

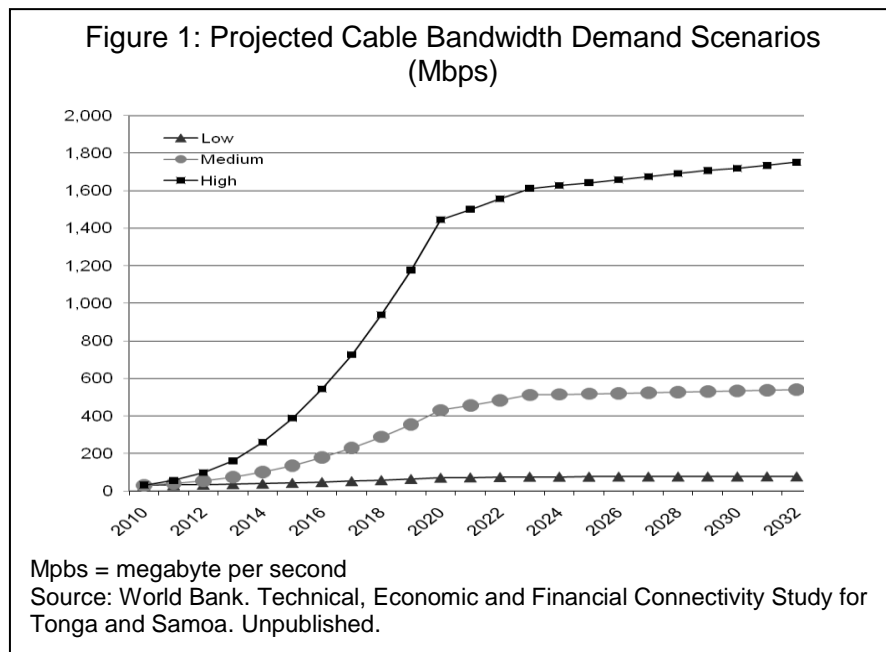
## FINANCIAL AND ECONOMIC ANALYSES

### A. Introduction

1. The Tonga–Fiji Submarine Cable Project will support the Government of Tonga to establish an 827 kilometer (km) submarine cable link and a landing station to enable Tonga to access the international communications network at a lower cost and with a high capacity. The financial and economic analyses were carried out in accordance with the Asian Development Bank's (ADB's) *Financial Management and Analysis of Projects and Guidelines for Economic Analysis of Projects*.<sup>1</sup>

### B. Demand and Pricing Projection

2. **Demand projection.** The future demand for international bandwidth was estimated by using available data on population growth, increase in telecommunication service penetration, usage per service, and the changes in technical parameters including contention and compression.<sup>2</sup> The underlying assumptions in the high demand scenario by 2020 are (i) a fixed line penetration of 19%, (ii) a mobile penetration of 90%, and (iii) a mobile internet penetration of 30% of the population. Demand scenarios are presented in Figure 1.



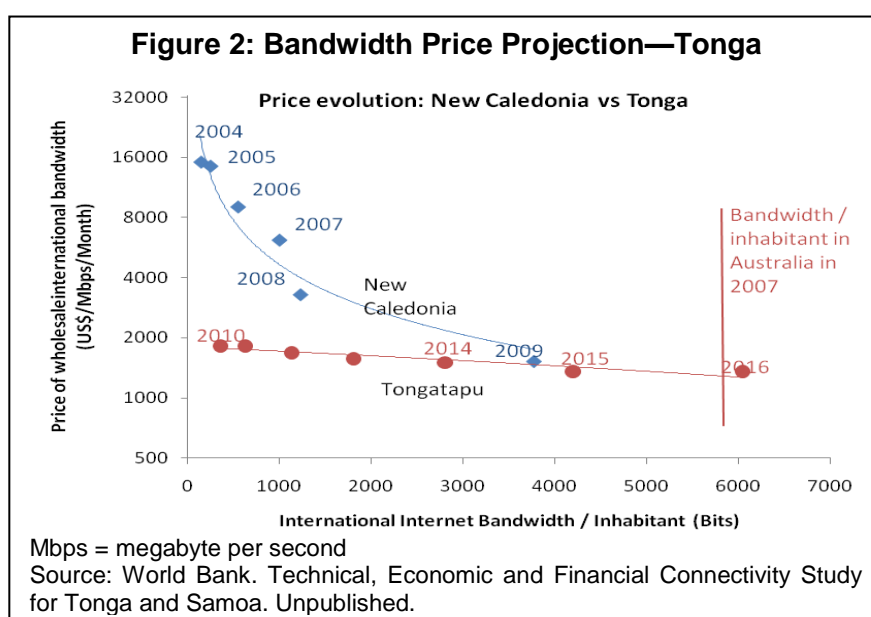
3. Once the submarine cable is operational and supported by an adequate regulatory framework, it will greatly reduce international wholesale bandwidth to Tonga's retail operators. Competition among the retail operators will reduce the end-user prices of communication services, especially broadband internet. Tonga Power is planning to develop a domestic fiber optic network reaching all power users in Tongatapu, which will be made available to operators on a wholesale basis. This will assist growth, reducing the challenge of national backhaul and "last mile" (backbone to user) access, especially for broadband internet. Therefore, the high

