

ECONOMIC AND FINANCIAL ANALYSIS

A. Introduction

1. Tuvalu consists of nine main islands stretching around 680 kilometers and the main island and outer islands are served by two large government passenger–cargo ships. No outer island has a docking facility for the government ships, and passengers and cargo are transferred by small crafts (workboats) from and to the ship floating offshore. Only a few islands have docking facilities even for the workboats—passenger embarkation and disembarkation is laborious and cargo has to be manually carried. Workboats have to go through channels to reach the shores of outer islands, which is dangerous depending on the sea conditions, and serious accidents occur, resulting in economic losses and fatalities. Transfer operations are not undertaken when the sea is rough, or after dark, which reduces the efficiency of ship operations. Under the ongoing projects small workboat harbors are being constructed at Niutao and Nukulaelae islands. The proposed additional financing will fund the construction of a workboat harbor at Nui island, which is one of the nine main islands of Tuvalu. The project will improve access to Nui by providing for safer and more efficient transfer from ship to shore.

2. The proposed project is considered a basic need to improve the livelihood and quality of life for the people of Nui. Following the same methodology and approach adopted for the current Asian Development Bank project, standard demand analysis for calculating the benefits of the project is not applicable for the project. Therefore, the economic analysis for the project was carried out using least-cost analysis considering the small size of the island population served. The least-cost analysis defines the needs that must be met by the project, develops alternative options that can satisfy these needs, and ensures that the chosen option is the most cost-effective one among the mutually exclusive and technically feasible alternative interventions. Where options have different cash flows over time, discounted cash flow techniques has been used to compare them on a net present cost basis. If alternatives have similar net present costs, a multicriteria analysis is used to make the final selection.

B. Demand Analysis

3. Vessel services to outer islands are provided by two ships owned by the Ministry of Communication and Transport, and these ships visits the islands every 2–3 weeks. Passenger and freight revenues pay for only about 20% of direct operating expenditure and the service is subsidized. In 2019, these vessels transported about 14,000 passengers and 1,600 cubic meters of cargo from all islands in Tuvalu, of which about 1,800 passengers and 205 cubic meters of cargo used the service through Nui (estimated based on the population and trip rates). The population growth overall in Tuvalu was 1.2% and economic growth 3%–4% during 2016–2019. There is out-migration from the outer islands of Tuvalu because of the lack of economic opportunities.

4. Economic growth is expected to slow from 3.0% to 2.0% in 2020 and 2.5% in 2021 because of the impact of coronavirus disease.¹ The outer island economic growth rate is likely to be much lower than the overall growth rate because there is much less economic activity in the outer islands compared to the main island of Funafuti. Considering population and economic

¹ ADB. 2020. *Asian Development Outlook 2020: What Drives Innovation in Asia?*. Manila; and ADB. 2020 *Asian Development Outlook 2020 Supplement: Lockdown, Loosening, and Asia's Growth Prospects*. Manila.

growth, passenger and cargo traffic to Nui is assumed to grow at 1.5% per annum during the analysis period.²

C. Economic Assessment

5. All costs and benefits were valued in 2020 constant prices, and all analyses use world price numeraire expressed in United States dollars, adjusted as necessary in accordance with standard cost-benefit procedures. Financial prices were converted into economic prices by removing all taxes. The currency is pegged 1:1 to the Australian dollar and an exchange rate of A\$1 = \$0.66 is used. A standard conversion factor of 0.9 was used in previous projects and also in this analysis.

6. In Nui, the current operation poses several key challenges:
- (i) The transfer of cargo and passengers from ships to the workboats is dangerous, particularly in larger swells and bad weather.
 - (ii) Entering the reef area is hazardous. Large wave breaks can occur in this zone, which requires timing of the workboat to ensure a safe entrance from deeper water to the shallower water of the reef area.
 - (iii) Traversing the reef in shallow water involves navigating several coral and rock outcrops, and this cannot be done at low tide.
 - (iv) Unloading and loading passengers and cargo at the existing boat ramp has no protection and is exposed during larger storm events, such as swells or waves.
 - (v) Cargo is mostly off-loaded manually because of lack of equipment, which is inefficient and laborious, particularly for the aging community.

