

ECONOMIC ANALYSIS

A. Introduction

1. **Macroeconomic and sector context.** Viet Nam has some of the highest rates of population and urban growth in Southeast Asia; the urban population numbered about 26 million in 2013 (equal to about 30% of the current population of 86 million). The urban population is expected to increase to 35 million (37%) by 2020. The strategic location of corridor towns provides the stimulus for increased trade and investment. Given these development opportunities, several corridor towns—including Bac Giang, Mong Cai and Sa Pa along the North–South Economic Corridor—are facing growing demands for urban infrastructure and essential support services. Rapid urbanization during the last decade has strained the government’s capacity to finance and operate public services and infrastructure and thus accommodate increased trade and the flow of goods and people from neighboring countries.

2. **Demand analysis.** To optimize the benefits from economic development in the Greater Mekong Subregion (GMS), the government of Viet Nam must improve the competitiveness of cities along the strategic economic corridors through investment in priority infrastructure (e.g., water supply, sanitation, roads, drainage, and solid waste management) and initiatives to increase private sector investment and participation in the provision, operation and maintenance (O&M) of public services and infrastructure.

B. Overall Approach to Economic Analysis

3. An economic analysis of the investments was undertaken in accordance with the principles and procedures set out in the Asian Development Bank guidelines,¹ with a 25-year period of analysis (2016–2040). Costs and benefits were quantified at April 2015 prices and were converted to their economic cost equivalents using shadow prices. An exchange rate of \$1 = D21,000 was used when converting foreign exchange costs to their local currency equivalent. All costs were valued using the domestic price numeraire. Economic costs were derived from the technical team’s financial estimates of investment and recurrent costs, adjusted for transfer payments and other market distortions. Taxes and duties were excluded because they represent transfer payments. Traded goods, net of taxes and duties, were adjusted by the shadow exchange rate factor of 1.1; for unskilled labor, a shadow wage rate factor of 0.75 was used.² Costs and benefits were treated as increments to a “without project” situation. A socioeconomic survey conducted in February 2015 is the source of economic data on consumer surplus and flood damages, which were used to quantify some economic benefits.

4. The economic viability of the project was determined by computing the economic internal rate of return (EIRR) and comparing the result with the economic opportunity cost of capital of 12%. An EIRR exceeding 12% indicates that the project is economically viable. The viability of the investments was then tested for changes in key variables (e.g., capital and O&M costs, and benefits) using sensitivity analysis. Distribution of project net benefits and poverty impact analysis were also undertaken to determine how much of the net economic benefit resulting from the investments will directly benefit the poor.

¹ ADB. 2013. *Cost–Benefit Analysis for Development – A Practical Guide*. Manila; ADB. 1997. *Guidelines for the Economic Analysis of Projects*. Manila; ADB. 1999. *Handbook for the Economic Analysis of Water Supply Projects*. Manila; and ADB. 1994. *Framework for the Economic and Financial Appraisal of Urban Development Sector Projects*. Manila.

² ADB. 2012. *Report and Recommendation of the President to the Board of Directors: Viet Nam Greater Mekong Subregion Corridor Towns Development Project*. Manila (Economic Analysis linked document: <http://www.adb.org/sites/default/files/linked-documents/43319-033-cam-ea.pdf>).

C. With- and Without-Project Situations

5. **Bac Giang.** The proposed roads will link the new expansion areas to the city's main built-up area and to the northern and western areas of Bac Giang, and improve access to adjacent farming areas and tourist attractions. Bac Giang's combined drainage system collects and pumps wastewater and stormwater to a wastewater treatment plant (WWTP) located south of the town, and to 10 urban ponds. Four ponds will be rehabilitated under the project to increase capacity, reinforce the pond edges, and divert wastewater from the households surrounding the ponds to a main collector. Bac Giang's stormwater improvements are necessary because it is situated in a low-lying area along the Thuong River and it is susceptible to flooding. River dikes and pump stations protect the town and under the project, a new earth-formed canal is proposed to improve the flow and define the flow path between Ung Bo Lake and the Van Son pump station. Submersible pumps are proposed to replace existing models to supplement the new pump building.

6. **Mong Cai.** Wastewater is currently treated in septic tanks or released directly into the Ka Long River which runs through the center of Mong Cai City, causing severe pollution. Separate reticulated sewerage systems and WWTPs will be constructed for both eastern and western areas. The proposed Mong Cai riverbank protection components will address a number of significant problems that affect the town's economic and social well-being: (i) deteriorating stone masonry at lower levels that could collapse into the river; and (ii) erosion of riverbanks during the rainy season, which damages existing structures and places residential areas along the river at risk. The project will dredge the riverbed, remove five island dunes, and construct an embankment protection structure along the river.

