

## ECONOMIC AND FINANCIAL ANALYSIS

### A. Introduction

1. The island of Niutao is 336 kilometers (km) or 181 nautical miles from the capital of Funafuti. The only access to Niutao is from the sea, and the island is served by two government-run passenger-cum-cargo ships. Passengers and cargo are transferred from the ships to shore across the reef using two small crafts (workboats) with outboard engines. Strong waves and a narrow entrance make the transfer dangerous and time-consuming, with much anecdotal evidence of injuries to people and damage to cargo. The project will improve access to Niutao by enabling a safer and more efficient transfer, and will thereby enhance the security of food and fuel supply, improve access to health care and other essential services, boost trade, and preserve the very fabric of society through better reachability. These are considered basic needs to improve the livelihood and quality of life for the people of Niutao.

### A. Sector Context

2. Vessel services to outer islands are owned, operated, and managed by the Ministry of Communication and Transport (MCT). Besides the two ships that service Niutao, the MCT has another vessel that is generally used only for cargo and does not go to Niutao. In 2014, these vessels transported about 11,000 passengers from all islands in Tuvalu, of which about 1,400 used the service through Niutao. The service is subsidised by the MCT, with passengers paying a nominal fee that accounts for a third of the operational costs. The vessels themselves were gifted to the Government of Tuvalu.

3. In Niutao, these services encounter numerous difficulties that could even endanger people's lives or result in losing cargo:

- (i) The transfer of cargo and passengers from the ship to the workboats is dangerous, particularly in larger swells and bad weather.
- (ii) Entering the reef area is also dangerous. Large wave breaks in this zone require accurate timing of the workboats when they move from the deep sea to the shallower waters of the reef area.
- (iii) Traversing the reef requires navigating several coral and rock outcrops and cannot be done at low tide.
- (iv) Unloading and loading of passengers and cargo takes place at a boat ramp that has no protection and is therefore exposed to storms and swells.
- (v) Cargo is being offloaded mostly manually because of a lack of equipment, and is inefficient and laborious, particularly for the aging community.

4. Apart from these precarious conditions, the government ships cannot travel to Niutao in bad weather, so the people of Niutao may miss out on transportation to and from Funafuti, both for themselves and their cargo. Anecdotally this happens at least a couple of times per year. The community also noted that in some instances, a passenger transfer might take place but cargo would not be loaded or offloaded because of the rough seas.

5. The proposed workboat harbor aims to improve the transfer conditions by providing a sheltered area with proper equipment for the shoreline operations, while also improving the approach through the reef area. The proposed warehouse will enable cargo to be stored safely until collected by the owners. However, the project will not be able to eliminate the danger involved in the transfers between the offshore ship and the workboats.

## B Methodology and Approach

6. Following the same methodology and approach than for the current ADB project, approved in 2016, the standard demand analysis for calculating the benefits of the project is not applicable.<sup>1</sup> This is because the small populations in the target outer islands would yield disproportionately low quantifiable benefits relative to investment costs. A basic needs perspective or one of basic public goods and services provision is more applicable; it takes into account that the without-project scenario would have a bad effect on local livelihoods because the import of basic goods would continue to be fraught with danger.<sup>2</sup> Hence a cost-effectiveness analysis is used to evaluate the project from an economic perspective.

7. Two options are considered under the cost-effectiveness analysis. Option 1 involves a wharf on the northeastern side of the island for small crafts and workboats. Option 2 involves a wharf at the same site but for a large vessel that could dock alongside, obviating the need for dangerous sea transfers. Primary costs associated with the proposed wharf are capital construction costs and annual maintenance costs for maintenance dredging, and maintenance of the mobile crane and ancillary facilities, such as the warehouse and transit area. Primary benefits associated with the options are the differences in travel time (both ship to shore and inland from wharf to village) and the reduction in the vessel operating costs thanks to a more efficient transfer of both passengers and cargo.

## C Assumptions and Parameters

8. All costs and benefits were valued in 2018 constant prices. The financial prices have been converted to economic prices by assuming a 70:30 cost ratio between materials and labor, and a further 70:30 split between skilled labor and unskilled labor. The world price numeraire was used to convert financial values to border-equivalent economic prices. All materials and skilled labor are traded costs, and unskilled labor was converted by a shadow wage rate factor (SWRF) of 0.8, in addition to the standard conversion factor of 0.9 used in similar projects in the region (see the supplementary appendix for a detailed explanation).<sup>3</sup> Taxes and duties on imported materials are exempted by the government and form part of its contribution to the project. Taxes, i.e., import duties for materials, average 18%, and a consumption tax of 7% is applied on the cost plus tax. As a transfer payment, taxes are excluded from the economic analysis. The analysis assumes a project economic life of 50 years, with no residual value thereafter. It uses an economic opportunity cost of capital of 12% in real terms.<sup>4</sup>

## E Cost Estimates

9. The project plans to provide Niutao with safe and suitable harbor facilities for safer and more efficient transfers of people and goods to and from the government ships. To this end, the project will implement the following infrastructure components: (i) marine works—dredging of the channel and basin, and reclamation; (ii) civil works—earthworks, piling, concrete sea walls, structural steelwork; (iii) building works—design, supply, and installation of the passenger

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<sup>1</sup> Asian Development Bank (ADB). 2016. *Proposed Grants and Administration of Grants to Tuvalu for the Outer Island Maritime Infrastructure Project*. Manila.