<sup>1</sup> ADB. 2005. *Financial Management and Analysis of Projects*. Manila; ADB. 1997. *Guidelines for the Economic Analysis of Projects*. Manila.

<sup>2</sup> This section refers to World Bank. Technical, Economic and Financial Connectivity Study for Tonga and Samoa. Unpublished.

demand scenario is very likely to be realized. Without the project, demand growth will stagnate because of the limited availability and high price of international capacity. As the satellite connectivity will be maintained for backup plan, 85% of the high demand scenario is set as the base-case demand for the submarine cable system.

4. **Pricing.** Based on a review of the proposed pricing table of Tonga Cable Limited (TCL) for the project, the expected price evolution is summarized in Figure 2. This figure shows the monthly price of 1 megabyte per second (Mbps) according to TCL's proposed pricing (marked as Tongatapu). To confirm the relevance of these prices, the price evolution curve has been compared with the actual historical price evolution curve in New Caledonia, France. The price for Tonga consists of the wholesale price of the cable capacity plus the cost of Tier 1 international wholesale internet access in Fiji. The figure shows that the high demand scenario can be achieved, assuming that TCL embraces the price used in the model and that competition in the retail market is effective.



## C. Financial Analysis

5. **Methodology and assumptions.** The weighted average cost of capital (WACC) of TCL was compared with the financial internal rate of return (FIRR) to determine the project's financial viability. The sensitivity of the FIRR to adverse movements in the underlying assumptions was also assessed. The financial viability was assessed based on the financial sustainability of TCL's operation during the lifespan of the submarine cable (25 years).

6. All financial costs and benefits are expressed in constant 2010 prices. Investment costs include the civil works to establish a landing station and associated facilities, a submarine cable system supply contract, consulting services for supervision of the construction, legal issues, and environmental management. Contingencies were excluded in the estimation. Operation and maintenance costs include (i) cable ship charges; (ii) landing party costs at Suva, Fiji; (iii) equipment maintenance at Tonga; (iv) utilities and land lease; and (v) administrative and management costs. The total estimated cost of the submarine cable system is \$30.202 million including project management and contingency, and estimated annual operating costs for the cable system are \$1.229 million. The financial benefits were estimated from the revenue

accruing to TCL, which is calculated by the demand for international bandwidth (measured in Mbps) multiplied by the proposed wholesale tariffs. As the tariffs will be regulated to be cost-based, and an increase in operation and maintenance costs caused by inflation will be reflected in the tariff, the inflation rate is assumed as zero for the financial analysis.

7. **Calculation of weighted average cost of capital.** TCL's WACC was computed based on the financing plan, which comprises the equity and debt contribution to the project by TCL and the grant financing from ADB and the World Bank (as TCL share purchased by the government). The costs of TCL equity and the TCL loan were assumed at 15% and 7%, respectively. The foreign inflation rate was assumed to be 0.5% and the domestic inflation rate 5%. Table 1 shows that the WACC is 0.02%.