7. **Sa Pa.** Route 152 connects Sa Pa town to the Lao Cai–Hanoi Expressway and links villages in the Muong Hoa valley to Sa Pa's economic and social opportunities. The project will develop farm-to-market roads, and connect visitors to tourist attractions, and improve the 14.4-km section between Sa Pa town and Ban Deng road to 6.5 meters. Sa Pa's existing combined wastewater and storm water collection system is in poor condition. It currently has no WWTP and relies on septic tanks, with no septage management. The project will include a separate wastewater collection system including a pipe network, pumping stations and WWTPs in the southwest and northeast areas of the town. The town center enhancement component will focus on the economic and social value of the town center to local residents, property owners, and tourists which is currently reduced by deteriorated street surfacing, street furniture and lighting, and poor environmental quality.

D. Economic Benefits

8. **Urban roads.** Benefits identified for Bac Giang and Sa Pa include improved savings in the vehicle operating costs (VOCs) and travel time.³

9. **Wastewater collection and treatment, and stormwater improvements.** By improving the quality of the effluent discharge, the subprojects are expected to reduce the pollution of

³ For Bac Giang, assumptions include: annual average daily traffic (AADT) of 6,868 in 2015 for the North-East Ring Road and 7,836 in 2015 for Tran Quang Khai Road; annual traffic growth of 4% for the North-East Ring Road and 1.7% for Tran Quang Khai Road; average speed without the project is 35 km per hour, while average speed with the project will be 60 km per hour; O&M is 1% of capital cost, periodic maintenance every 5 years is 3% of capital cost; bus capacity of 30 passengers; VOC savings will be \$0.012–\$0.092 per vehicle-km; generated traffic is 50% of normal traffic; and the wage rate is D17,600 per hour. For Sa Pa, assumptions include: AADT of 4,043 in 2015, traffic growth of 4% per year; average speed without the project of 20 km per hour, and average speed with the project of 50 km per hour; 12 persons per bus; an average wage rate of D17,614 per hour; O&M is 1% of capital cost; VOC savings will range from \$0.004 to \$0.032 per vehicle-km; and generated traffic is 50% of normal traffic.

watercourses and the occurrence of waterborne diseases. In the absence of reliable data on the occurrence of waterborne diseases in the area, the value of wastewater revenues and consumer surplus are used to estimate the economic benefits.⁴ The Bac Giang stormwater improvement will install new pumps to enhance energy-efficiency, improve the capacities and flow rates of the stormwater canals, and reduce flood risk.⁵

10. **Mong Cai riverbank protection.** This subproject will increase economic trade by improving river port operations, and will reduce economic disruptions in Mong Cai's urban areas, particularly in the downtown area.⁶

11. **Sa Pa town center enhancement.** The phased implementation of the enhancements will benefit the town through improved land and property values resulting from provision of open space for use by local residents, and improved facilities for use by tourists.⁷

12. Table 8.1 shows the beneficiaries of the subprojects.

Table 8.1: Subproject Beneficiaries

Town	Subproject	2016 (non-incremental)	2016–2028 (incremental)	2028	Average Benefit (D)
Bac Giang	WWCT		2,191	2,191	4.4 million/connection/year
	Urban roads	33,646	71,961	105,607	338/passenger/trip
	Storm water improvement		2,820	2,820	9.0 million/household/year
Mong Cai	WWCT		2,625	2,625	4.8 million/household/year
	River protection		877	877	0.5 million/household/year
Sa Pa	WWCT		1,583	1,583	10.4 million/collection/year
	Urban roads	6,840	4,111	10,951	7,609/passenger/trip
	Town center		Local		17.4 billion incremental
	enhancement		economy		income from tourism/year

WWCT = wastewater collection and treatment

Source: Asian Development Bank.

E. Economic Costs

13. Economic costs were derived from the financial estimates of capital and non-capital investments, replacement costs and O&M costs; removal of price contingencies, duties and taxes; and multiplication of the net result by the conversion factors. The weighted overall factors

⁴ The participating local governments have existing wastewater operations, and wastewater fees are collected by water supply companies as a percentage of the water bill. The consumer surplus is based on a willingness to pay (WTP) for wastewater services of D20,000 per household per month for all three locations. In Bac Giang, 58% of respondents were reportedly willing to pay this amount, which is much higher than the current monthly wastewater bill of D4,464 per household. In Mong Cai, 67% of respondents reportedly were willing to pay this, which is much more than the current bill (D7,299 per month). In Sa Pa, 94% of respondents were willing to pay this, which is much more than the current wastewater bill (D5,155 per month).

⁵ Reducing flood risk will generate savings of up to 95% of estimated annual flood damages of D9.5 million per household or business for an estimated 2,820 incremental households by 2028.

⁶ An estimated incremental 877 households will benefit from the subproject by 2028, by avoiding the damages resulting from flood and soil erosion, which are calculated to equal D1.05 million per household or business per year. The projected increase in productivity is based on: annual export value of \$553 million and import value of \$88 million in 2014; 25% of trade passes through the Ka Long River; and 0.25% increase in productivity due to improvement in the Ka Long River.