<sup>2</sup> The project also involves unquantifiable benefits: avoidance of a potential maritime accidents (sinking of passenger ferry, oil tanker, or fishing boat) with associated economic costs, along with human and environmental losses.

<sup>3</sup> Financial and Economic Analysis: Supplementary Appendixes (accessible from the list of linked documents in Appendix 2 of the report and recommendation of the President)

<sup>4</sup> Since the current project was approved before ADB. 2017. *Guidelines for the Economic Analysis of Projects*. Manila became applicable, the rate of the previous guidelines (12%) was used.

terminal, warehouse, septic tanks, water tanks, and toilets; (iv) electrical reticulation and lighting; and (v) boat ramps.

10. The project engineers provided bills of quantities for two design options: (i) a smaller harbor facility for the docking of workboats and (ii) a larger harbor facility for the docking of the government ships. The base cost—excluding contingencies for the workboat docking facility and other ancillary works such as the passenger terminal and warehouse—is A\$13.4 million for option 1 and A\$85.6 for option 2. Physical contingencies were estimated at 10% of the base cost.

11. The annual operation and maintenance costs were estimated at 3% of capital costs. In addition, maintenance dredging may be required as a result of siltation caused by post-cyclone activities, which is quantified on an annualised basis at 2% of capital costs.

**Table 1: Cost Estimates**  
(A\$'000)

<b>Investment Cost<sup>a</sup></b>	<b>Option 1</b>	<b>Option 2</b>
Total financial cost	13,393	85,593
Total financial cost (with physical contingencies)	14,732	94,152
Total economic cost (with physical contingencies)	14,075	89,949
Operation and maintenance (per annum)	737	4,497

## **F. Quantification of Benefits**

Only a small proportion of benefits was quantified because the benefits to people in terms of safety, food and energy security, or access cannot be quantified but are very significant. The quantified benefits are (i) savings in time and costs associated with workboat travel from ship to shore and inland travel from shore to village, typically by motorbike or scooter; and (ii) savings in vessel operating costs thanks to more efficient transfers of passengers and cargo. By widening the channel, navigation will be faster and safer, allowing for time to be saved. Inland travel, however, will take longer because the new wharf will be further away from the village than the without-project landing facility. The without-project transfer from ship to shore is estimated to average about 48 minutes, whereas the with-project transfer averages about 32 minutes by workboats. The distance from shore to village in the without-project scenario is 780 meters, and 2,090 meters in the with-project scenario. On the assumption that inland travel will be by motorcycle or scooter, at an average speed of 15 kilometers per hour, the without-project travel time will be about 3 minutes and the with-project travel time about 8 minutes, for both options (1 or 2).

12. Time saved in the sea transfer and time spent in the land transfer was quantified using the per capita income of \$3,893 and the passenger throughput in Niutao. To project per capita income into the future, population growth, the economic growth of the country, and its relationship with Niutao need to be projected.<sup>5</sup> The population in Niutao was 749 in the 1991 census, 663 in the 2002 census, and 606 in the 2012 (latest) census. A population decline as suggested by this data has not been assumed in the economic analysis since the project is expected to have a significant impact by providing better access and may thus stop the decline. An average gross domestic product growth rate of 1.5% was used for 2016–2021 and 1% thereafter.<sup>6</sup> The MCT maintains voyage logs for both government ships, including details of

<sup>5</sup> ADB. 2017. *Basic Statistics 2017*. Manila

<sup>6</sup> ADB. 2016. *Regional Technical Assistance Trade and Transport Facilitation in the Pacific*

passengers embarking and disembarking at Niutao. Based on an average of the voyages in 2016 and 2017, the passenger throughput from ship Nivaga III to Niutao or vice versa was 1,182, and transfers between ship Manu Folau and Niutao were 217, totaling 1,399 passengers.

**Table 1: Travel Time Costs**

Option	Estimated Passengers per Year	Workboat Travel (min)	Land Travel (min)	Workboat Travel per Year (h)	Land Travel per Year (h)	Total Travel Time per Year	Annual Economic Cost (A\$ – 2017) <sup>a</sup>
Existing	1,399	48	3	1,119	72	1,191	\$2,859
Option 1 – workboats	1,399	32	8	758	194	952	\$2,285
Option 2 – ship	1,399	16	8	379	194	573	\$1,376

\$ = United States dollar, A\$ = Australian dollar, h = hour, min = minute.

<sup>a</sup> Assuming A\$2.40 per hour; a per capita income of \$3,893; an exchange rate of A\$1 = \$0.78; and 2,080 productive hours per year.

Source: Asian Development Bank.