**Table 1: Weighted Average Cost of Capital**

Item	ADB and World Bank grants	TCL Equity	TCL Loan	Total
A. Amount (\$'000)	24,500	2,000	3,702	30,202
B. Weighting	81.12%	6.62%	12.26%	100.00%
C. Nominal cost	0.00%	15.00%	7.00%	
D. Tax rate	25.00%	25.00%	25.00%	
E. Tax-adjusted nominal cost	0.00%	11.25%	5.25%	
F. Inflation rate	0.50%	5.00%	5.00%	
G. Real cost	(0.50%)	5.95%	0.24%	
H. Weighted component of WACC	(0.40%)	0.39%	0.03%	<b>0.02%</b>

( ) = negative, ADB = Asian Development Bank, TCL = Tonga Cable Limited, WACC = weighted average cost of capital.

Source: Asian Development Bank estimates.

8. **Calculation of financial internal rate of return.** The FIRR is calculated at 13.63% over 27 years including the construction period of 2 years. This far exceeds the estimated WACC at 0.02%, supporting the financial viability of the project.

9. **Sensitivity analysis.** Financial risks for the project include (i) an increase in the price of civil works and the cable system contract, (ii) delays in project implementation, and (iii) lack of access to necessary counterpart funds. These risks are considered low because (i) the cost estimates are based on recent tenders received during the preparation of the detailed project report by TCL and bids have been received for the civil works for the landing station; (ii) advance procurement actions were taken to reduce the time lag for implementation; and (iii) the counterpart funds are coming from Tonga Communications Corporation (TCC), which has a solid revenue stream and a good credit history to meet the funding requirement from its own cash reserves or through debt financing.

10. Analysis was carried out to test the sensitivity of the FIRR and the financial net present value (NPV) to adverse changes in key variables—a decrease in revenue (caused by a demand decrease) and an increase in capital and operational costs. As the project is for a revenue generating entity, a discount rate of 10% is used for the NPV to examine commercial viability. The analysis results are in Table 2. The project is most sensitive to a revenue decrease while less sensitive to a capital cost overrun or operational cost overrun. However, the project will remain viable unless the demand decreases by 63%. To ensure its financial viability, TCL must encourage demand growth through fair and open access and attractive transparent pricing for all retail service providers, and the Ministry of Information and Communication must enforce

regulations that are conducive for competition among retail service providers and growth in internet demand. The financial NPV evaluation indicates that the project has a modest NPV, which becomes negative when revenue decreases by 24% or more. Private sector investment may not materialize because of this financial risk due to sluggish demand or government's policy to lower the cable bandwidth price.

**Table 2: Sensitivity Analysis**

Scenario	FIRR (%)	FNPV <sup>a</sup> (\$)	Switching Value (%)
Base scenario	13.63	11,401,737	
25% decrease in revenue	9.86	(403,830)	(67%)
10% increase in Capex	12.62	8,741,641	409%
10% increase in Opex	13.35	10,479,780	403%

( ) = negative, FIRR = financial internal rate of return, FNPV = financial net present value, Capex = capital expenditures, Opex = operating expenditures.

<sup>a</sup> discounted at 10%.

Source: Asian Development Bank estimates.

11. **Financial Sustainability.** The Ministry of Finance and National Planning (MFNP), will be the recipient of ADB and the World Bank grants, and will use the proceeds to purchase the share of TCL. As TCL is a new company established in December 2009 and will not be operational until FY2012, a simple cash flow projection was prepared to examine the robustness of TCL's financial position over time. Table 3 illustrates that TCL's net cash flows will turn positive as soon as the cable system start generating revenue and remain positive.

**Table 3: Tonga Cable Limited's Cash Flow Projection**  
(\$'000)

Item	2011	2012	2013	2014	2015	2016	2017
<b>Inflows</b>							
Revenues from cable capacity sales			1,924	2,922	3,813	4,843	5,916
<b>Outflows</b>							
Capex	(19,852)	(10,350)					
Opex			(1,229)	(1,229)	(1,229)	(1,229)	(1,229)
<b>Net flows</b>	(19,852)	(10,350)	695	1,693	2,584	3,614	4,687

( ) = negative, Capex = capital expenditures, Opex = operational expenditures.

Source: Asian Development Bank estimates.

