

ECONOMIC AND FINANCIAL ANALYSIS

A. Introduction

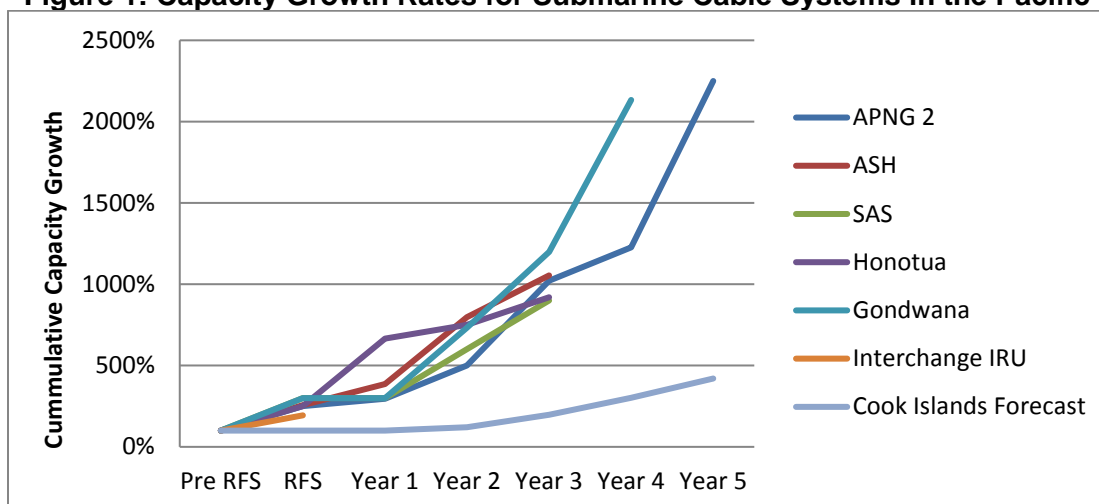
1. **Project summary.** The Government of the Cook Islands has requested the Asian Development Bank (ADB) to support a submarine internet cable project. The project will link the islands of Rarotonga and Aitutaki in the Cook Islands and Niue (a non-member country) to Samoa and French Polynesia with the Manatua cable system, a regional submarine internet cable system. The Government of New Zealand, represented by the Ministry of Foreign Affairs and Trade, will also provide a grant to the government in support of the project.

2. **Demand projection.** A top-down methodology is used to predict adoption rates by benchmarking other broadband connectivity projects in the Pacific region corresponding to Cook Island's current demand distribution across its telecommunications services. The adoption of Other Three Billion (O3B) technology in 2014, an alternative high-speed satellite solution, is considered a demand driver, and competition with O3B service has been offset. Demand for capacity per megabit per second is forecast conservatively below the region's average adoption rates, at approximately 45% average growth in the first 5 years after the cable comes into service, and then declining steadily to 2% over the next 15 years, with minimal growth sustained thereafter as the market saturates. The average annual growth rate over 25 years is estimated at 24%. The resulting capacity is positioned at the lower end of all available Pacific-based benchmark data (Figure 1). On the same basis, subscriber growth has been estimated to peak at 6,000 new users after 5 years as better-quality services at lower costs are introduced, followed by a 2-percentage point growth thereafter for five years. Tourist subscribers, a significant factor given the Cook Islands' sizable tourism sector, have also been considered as part of total population figures.

3. **Pricing.** Table 1 outlines pricing per megabit per second that ensures competitiveness of the submarine cable system (SCS) at the maximum allowable price and matches the minimum price level of comparative high-speed satellite services. It is estimated that prices can be lowered by as much as 60% and this 60% reduced price—applied throughout the analysis—ensures financial and economic viability, while passing on potential benefits to customers. The financial model shows that this price scheme can produce a good return while also being a fair basis for charging the buyers of capacity. Irrespective of demand growth, revenue streams are conservatively capped at 2% of gross domestic product (GDP).

B. Financial Analysis

4. **Methodology and assumptions.** Financial viability was assessed based on the financial sustainability of Avaroa Cables' operations over the cable's estimated life (2 years of system construction and 25 years of full operation). The weighted average cost of capital (WACC) for the project 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 total estimated financial cost of the SCS is \$27.47 million, including project management and contingency. Avaroa Cables' operating costs for the SCS are estimated at \$0.27 million for the first year, with an annual increase of 3% in real terms for next 26 years, excluding internet transit fees. Financial benefits are estimated based on Avaroa Cables' revenue calculated through demand for international bandwidth multiplied by estimated reduced wholesale tariffs.