7. To address all of the above issues, a large harbor and a deep and wide channel through the 500-meter-long flat reef is needed so that ships have safe access, however the small number of vessel calls and low transport demand does not justify the expense of constructing this. The shallow reef extends 500 meters into the ocean from the shore right around the island. A workboat harbor with a dredged and protected channel through the flat reef and a protected basin and wharf for safe unloading, maneuvering, and operation of workboats will address all of the issues listed above, except the need for sea transfers. The workboat harbor is much smaller in scope and cost and aims to improve the transfer operation by providing a sheltered area with equipment for shoreline operations, while also improving the approach through the reef area. Provision of a workboat harbor has therefore been explored for Nui atoll.

8. The workboat harbor will involve (i) marine works (dredging the channel and basin) and reclamation; (ii) construction of a concrete approach structure, a concrete wharf for the loading and unloading of workboats, a boat ramp, and a concrete low landing platform for passenger access (precast concrete blockwork); (iii) construction of a detached breakwater for wave protection; (iv) building works and installation of a passenger terminal and warehouse; (v) installation of appropriate navigation aids (performance specification); and (vi) services, utilities, and miscellaneous items. For the proposed workboat harbor, a detailed assessment was made to identify the most suitable location, layout, and land-side facilities by analyzing alternative options in terms of engineering suitability and least cost.

9. The southernmost islet of the atoll, Fenua Tapu, is home to the majority of the island's population and is the location where workboats currently approach the shore using an existing channel which serves as the main loading point for cargo and passengers travelling by boat to

² Considering population growth of 0.5%, taking into account the out-migration and economic growth of 1.0%.

and from Nui. After examining potential locations, this location was chosen for the proposed harbor because of its proximity to the local community and existing roads, and to utilize the already dredged channel through the reef. At this location a flat reef extends approximately 500 meters from the shoreline before dropping off rapidly to deep water. This extended flat reef offers additional protection to the structures and harbor. The selected location offers the least-cost option among the locations considered as all other technically feasible locations considered need significantly more dredging and earthworks, while the remaining project cost components are similar.

10. Multiple options were studied for the harbor layout, construction material, and terminal locations and the preferred option was selected based on least-cost or multicriteria analysis of technical, operational, environmental, and social aspects with the cost of alternative options being similar. For the harbor layout, two technically feasible options were studied, one with an access channel connected with a bend to a turning basin and another with a turning basin aligned with a straight access channel. The least-cost option for the harbor layout was selected, in which the turning basin is aligned with the access channel. For the structures, a mass concrete gravity structure is considered to be the most appropriate, rather than a more common piled structure, and more suitable given the underlying geotechnical condition.

11. For the terminal facilities, three options were considered and the multicriteria analysis presented in Table 1 identifies option A as the preferred option.

- (i) **Option A: Coastal reclamation.** This option was identified as a method to utilize dredge material while attempting to follow the coastline of the area of interest. With this layout, the intention is to minimize the area of land required for spoil as much as possible.
- (ii) **Option B: Sports field area.** This option includes the passenger terminal and cargo warehouse located in the existing sports field area. This would result in only being able to fit in a smaller soccer pitch for the community to use.
- (iii) **Option C: Land reclamation.** This option was identified as a method to utilize dredge material for a reclaimed area for the passenger terminal, cargo warehouse, hardstand or concrete area for fishing boats, and car park. With this layout, the intention is to minimize the area of land required for spoil as much as possible.

Table 1: Results of Options Assessment (Weighted Scores)

Criterion	Weighting (%)	Option A (Coastal Reclamation)	Option B (Sports Field Area)	Option C (Land Reclamation)
Capital cost	5	Not considered as only marginally different		
Engineering	40	4.0	2.8	2.4
Environmental	20	3.2	4.4	2.4
Social	20	1.6	1.0	2.2
Climate resilience	15	0.0	0.0	0.0
Total score	100	8.8	8.2	7.0

Source: Asian Development Bank.

12. The engineering assessment study estimated the cost of the selected option at \$19.0 million and contingencies at \$3.0 million. Maintenance dredging may be required as a result of siltation caused by post-cyclone activities, which is quantified on an annualized basis at \$70,000.

13. By widening and protecting the channel, navigation will be faster and safer, allowing for time to be saved. Inland travel will be similar in the with- and 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. Time saved was quantified based

on per capita annual income of \$2,780 (assuming per capita income at two-thirds of the national per capita income) and passenger throughput estimates the value of time saved at \$570 per year with the project. Another direct benefit is the savings in vessel 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 as 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 20 vessel calls per year. The project will provide a mobile crane onshore and reduce the cargo transfer time considerably to about 23 minutes. The annual value of savings in vessel operating cost is estimated at \$180,500 per year at 2020 prices.