12. **Financial Management Assessment.** In November 2009, TCL was established as a limited liability company following the Companies Act (Amendment) 2009. It became a wholly-owned subsidiary of TCC, a state-owned enterprise, with the intention to offer 20% of TCL's share capital to private investors after the cable system becomes operational. In order to ensure TCL's independent operation and open access to the cable capacity, the government decided in March 2011 to convert TCL into a public enterprise once the submarine cable becomes operational.

13. As a start-up company, TCL does not have any staff other than the board members and an interim managing director as of May 2011, and as the cable system construction will take over 18 months from the award of contract, it is proposed that TCC's finance staff, accounting system, and procurement processes will be used to administer the project funds on behalf of TCL during the construction phase and the operation phase, as necessary. A formal agreement between TCC and TCL was signed in June 2011 to facilitate this. TCC has a comprehensive

financial management policy, and the finance staff and management are compiling a procedure manual. TCC's accounting system can differentiate funds by financiers, and TCC has experience in administering funds from development partners including ADB. TCC's internal control systems are considered suitable and are well documented. TCC has its own internal audit unit.<sup>3</sup>

14. As ADB funds will be disbursed using the direct payment method against one submarine cable contract, financial management will be less burdensome on the implementing agency. TCL will provide financial reports and comply with external audit requirement following ADB and World Bank requirements.

#### **D. Economic Analysis**

15. **Project rationale.** Tonga's small size and distance from large markets do not allow economies of scale to be exploited. Its narrow resource base and small market have resulted in a highly undiversified economy, dependent on remittances and foreign aid. Tonga's isolation and other constraints to economic development may be mitigated in part by improved access to and more affordable telecommunications, especially high-speed broadband internet. Broadband internet offers new economic opportunities domestically, as well as connections to larger markets, and new avenues for delivery of services, nationally and internationally. A recent World Bank study indicates that a 10% increase in broadband penetration results in a 1.38% increase in gross domestic product growth in low- and middle-income countries.<sup>4</sup>

16. Tonga was the first country in the Pacific to liberalize its telecommunications sector and has witnessed rapid growth in mobile penetration and falling call tariffs since 2002. Internet penetration, however, remains low because of the high cost and limited availability of international bandwidth. Competition in the internet service market is limited to the two telecommunication operators because of the high cost of satellite infrastructure and capacity leases that non-telecommunication operator internet service providers cannot afford. Tonga's total dependence on satellite for international bandwidth is the main constraint to higher internet penetration, the introduction of new telecommunications services, and new market entrants. The current market price for two-way satellite capacity is about \$3,600 per Mbps per month. With normal growth, Tonga's bandwidth demand is projected to increase up to 1.243 Gigabytes per second (Gbps) by 2032.<sup>5</sup> With the current satellite capacity and price, it would be impossible to meet growing demand.

17. The Tonga–Fiji Submarine Cable Project will invest in a new submarine fiber optic cable link to the Southern Cross Cable Network (SCCN) in Fiji. This will provide a substantially higher initial capacity of 10 Gbps and reduce international connectivity costs by at least 50%. The submarine cable system will stimulate increased take-up of broadband internet and lower the cost of international telecommunications services generally.

18. In addition to the positive economic and social impact in Tonga, the Tonga–Fiji Submarine Cable Project will contribute to regional integration. It will increase the frequency and quality of communications among countries in the region, thus increasing trade in services (tourism and back-office functions) and allowing the region to form a sizable market for digital

<sup>3</sup> A financial management assessment of the implementing agencies was carried by the World Bank in May 2010, and in accordance with the OECD Paris Accord (2008) on harmonization of donor activities ADB is content to rely on the information provided by this assessment. The financial management assessment results are summarized in Section V. A of the Project Administration Manual (accessible from the list of linked documents in Appendix 2).

<sup>4</sup> World Bank. 2009. Extending Reach and Increasing Impact. *Information & Communication Technology for Development*. Washington, D.C.: World Bank.

<sup>5</sup> World Bank. Technical, Economic and Financial Connectivity Study for Tonga and Samoa. Unpublished.

products and services. It will strengthen existing regional public goods and encourage new ones by allowing countries to share the limited knowledge and human resources in the Pacific.

