0	0	0	72	867	852
2039	0	15	15	431	388	819	0	0	0	72	891	876
2040	0	15	15	447	397	844	0	0	0	72	916	901
2041	0	15	15	462	407	869	0	0	0	72	941	926
2042	0	15	15	477	417	894	0	0	0	72	966	951
2043	0	15	15	493	427	920	0	0	0	72	992	977
2044	0	15	15	508	437	945	0	0	0	72	1017	1002
2045	0	15	15	513	438	951	0	0	0	72	1023	1008
2046	0	15	15	518	439	957	0	0	0	72	1029	1014
2047	0	15	15	521	440	961	0	0	0	72	1033	1018
2048	0	15	15	525	441	966	0	0	0	72	1038	1023
2049	0	15	15	542	455	997	0	0	0	72	1069	1054
Total	3684	568	4252	9609	8900	18509	0	384	271	1941	21105	
	3,255	317	3,572	4,182	3,963	8,145	0	294	208	927	9,574	

Bangladesh, like most nations, faces a large number of challenges. What should be the top priorities for policy makers, international donors, NGOs and businesses? With limited resources and time, it is crucial that focus is informed by what will do the most good for each taka spent. The Bangladesh Priorities project, a collaboration between Copenhagen Consensus and BRAC, works with stakeholders across Bangladesh to find, analyze, rank and disseminate the best solutions for the country. We engage Bangladeshis from all parts of society, through readers of newspapers, along with NGOs, decision makers, sector experts and businesses to propose the best solutions. We have commissioned some of the best economists from Bangladesh and the world to calculate the social, environmental and economic costs and benefits of these proposals. This research will help set priorities for the country through a nationwide conversation about what the smart - and not-so-smart - solutions are for Bangladesh's future.

SMARTER SOLUTIONS FOR BANGLADESH

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Copenhagen Consensus Center is a think tank that investigates and publishes the best policies and investment opportunities based on social good (measured in dollars, but also incorporating e.g. welfare, health and environmental protection) for every dollar spent. The Copenhagen Consensus was conceived to address a fundamental, but overlooked topic in international development: In a world with limited budgets and attention spans, we need to find effective ways to do the most good for the most people. The Copenhagen Consensus works with 300+ of the world's top economists including 7 Nobel Laureates to prioritize solutions to the world's biggest problems, on the basis of data and cost-benefit analysis.