Figure 1: Capacity Growth Rates for Submarine Cable Systems in the Pacific^a

APNG-2 = submarine cable linking Papua New Guinea and Australia (RFS 2006), ASH = America Samoa Hawaii Cable (RFS 2009), Gondwana-1 = submarine cable linking New Caledonia and Australia (RFS 2008), Honotua = submarine cable linking French Polynesia via Tahiti to Hawai'i, United States (RFS 2010), Interchange IRU = submarine cable linking Vanuatu and Fiji (RFS 2013), IRU = indefeasible right of use, RFS = ready for service, SAS = Samoa–American Samoa Cable (RFS 2009).

Note: The proposed Cook Islands submarine cable system has a presumed RFS of 2019.

^a For details on the referenced regional cables, see Submarine Cable Map. <http://www.submarinecablemap.com/>

Sources: Asian Development Bank and World Bank estimates.

Table 1: Proposed Pricing as Demand Increases

Item	2017	2018	2019	2021	2025	2030
Demand (Mbps)	520	1,024	1,593	2,968	7,632	17,887
Cable capacity supply (Mbps)	0	0	0	2,968	7,632	17,887
Maximum pricing (\$/megabit/month)	361	361	361	361	361	293
Reduced pricing (reduction of 60%) (\$/megabit/month)	145	145	145	145	145	117

Mbps = megabit per second.

Source: Asian Development Bank estimates.

5. Calculation of weighted average cost of capital and financial internal rate of return.

The project's WACC was computed based on the financing plan, which comprises ADB ordinary capital resources debt financing and grant funding from the Government of New Zealand's Ministry of Foreign Affairs and Trade to the government. Additionally, the government contributes tax and duties exemptions as well as Avaroa Cables' start-up costs to the project. The cost of equity was assumed to be 15%. ADB's ordinary capital resources loan costs to the government are assumed at a 2.6% interest rate with onlending to Avaroa Cables occurring at the same rate. Table 2 shows that the resulting WACC is 6.62%. The FIRR is determined at 11.2% over 27 years (including the construction period of 2 years) and exceeds the WACC, supporting the financial viability of the project.

Table 2: Weighted Average Cost of Capital

Item	Gov't of New Zealand			Total
	ADB OCR	MFAT	Gov't	
A. Amount (\$ million)	15.00	10.00	2.47	27.47
B. Weighting (%)	54.6	36.4	9.0	100.0
C. Nominal cost (interest rate) (%)	2.6	15.0	15.0	
D. Tax rate (%)	0.0	0.0	0.0	
E. Tax-adjusted nominal cost [C x (1-D)] (%)	2.6	15.0	15.0	
F. Inflation rate (%)	1.5	1.5	1.9	
G. Real cost [(1+E)/(1+F)-1] (%)	1.1	13.3	12.9	
H. Weighted component of WACC (real) (%)	0.6	4.8	1.2	6.62

ADB = Asian Development Bank, Gov't = government, MFAT = Ministry of Foreign Affairs and Trade, OCR = ordinary capital resources, WACC = weighted average cost of capital.

Source: Asian Development Bank estimates.

6. **Sensitivity analysis.** The main financial risks include (i) an increase in the price of the cable system, (ii) an increase in operating costs, and (iii) a shortfall in anticipated demand and hence revenues. These risks are considered low because (i) the cable system cost estimates and operating costs were based on similar cable project developments, and (ii) demand and thus resulting revenue were considered at a growth rate well below similar implementations in the Pacific. Further, the model considers revenue generation at 60% below the maximum wholesale price Avaroa Cables could charge, while maintaining competitiveness with broadband satellite providers. The risk of price and hence revenue attrition from a second SCS operator entering the market is considered very low because of the very high capital cost of entry and the country's small size. As for the funding sources, the requisite ADB loan is already earmarked and contributions from the government have been agreed upon.

Table 3: Sensitivity Analysis

Scenario	FNPV (\$ million)	FIRR (%)	Switching Value
			(%)
Base case	13.3	11.2	
10% decrease in revenue	6.5	9.0	20.0
10% increase in capital expenditures	11.1	10.2	60.0
10% increase in operating expenditures	10.0	10.2	40.0

FIRR = financial internal rate of return, FNPV = financial net present value.

Source: Asian Development Bank estimates.