19. **Economic costs.** The financial costs of the submarine cable include (i) capital expenditures to establish the submarine cable system, which consist of a cable landing station in Tonga and a 827 km cable link between Nuku'alofa (Tonga) and Suva (Fiji); and (ii) operational expenditures to operate the cable system. The financial costs were divided into tradable, non-tradable, labor, and tax; and conversion factors<sup>6</sup> were used to compute economic costs. The analysis is based on a domestic price numeraire using a shadow exchange rate factor of 1.11.

20. **Economic benefits.** The economic benefits of the submarine cable are similar to those of social overhead capital (such as highways or railways) since the submarine cable capacity takes on the character of intermediary goods. Therefore, it is predicted that the ripple effects from the project will be much more diverse and greater in scale than easily computable benefits. Some of the ripple effects on the economy arising from the submarine cable project are as follows:

- (i) **Travel cost and savings.** Information and communication technology (ICT) can reduce travel time by substituting expenditure on travel with telephone calls, videoconferencing, and mobile application usage, especially in neighboring islands where traders have to travel to the main islands to receive market information and sell their products. ICT has been shown to have direct impact on reducing transport costs and associated negative externalities such as pollution and congestion.
- (ii) **Improved public access to information and services.** More people will be able to access information through the use of the internet, which will support wider access to public information and promote better knowledge management, eventually moving toward a knowledge-based society.
- (iii) **Access to education.** Linkages across universities and public institutions will increase. People can access more educational resources through the internet, which will improve the quality of education and knowledge sharing and management approaches.
- (iv) **Access to health.** The widespread use of broadband by public institutions will help ease data and information management, resource management, and direct patient care in health services. Telemedicine applications will help Tongans access medical advice from specialists.
- (v) **Social cohesion.** Studies have found that access to ICT supports family relationships—particularly for low-income families, families with family members working abroad, and families where transport costs are relatively high.
- (vi) **New services (e.g., mobile banking).** High capacity internet (broadband) will provide opportunities to develop new commercial retail services such as electronic banking and other content services.
- (vii) **Regional integration and cooperation.** The proposed cable systems will increase the frequency and quality of communications among countries in the region, thus increasing trade in services (tourism and back-office functions). Improved ICT connectivity will allow the region to form a sizable market for digital products and services, and some countries can develop new business opportunities by leveraging skills and capital from their relatives migrated to developed countries. It will also strengthen the existing regional public goods and

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<sup>6</sup> Tradable (1.11), non-tradable (1.00), labor (0.75), and tax (0.00).

encourage new ones by allowing countries to share the limited knowledge and human resources available in the Pacific region.

21. As such, ripple effects are difficult to quantify because of attribution, the economic analysis considers more immediate economic benefits of the submarine cable, including the following:

- (i) Incremental benefits.
  - (a) Incremental revenue of TCL from the sales of cable capacity, and
  - (b) Consumer surplus for the additional internet subscribers as a result of the lower internet price.
- (ii) Non-incremental benefits.
  - (a) Savings from replacing satellite capacity with the submarine cable for international bandwidth, and
  - (b) Savings in spending on broadband internet by existing subscribers because of the lower internet price.

22. The submarine cable will provide a large supply of international bandwidth to Tonga, which will far exceed the supply from satellite service. It will create both incremental benefits from additional international bandwidth (in the form of TCL's revenue) and non-incremental benefit by replacing high-cost satellite connectivity. The latter was computed based on the low-demand scenario where international bandwidth price is not much lower than the satellite. The low-demand scenario can be regarded as without-project demand projection. As some of the satellite bandwidth should be reserved as backup capacity, it was assumed that 85% of the demand would be absorbed by the submarine cable. As of the end of 2009, the satellite bandwidth price was \$3,600/Mbps/month, and based on the past trend, the price was assumed to decrease by 1% every year. The saving from replacing 85% of satellite bandwidth with submarine cable was estimated at \$1 million per annum on average.