13. The other quantified benefit relates to savings in vessel operating costs. It is assumed that motorcycle operating costs will be small and have therefore been disregarded. Ship operating costs were obtained from the MCT,<sup>7</sup> both for Nivaga III and Manu Folau, and these include salaries and allowances for crew, vessel maintenance, food and supplies, and fuel. Fuel accounts for about 40% of total vessel expenditure. To estimate the economic cost of vessel operations, the fuel costs were projected using the World Bank Commodity Price Projections<sup>8</sup> and added to other operating costs. The vessel incurs waiting time during both the transfer of passengers and the loading and unloading of cargo, and during this time the vessel is steaming no mooring facilities exist. Without the project, the cargo transfer time is estimated at an average of 94 minutes per trip, with an estimated 10 trips per workboat for a total of 22 vessel calls per year. Option 1 would provide a mobile crane onshore and reduce the cargo transfer time considerably to about 23 minutes. Option 2 involves no sea transfer, and the transfer of cargo to the dock is estimated to take 11.5 minutes.

**Table 2: Vessel Operating Costs**

Option	Cargo Operations				Workboat Travel per Year (h)	Total Ship Operations per Year (h)	Cost per Hour (A\$ – 2017) <sup>a</sup>	Annual Economic Cost (A\$ – 2017)
	Transfer (min)	Workboat Trips per Voyage	No. of Voyages per Year	Ship Operations per Year (h)				
Existing	94	10	22	345	1,119	1,463	285	417,683
Option 1 – workboats	23	10	22	83	758	840	285	239,748
Option 2 – ship	11.5	-	22	41.5	379	420	285	119,874

h = hour, min = minute.

<sup>a</sup> Financial and Economic Analysis: Supplementary Appendixes (accessible from the list of linked documents in Appendix 2 of the report and recommendation of the President) lists the key assumptions for the cost estimation. Source: Asian Development Bank.

14. **Unquantified benefits.** The improved safety of passengers is a major benefit that was not quantified. Nor was the reduction in the damage to cargo quantified. The new wharf will also reduce congestion at the existing landing site, which is adjacent to the village and will boost economic activity on a side of the island that has not been used. There are also benefits to other outer islands, and Funafuti in particular, since the elderly, very young, and pregnant women

<sup>7</sup> MCT Vote Book 2017, actual expenditure.

<sup>8</sup> World Bank Commodity Price Forecast, 26 October 2017.

often stay with relatives because of the precarious access to their island. This increases the pressure on resources in Funafuti.

## E. Assessment Results

15. The assessment was undertaken by comparing the net present value of capital investment costs and travel cost improvements of options 1 and 2. While not all benefits were incorporated, the options can be weighed by comparing the travel cost improvements (being the incremental differences between the existing facility and either option) with the capital and operating costs. This is shown as cost per dollar saved (Table 3). The result demonstrates that option 1 is more cost-effective in reducing travel times and ship operating costs than option 2. Option 1 has a lower cost per dollar saved and is the most cost-effective option.

**Table 3: Net Present Value of Costs and Benefits**  
(A\$'000)

Option	Capital & Operational Costs (Economic Prices)	Travel Cost Improvements	Cost per Dollar Saved
Option 1	16,283	1,509	11
Option 2	104,063	2,434	43
Difference	-87,780		

## F. Financial Sustainability

16. The proposed wharf is not revenue earning; it is constructed and operated by the MCT in coordination with the local community, which receives annual budget allocations for operation and maintenance of infrastructure assets. During 2014–2017, the MCT received on average 9% of the total government budget. About 80% of the MCT's budget is allocated to the marine division (salaries of the crew, fuel, food, and maintenance of ships and workboats).

17. The MCT receives about 17% of the government revenues, of which 80% accrues from revenues through the lease of the dotTV domain. The rest stems from the sale of tickets on the government ships. On the expenditure side, 45% goes to salaries and wages, 20% to fuel and oil for the government ships and workboats, and 12%–15% to the maintenance of the vessels. Salaries and wages have increased by 8% year-on-year, which is well above inflation running at about 2%–3%. The total public sector has 1,095 permanent staff, which means that 1 in 10 Tuvaluans works full-time for the government. Non-recurrent expenditure or capital expenditure was minimal, which is a cause for concern since investment is not taking place.

18. The project will not cause an increase in recurrent expenditures but rather a moderate decline in the fuel and oil costs thanks to more efficient ship-to-shore transfers. However, the infrastructure created will need to be maintained. Maintenance dredging after every major tropical cyclone will be required, while other steel or concrete structures will not need major maintenance works. Major cyclones have hit Tuvalu once every 10 years on average, and dredging would cost A\$500,000–A\$1,000,000 depending on the number of islands affected. On average at most A\$100,000 per annum is estimated to be required for maintenance dredging. On the other hand, it is estimated that 6 acres will be leased at an annual cost of A\$3,000 per acre. In its 2017 budget, the government provided projections for the MCT for 2018 and 2019. Projections from 2020–2022 are based on average annual growth over 2014–2017. The projections demonstrate that sufficient budget will be available to finance project-related maintenance costs and the lease of land under the cost-effective option.