⁷ The "multiplier approach" is used to estimate the economic benefits of increased tourism volume. Assumptions include: in 2010 tourists included 460,000 local visitors and 46,000 international visitors; the annual growth rate is 1.1% for local tourists and 2.1% for international; local tourists stay an average of 1.2 days per trip, and international tourists an average of 0.9 day per trip; the average expenses of local tourists total D0.74 million per day, and those of international tourists D0.95 million per day; 70% of these expenditures are spent in the locality, and 80% of the resulting local income is also spent in the locality; the income multiplier factor is 2.27. The income multiplier is computed as follows: $1 / (1 - [\text{local income spent within locality} \times \text{tourist spending in locality}])$.

for capital costs and O&M costs were computed and applied to the net costs to derive the economic cost equivalents of the proposed capital investments and O&M (Table 8.2).

Table 8.2: Summary of Economic Costs (D billion)

Town	Subproject	Capital Cost	Annual O&M Cost
Bac Giang	Wastewater collection and treatment	7.4	6.2
	Urban roads	12.2	1.6
	Storm water improvement	6.4	1.4
Mong Cai	Wastewater collection and treatment	14.9	6.2
	River protection	10.7	2.3
Sa Pa	Wastewater collection and treatment	10.1	5.3
	Urban roads	8.4	1.8
	Town center enhancement	7.0	2.9

O&M = operation and maintenance

Source: Asian Development Bank.

F. Economic Internal Rate of Return and Sensitivity Analysis

14. The overall EIRR for Bac Giang, Mong Cai and Sa Pa is 17.1% for the base case and 15% to 17% for the sensitivity tests. Details of the computations for each individual subproject are in Tables 1 to 8 of the Supplementary Appendix.

Table 8.3: Overall Economic Viability Results

Item	EIRR	NPV (D billion)	SV
Base Case	17.1%	718.5	
10% Increase in Capital Cost	15.9%	596.3	59%
10% Increase in O&M Cost	17.0%	702.2	440%
10% Decrease in Benefits	15.8%	526.0	-37%
1-Year Delay in Benefits	15.0%	445.9	

EIRR = economic internal rate of return, NPV = net present value, O&M = operation and maintenance, SV = switching value.

Source: Asian Development Bank.

15. The stream of economic benefits and costs over the 25-year period render all subprojects economically viable, with EIRRs higher than the assumed EOCC of 12%. Sensitivity tests were computed for each subprojects with results summarized in Table 8.4 below.

G. Distribution of Net Economic Benefits and Poverty Impact

16. The eight subprojects are expected to generate a total net economic benefit of D18 billion to D172 billion.⁸ A significant portion will accrue to urban road and drainage beneficiaries. The general public will likewise benefit from the wastewater and stormwater drainage improvement subprojects. A significant number of person-days will be needed for physical construction, rehabilitation or replacement of the facilities and their eventual operation, which will benefit local laborers. The government or the local economy will lose because of exchange rate distortions.⁹ The computed poverty impact ratios for the infrastructure investments are 24% to 51%, which means that at least 24% of the net economic benefit will directly benefit the poor. Summary results and detailed computations are in the Supplementary Appendix (Tables 9–14).

⁸ The net economic benefit is the difference between the present value of economic benefits and financial revenues.

⁹ Viet Nam's economic price of foreign exchange and official exchange rate differ, as indicated by the SERF of 1.1. This implies that foreign exchange costs have a higher economic cost than the financial cost borne by the government or economy.

Table 8.4: Economic Viability Results per Component

	BAC GIANG						MONG CAI				SA PA					
	Urban Roads		Wastewater Improvement		Stormwater Improvement		Wastewater/ Stormwater Improvement		Riverbank Protection		Urban Roads		Wastewater and Drainage Improvement		Town Center Enhancement	
	EIRR (%)	ENPV (D billion)	EIRR (%)	ENPV (D billion)	EIRR (%)	ENPV (D billion)	EIRR (%)	ENPV (D billion)	EIRR (%)	ENPV (D billion)	EIRR (%)	ENPV (D billion)	EIRR (%)	ENPV (D billion)	EIRR (%)	ENPV (D billion)
Base Case	20.0	157.0	21.0	172.0	15.0	25.0	14.0	157.0	19.0	160.0	15.0	39.0	15.0	86.0	15.0	18.0
10% Increase in Capital Cost	19.0	138.0	20.0	160.0	14.0	15.0	13.0	128.0	18.0	143.0	14.0	26.0	15.0	69.0	13.0	8.0
10% Increase in O&M Cost	20.0	155.0	21.0	169.0	15.0	24.0	14.0	134.0	19.0	159.0	15.0	38.0	15.0	83.0	15.0	17.0
10% Decrease in Benefits	18.0	120.0	20.0	140.0	14.0	12.0	13.0	89.0	17.0	125.0	15.0	35.0	14.0	58.0	14.0	9.0
1-Year Delay in Benefits	17.0	112.0	19.0	129.0	13.0	9.0	13.0	97.0	17.0	113.0	13.0	18.0	14.0	47.0	12.0	2.0
Switching Value-Capital Cost	81.0		145.0		24.0		26.0		93.0		30.0		53.0		17.0	
Switching Value-Benefits	(42.0)		(53.0)		(19.0)		(18.0)		(47.0)		(96.0)		(31.0)		(19.0)	

EIRR = economic internal rate of return, NPV = net present value, O&M = operation and maintenance.

Source: Asian Development Bank.