14. In addition to the direct benefits mentioned above, there are several unquantified benefits such as improved safety of passengers while travelling through the channel and at embarking and disembarking points, reduction in damage to cargo, and the overall time ships take to go around, thus benefiting all outer islands and populations associated with improved access. The proposed boat harbor at Nui is the least-cost option and an essential requirement for the safety of shipping operations. For the considered option, technical alternatives were considered and the most cost-effective solution was adopted, as described above.

D. Financial Sustainability Analysis

15. The objective of the analysis is to ensure that the project is financially sustainable. As the project involves non-revenue-generating infrastructure, the financial analysis focused on assessing the capacity of the implementing agency to absorb the incremental operation and maintenance (O&M) cost associated with project. The analysis involved identifying the budget allocation for O&M by the government, estimating the incremental O&M cost associated with the proposed project, and assessing the likelihood of adequate budget allocation to cover the required maintenance. The harbor will be constructed by the Ministry of Public Works, Infrastructure, Environment, Labor, Meteorology and Disaster and operated by the Ministry of Transport, Energy and Tourism (MTET) in coordination with the local community, which receives annual budget allocations for O&M of infrastructure assets.

16. During 2014–2019, the MTET received on average 7%–9% of the total government budget. About 80% of the MTET's budget is allocated to the marine division (salaries of crews, fuel, food, and maintenance of ships and workboats). The 2019 budget allocation for the MTET was A\$7.6 million (\$4.9 million). The allocation for 2020 comprises A\$6.0 million for recurrent expenditure and A\$1.4 million for nonrecurrent program expenditure, including A\$1.0 million for special development expenditure. The increased allocation indicates increased importance given to transport improvement. In addition, the containment of expenditures and the growth in revenues indicates good performance of the MTET budget as indicated in table 2. The project will not cause an increase in recurrent expenditures but will help with a moderate decline in the fuel and oil costs with more efficient ship-to-shore transfers.

Table 2: Ministry of Transport, Energy and Tourism Budget
(A\$)

Item	2018 ^a	2019 ^a	2020 ^b	2021 ^c	2022 ^c
Taxes	175,401	342,121	300,000	306,000	312,200
Marine	1,494,604	1,803,196	2,046,000	2,123,900	2,204,700
Other charges	125,646	243,367	367,000	367,000	367,000
Internet domain .tv	6,619,658	5,179,021	7,142,900	7,142,900	7,142,900
Revenues	8,415,309	7,567,705	9,855,900	9,939,800	10,026,800
Staff	2,695,848	2,751,350	2,436,900	2,485,400	2,534,800
Travel and communications	553,720	618,033	167,300	167,300	167,300
Maintenance	921,840	618,157	607,800	607,800	607,800
Goods and services	442,280	816,852	542,900	542,900	542,900
Fuel and oil	1,273,149	1,521,686	1,488,500	1,488,500	1,488,500
Grant and subsidies	0	0	5,000	5,000	5,000
Other expenses	0	110,515	217,900	217,900	217,900
Overseas contributions	98,171	125,664	187,000	187,000	187,000
Capital	46,673	49,110	0	0	0
Special development expenditure	319,722	0	1,024,500	0	0
Expenditures	6,351,403	6,611,367	6,677,800	5,701,800	5,751,200
Land leases and compensation of economic losses				100,000	100,000
Maintenance dredging				100,000	100,000
Project expenditures				200,000	200,000

^a Actual

^b Budget

^c Projections

Source: Ministry of Transport, Energy and Tourism. Government of Tuvalu.

17. 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 for many years. 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, a maximum of A\$100,000 per annum is estimated to be required for maintenance dredging. The 2019 budget allocations and forward projections demonstrate that sufficient budget will be available to finance project-related maintenance costs in the initial years.

18. The government created the Deferred Maintenance Fund in 2015 to annually transfer funds to the Tuvalu Development Fund for long-term maintenance of government assets, guided by an approved maintenance policy. The Deferred Maintenance Fund is an expenditure item used by a ministry to request budget allocation for repairs and maintenance. In addition, the project will provide training for the outer island communities after the completion of the harbors for the basic and routine maintenance of the facilities.