23. The submarine cable will also lower the cost of internet access for end users. Because of the lack of available information on users' spending on internet access, subscribed users were considered for the analysis, and the minimum price for broadband internet was used for the benefit computation. The incremental benefit consists of the consumer surplus from the additional broadband subscribers caused by the lower internet price. The non-incremental benefit is from existing subscribers' saving on internet service as a result of the lower cost. A 50% fall in the internet price and a 50% increase in internet subscribers were assumed as the project outcome performance target aims. A linear demand for broadband internet service was assumed.

24. Table 4 summarizes the economic cost and benefit analysis in domestic price numeraire. The economic internal rate of return (EIRR) resulted in 17.3%, exceeding the economic opportunity cost of the capital.

**Table 4: Economic Costs and Benefits of the Submarine Cable**  
(\$'000)

Year	Benefits			Costs			Net Benefits
	Incremental	Non-incremental	Total Benefits	Capex	Opex	Total Cost	
2011	0	0	0	21,109	0	21,109	(21,109)
2012	0	0	0	11,006	0	11,006	(11,006)
2013	1,987	1,529	3,516	0	1,268	1,268	2,248
2014	3,047	1,577	4,624	0	1,268	1,268	3,356
2015	4,000	1,637	5,637	0	1,268	1,268	4,369
2016	5,030	1,775	6,806	0	1,268	1,268	5,537
2017	6,103	1,862	7,965	0	1,268	1,268	6,696
2018	7,066	1,958	9,024	0	1,268	1,268	7,756
2019	7,825	2,063	9,888	0	1,268	1,268	8,620
2020	9,132	2,178	11,309	0	1,268	1,268	10,041
2021	8,467	2,183	10,650	0	1,268	1,268	9,381
2022	8,346	2,192	10,538	0	1,268	1,268	9,270
2023	8,442	2,205	10,646	0	1,268	1,268	9,378
2024	8,518	2,184	10,702	0	1,268	1,268	9,434
2025	8,412	2,163	10,575	0	1,268	1,268	9,307
2026	8,492	2,142	10,633	0	1,268	1,268	9,365
2027	8,572	2,121	10,693	0	1,268	1,268	9,425
2028	8,654	2,100	10,753	0	1,268	1,268	9,485
2029	8,544	2,079	10,623	0	1,268	1,268	9,355
2030	8,597	2,058	10,655	0	1,268	1,268	9,387
2031	8,678	2,037	10,715	0	1,268	1,268	9,447
2032	8,581	2,016	10,598	0	1,268	1,268	9,330
2033	8,581	1,994	10,575	0	1,268	1,268	9,307
2034	8,581	1,971	10,553	0	1,268	1,268	9,284
2035	8,581	1,949	10,530	0	1,268	1,268	9,262
2036	8,581	1,927	10,508	0	1,268	1,268	9,240
2037	8,581	1,905	10,486	0	1,268	1,268	9,218
NPV	39,047	11,858	50,905	27,621	7,930	35,551	15,354
IRR							<b>17.3%</b>

( ) = negative, Capex = capital expenditure, IRR = internal rate of return, NPV = net present value, Opex = operational expenditure.

Source: Asian Development Bank estimates.

25. A sensitivity analysis was conducted with three scenarios: (i) capital expenditures increase by 10%, (ii) TCL revenue falls by 20%, (iii) the broadband internet price falls by 25%, and (iv) the number of broadband subscribers increases by 25%. The analysis shows that the EIRR is sensitive to TCL revenue as shown in Table 5. If TCL revenue falls more than 40%, the EIRR will be lower than the economic opportunity cost of the capital. However, considering that the TCL revenue projection is based on conservative demand projection, revenue is unlikely to decrease by over 40%. This illustrates that the project's economic viability is robust.

**Table 5: Sensitivity Analysis of Economic Internal Rate of Return**

Scenario	EIRR (%)	ENPV (\$'000)	Switching Value (%)
Base case	17.3	15,354	
Capex increases by 10%	16.0	12,592	55.4
Revenue decreases by 20%	14.8	7,754	(40.7)
Internet price falls by 25%	16.3	12,488	
Subscriber increases by 25%	17.1	14,832	

( ) = negative, Capex = capital expenditure, EIRR = economic internal rate of return, ENPV = economic net present value.

Source: Asian Development Bank estimates.