7. The FIRR and the financial net present value (FNPV) were tested against decreased revenue (caused by a demand decrease), and increased capital and operational costs. The analysis indicates the project is sensitive to a revenue decrease, and less sensitive to a capital or operational cost overrun (Table 3). To ensure the Project's financial viability, Avaroa Cables must encourage demand growth through fair and open access, and attractive and transparent pricing for all retail service providers. While the FNPV evaluation indicates negative FNPV values for revenue and operating expenditure sensitivity, the calculation is based on a 60% price reduction,

which provides more than sufficient headroom for wholesale price adjustment in case of these scenarios.

Table 4: Avaroa Cables Cash Flow Projection

(\$)

Year	Capital Expenditure	Operating Inflows	Operating Outflows	Operating Cash Adjustments	Net (Free Cash Flow)
1	(13,702,960)	0	0	0	(13,702,960)
2	(13,766,691)	0	0	0	(13,766,691)
3	(349)	3,965,904	(1,804,851)	0	2,160,705
4	0	5,148,185	(2,271,914)	0	2,876,271
5	0	6,418,838	(2,741,693)	0	3,677,145
6	0	7,435,229	(3,153,176)	0	4,282,053
7	0	7,591,369	(3,464,160)	0	4,127,209
8	0	7,750,788	(3,893,151)	0	3,857,637
9	0	7,913,554	(4,297,333)	0	3,616,221
10	0	8,079,739	(4,678,473)	0	3,401,266
11	0	8,249,413	(5,038,198)	0	3,211,215
12	0	8,422,651	(5,378,013)	0	3,044,638
13	0	8,599,527	(5,699,306)	0	2,900,221
14	0	8,780,117	(5,710,604)	0	3,069,513
15	0	8,964,499	(5,723,131)	0	3,241,368
16	0	9,152,754	(5,739,853)	0	3,412,900
17	0	9,344,962	(5,759,181)	0	3,585,780
18	0	9,541,206	(5,781,055)	0	3,760,151
19	0	9,741,571	(5,805,421)	0	3,936,150
20	0	9,946,144	(5,832,231)	0	4,113,914
21	0	10,155,013	(5,861,438)	0	4,293,575
22	0	10,368,268	(5,893,005)	0	4,475,264
23	0	10,586,002	(5,926,894)	0	4,659,109
24	0	10,808,308	(5,963,073)	0	4,845,235
25	0	11,035,283	(6,001,517)	0	5,033,766
26	0	11,267,024	(6,136,835)	0	5,130,188
27	0	11,503,631	(6,176,132)	0	5,327,499
Net Present Value (NPV) @ WACC					
6.62%					13,330,872
FIRR					11.2%

() = negative, FIRR= financial internal rate of return, NPV = net present value, WACC = weighted average cost of capital.

Note: Numbers may not sum precisely because of rounding.

Source: Asian Development Bank estimates.

C. Financial Management Assessment

8. Avaroa Cables is a newly established entity and will need to recruit personnel to manage accounting. During implementation, the project will engage experienced consultants to set up

procedures, systems, and a reporting mechanism to implement robust financial management practices. Avaroa Cables will engage qualified accounting staff in a timely manner so their employment sufficiently overlaps with consultants. This will help them develop adequate capacity to continue accounting practices after the implementation period. Avaroa Cables will follow the government's yearly auditing process. Overall, the financial management risk is expected to be high. The detailed time-bound action plan is in Table 5.

Table 5: Avaroa Cables Time-Bound Action Plan

Action	Purpose	Responsibility	Time Frame
Recruit a specialized team of financial management specialists as part of the project management unit	To set up an accounting system, practices, and procedures	Avaroa Cables	Within 6 months of project effectiveness
Set up an organizational structure	To ensure proper approval authority and prevent conflicts of interest	Avaroa Cables	Within 6 months of project effectiveness
Engage qualified accounting staff	To make accounting practices sustainable	Avaroa Cables	By Q4 2018, so there is sufficient overlap with consultants to ensure proper training and handover
Arrange periodic internal audit	To ensure compliance with Cook Islands accounting policy	Avaroa Cables	By Q1 2019
Arrange periodic external audit	To ensure compliance with Cook Islands' accounting policy and other requirements	Avaroa Cables	By Q1 2019
Allocate budget for audit	To prepare timely audit reports	Ministry of Finance and Economic Management and/or Avaroa Cables	During the project implementation period (by Ministry of Finance and Economic Management and afterward (by Avaroa Cables))
Arrange periodic training program and capacity development	To introduce new processes, instructions, and systems	Ministry of Finance and Economic Management and/or Avaroa Cables	Once a year

Q = quarter.

Source: Asian Development Bank estimates.

D. Economic Analysis

9. **Macroeconomic context.** The Cook Islands is an island nation with a population of roughly 20,000 and a narrow yet open economic base. These characteristics make the economy vulnerable to shocks of all kinds, including economic and natural. Its size and dispersion over a remote and wide area of ocean reduces opportunities to achieve economies of scale.

Despite these difficulties, since 2012, macroeconomic stability has been maintained. Prices have been relatively stable; the current account has large and persistent surpluses and the financial system is sound. Significant public investments have been made in infrastructure. However, long-term average growth currently hovers just above 1%. This manifests itself in limited job creation and slow growth in government revenue.

10. The island country has achieved all its Millennium Development Goals (MDGs), especially MDG 1 on eradicating extreme poverty and hunger, MDG 4 on reducing child mortality, and MDG 5 on improving maternal health. However, sustaining achievements and ensuring equitable service distribution remain an issue. The Cook Islands has defined information and communication technology (ICT) indicators as part of the country's National Sustainable Development Plan related to broadband connectivity, affordability, and reliability under goal 2.5¹.

11. An economic analysis was conducted to quantify the project's expected benefits. Economic welfare was defined as the sum of consumer surplus (i.e., the difference between a consumer's willingness to pay and the actual price of a good or service) and producer surplus (i.e., the difference between actual sales value and the price at which a producer is willing to offer a good or service). Incremental economic growth was excluded from the quantitative analysis.

12. **Least-cost analysis.** The Cook Islands has recognized the need to improve internet connectivity. However, a 2013 assessment financed by ADB found the cost of building a cable connection to Samoa (the closest internet connection point) was too costly to be financially viable for the Cook Islands alone.² Shared construction of a submarine cable would have reduced the cost borne by the Cook Islands, but this option did not eventuate given different countries' (Samoa, French Polynesia and Tonga) priorities. The project foresees investment financing for an SCS linking the Cook Islands through Samoa and the Tui-Samoa Submarine Cable to Fiji, while offering an opportunity to share implementation and operating cost of the cable with French Polynesia and Niue.

13. **Economic valuation of costs and benefits.** A detailed cost allocation model and economic analysis were prepared for the technical submarine cable configuration discussed. It considers current O3B high-speed satellite contracts and disregards telephony voice usage as insignificant in terms of capacity and scale. For the purposes of the analysis, it is assumed that the project will result in a new, faster, and a more reliable broadband internet service. Nevertheless, as current O3B-based internet services offer broadband connectivity, incremental demand and non-incremental demand are separately considered, with existing user benefits including only additional price reductions and a premium for service reliability improvements. A GDP cap of total project benefits is considered to ensure that ICT sector-related benefits are not overvalued as a share of total GDP.

14. **Estimation of costs.** The Cook Islands' share of the capital cost for the purpose of the economic analysis of the SCS is estimated at \$26.1 million, including physical contingencies, covering four milestones over the implementation period.

15. The analysis used constant prices as of 2017 and a world price numeraire. Benefits, onshore operating costs, and 60% of costs incurred by domestic retail service providers were

¹ Government of the Cook Islands, Prime Minister's Office, Central Policy and Planning Office. 2016. *Te Kaveinga Nui: National Sustainable Development Plan, 2016–2020*. Rarotonga.

² ADB. 2013. *Report on the Feasibility of an International Submarine Cable System for the Cook Islands. Consultant's report*. Manila (TA 7787-REG).

adjusted to economic values using a standard conversion factor of 0.87 (implying a shadow exchange rate factor of 1.15) and a shadow wage rate factor of 0.95 in line with infrastructure development projects of ADB's Pacific Department in the Cook Islands.³ No conversion factors were applied to tradable capital costs. Taxes and subsidies were excluded. The economic price of land was not considered beyond its financial costs, as the cable runs deep underneath land with no impact on land use and occupies only a small footprint for the landing station.

16. Retail service providers (Avaroa Cables' wholesale customers) will also incur some incremental capital costs to expand and upgrade their capacity to meet increased demand throughout the cable system's life of 25 years. These costs were assumed at 60% share of total revenue and split at 50% for capital and 50% for operational expenditure. The retail service providers' existing domestic capacity and investment programs (independent of the cable project) are sufficient to cope with the initial surge in demand given existing fiber-optic networks and 3G deployments in place. Reallocation of O3B network infrastructure for backup purposes would result in savings by replacing costly conventional satellite backup links currently in place.

17. Incremental operating costs are expected to be at \$0.27 million for the first year, with an annual increase of 3% for next 26 years and \$1.4 million in internet provider transit fees, increasing in line with demand growth.

18. **Estimation of benefits.** For the purposes of the analysis, only a 60% price reduction and a 20% increase in service quality are considered for existing internet users. For new customers, willingness to pay corresponds to the entire area under their demand curve. This was evaluated against all capital, operation and maintenance, and the telecommunications provider's incremental costs associated with providing such internet services.

19. The analysis assumed that benefits are proportional to internet users' willingness to pay. Willingness to pay is calculated as the sum of two components: (i) the annual consumer surplus, estimated at about 0.8% of GDP, a constant ratio determined through existing World Bank estimates of comparable demand curves for mobile telephony in the People's Republic of China, India, and the Philippines, and estimated consumer surplus ratios in those countries;⁴ and (ii) the annual revenue per user (ARPU) for retail internet services, which is the product of the mature market ARPU and projected number of subscribers. The mature market ARPU was estimated at 7% of GDP per capita (\$84 per subscriber per month in 2016) based on a composite normalized demand curve for the same three countries, which flattens out at 7% beyond a 15% penetration rate. While the demand curves based on the World Bank findings relate to mobile telephony, the demand curve can be abstracted for broadband purposes, as penetration rates in the Cook Islands already approach 50%. Benefits are considered to grow in line with real GDP growth (assumed at 2.1% per annum) and capped at 3.5% of GDP.

20. **Economic internal rate of return.** Applying the estimates and assumptions listed in para 25, and allowing benefits to grow in line with real GDP growth, the economic performance of the project is as shown in Table 6 outlining the base case scenario. The project's economic internal rate of return comfortably exceeds the minimum required for ADB investment projects of 9% per year.

³ ADB. 2014. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Administration of Grant to the Cook Islands for the Renewable Energy Sector Project*. Manila.

⁴ A. Bhavnani et al. 2008. *The Role of Mobile Phones in Sustainable Rural Poverty Reduction*. Washington DC: World Bank, ICT Policy Division, Global Information and Communications Department.

21. Sensitivity tests were applied as follows: (i) 20% decrease in benefits, (ii) 10% increase in capital costs, and (iii) 10% increase in operating costs. The risk for the (ii) and (iii) are considered low as the SCS cost estimates are based on similar cable project developments in the region and operating costs were conservatively estimated during the cost allocation determination. Further a 60% price reduction allows for headroom in case of increased operation and maintenance costs. The economic risk of decreased benefits is considered low, as benefits are directly proportional to demand and subscriber growth rates, which are, for the purposes of the conservative analysis, assumed to grow at a rate well below similar projects across the Pacific. The government's commitment to implementing a regulatory framework will further ensure that benefits are duly passed on to end consumers. The sensitivity tests confirm that economic viability is maintained under each adverse shock considered (Table 7).

Table 6: Summary of Economic Internal Rate of Return Calculation
(\$ million)

Year	Economic Costs			Economic Benefits ^c	Net Economic Benefits
	Operating Costs ^a	Capital Costs ^b	Total		
2017	0.00	0.00	0.00	0.00	0.00
2018	0.17	12.52	12.69	0.00	(12.69)
2019	1.32	13.61	14.93	0.00	(14.93)
2020	3.29	1.42	4.71	5.57	0.86
2025	6.57	2.18	8.75	13.56	4.81
2030	8.72	2.42	11.14	15.05	3.91
2035	8.72	2.68	11.40	16.70	5.30
2040	8.81	2.98	11.79	18.53	6.74
2045	4.96	0.00	4.96	20.13	15.17
Switching values:					
EIRR	13.6%	per annum		Costs	45%
NPV	12.99			Benefits	(31%)

() negative, EIRR = economic internal rate of return, NPV = net present value.

^a Operating costs include Avaroa Cables operating costs and internet access fees paid offshore, and incremental operating costs by retailers to maintain network improvements.

^b Capital costs correspond to the project's financial drawdown schedule during implementation and includes capital expenditures by retailers to invest in network improvements as the subscriber base grows.

^c Includes economic benefits for new and existing broadband internet subscribers.

Source: Asian Development Bank estimates.

Table 7: Sensitivity Test Results

Scenario	ENPV (\$ million)	EIRR (%)	Switching Value (%)
Base case scenario	13.0	13.6	
20% decrease in benefits	6.7	11.2	29.0
10% increase in capital expenditures	10.8	12.6	45.0
10% increase in operating expenditures	9.9	12.6	42.0

EIRR = economic internal rate of return, ENPV = economic net present value.

Source: Asian Development Bank estimates.